1-1-2018

Student attitudes towards technology and their preferences for learning tools/devices at two universities in the UAE

Matthew Andrew
Khalifa University of Science and Technology

Jennifer Taylorson
University of St Andrews

Donald J. Langille
Khalifa University of Science and Technology

Aimee Grange
Zayed University, aimee.grange@zu.ac.ae

Norman Williams
Zayed University

Journal of Information Technology Education: Research

An Official Publication of the Informing Science Institute InformingScience.org

JITEResearch.org

Volume 17, 2018

STUDENT ATTITUDES TOWARDS TECHNOLOGY AND THEIR PREFERENCES FOR LEARNING TOOLS/DEVICES AT TWO UNIVERSITIES IN THE UAE

Matthew Andrew *	Khalifa University of Science and Technology, Abu Dhabi, United Arab Emirates	matthew.andrew@ku.ac.ae
Jennifer Taylorson	University of St. Andrews, St. Andrews, Scotland, United Kingdom	jentaylorson@gmail.com
Donald J Langille	Khalifa University of Science and Technology, Abu Dhabi, United Arab Emirates	john.langille@ku.ac.ae
Aimee Grange	Zayed University, Abu Dhabi, United Arab Emirates	aimee.grange@zu.ac.ae
Norman Williams	Zayed University, Abu Dhabi, United Arab Emirates	norman.williams@zu.ac.ae

* Corresponding author

ABSTRACT

Aim/Purpose: The purpose of this study was to survey student opinions about technology in order to best implement and utilize technology in the classroom. In this paper, technology refers to 'digital technology'. The aims of this study were to: (1) examine student attitudes towards technology in regards to enjoyment and perceived usefulness; (2) investigate what tools and devices students enjoyed and preferred to use for learning; (3) examine whether students preferred learning with books and paper instead of technological devices (e.g. laptops, tablets, smartphones); and (4) investigate whether student opinions about digital technology and preferred learning tools differ between two universities (based on their level of technology implementation) and between two programs (Foundation Studies and General Studies).

Background: Previous studies have investigated student device choice, however, fewer studies have looked specifically at which tools and devices students choose for certain academic tasks, and how these preferences may vary according to the level of digital technology integration between two different universities.

Accepted by Editor Bronwyn Hegarty | Received: January 11, 2018 | Revised: May 10, June 13, July 20, 2018 | Accepted: August 30, 2018.

Cite as: Andrew, M., Taylorson, J., Langille, D. J., Grange, A., Williams, N (2018). Student attitudes towards technology and their preferences for learning tools/devices at two universities in the UAE. *Journal of Information Technology Education: Research, 17,* 309-344. https://doi.org/10.28945/4111

Methodology	In this study, a mix of quantitative and qualitative data was gathered from 1102 participants across two universities in the United Arab Emirates from an English-language Foundation Studies program and a first-year General Studies program. A questionnaire (containing closed-ended and open-ended questions) was followed by three focus-group interviews (n=4,3,2). ANOVA and t-Tests were used to test for statistically significant differences in the survey data, and qualitative survey and interview data were analyzed for recurring themes.
Contribution	This study aims to provide a more comprehensive account of the learning tools (including books/paper, laptops, tablets, and phones) students prefer to use to complete specific academic tasks within a university context. This study also seeks to evaluate student attitudes towards using digital technology for learning, in order to best implement and utilize technology in the context of higher education institutions in the Middle East and around the world.
Findings	Findings suggest that participants enjoy learning how to use new technology, believe it improves learning, and prepares them for future jobs. Books/paper were the most preferred resources for learning, followed closely by laptops, while tablets and smartphones were much less preferred for specific educational tasks. The data also revealed that respondents preferred learning through a combination of traditional resources (e.g. books, paper) and digital technological tools (e.g. laptops, tablets).
Recommendations for Practitioners	These findings can be used to recommend to educators and higher education administrators the importance of adopting learning outcomes related to digital literacy in the classroom, to not only help students become more effective learners, but also more skilled professionals in their working lives. Additionally, classroom practices that incorporate both traditional tools and newer technological tools for learning might be most effective because they provide flexibility to find the best learning tool(s) for the task.
Recommendations for Researchers	Participants preferred books and paper for learning. One reason was that paper helped them remember information better. More research needs to be done on the learning benefits of using more tactile mediums, such as paper for reading and writing.
Impact on Society	The findings from this study suggest that some learners may benefit more from the use of digital technology than others. Institutions and organizations need to provide flexibility when it comes to technology implementation for both students and faculty. This flexibility can accommodate different learning styles and preferences and not isolate individuals in the classroom or workplace who may be slower to adapt to new technologies.
Future Research	Future research is needed to investigate student attitudes towards digital technology at higher education institutions in other parts of the world. In addition, this study focused mostly on student perceptions of learning tools and devices in the classroom. More research needs to be done on the impact technology has on learning per se – specifically how certain tools may help learners more effectively complete different educational tasks.
Keywords	student attitudes, digital technology, device choices, learning tools, higher education

INTRODUCTION

Mobile learning (m-learning) can define the way we access, absorb, transfer, and manipulate information within a university context. Sharples, Taylor and Vavoula (2005) state that we need to rethink how information is learned in our mobile age as humans "learn across space" and "across time", applying information in one location that was acquired in a different location (p. 2). As to the motivational benefits of m-learning, Jones, Issroff, Scanlon, Clough and McAndrew (as cited by Jones & Issroff, 2007, p. 248) list "control (over learners' goals), ownership, learning-in-context, continuity between contexts, fun and communication". Mobile learning aids student motivation as learners can take ownership over specific projects in an academic context, and enjoy doing it. This approach encourages collaborative learning and enhances student interactions with their instructors, because it provides university students with opportunities to learn through "collaborative idea-sharing" between students and at the same time connects the instructor with the student (Castillo-Manzano, Castro-Nuño, López-Valpuesta, Sanz-Díaz & Yñiquez, 2017, p. 330). In other words, it engages learners as it helps them do new things with their learning. Pea and Maldonado (2006) also explain how wireless interactive learning devices (WILD) provide more transformative potential for learning than desktop computers because of their availability everywhere and at any time.

Many higher education institutions, excited over the benefits of digital and mobile technologies/tools, are adopting new educational technology policies and procedures. According to Kalinic, Arsovski, Stefanovic, Arsovski and Rankovid (2011) numerous universities, including the University of Glasgow, the University of Sussex and the University of Regensburg, have been working towards embedding the 'concept of m-learning in their learning systems'. For example with regards to course delivery, (Castillo-Manzano et al., 2017) discuss the integration of mobile devices (tablets and/or laptops) into economic classes in Spain. They maintain that "there are personal, socio-economic and technical differences that explain students' preferences for the use of one device or another" within their program (Castillo-Manzano et al., 2017, p. 330). These researchers also state that students demand a return on their investment in a laptop/tablet through an increased level of integration of these electronic devices into the regular teaching activity. Spiegel and Rodriguez (2017, p. 848) reported on students being exposed to mobile technology (MT) during their freshman year and that instructors were requiring an "increasing use of M" within the university context. Mayisela (2013, p. 17) suggests that mobile technology "has a potential to support blended learning beyond (university) classrooms and computer centres," whereas Jacob and Issac (2008, p. 782) explore the issue of "whether the students … are ready to embrace mobile learning." Gikas and Grant (2013) present some of the advantages of using mobile devices that American university students cited in their study; namely, accessing information quickly through discussion boards, course readings, communicating with fellow students and instructors, providing new ways to learn and interact with the course materials, and allowing for interaction with course content/classmates in a highly 'situated' and contextualized way.

However, one might suspect that in many cases the decisions to implement these digital technologies are not necessarily based on the thorough research of student needs, course objectives and delivery (Al-Emran, Elsherif, & Shaalan, 2016; Martínez, 2017; Park, Nam, & Cha, 2012; Şad & Gŏktaş 2014; Taleb & Sohrabi, 2012). Dahlstrom (2012) states that student feedback is important for indicating which technologies are most effective for learning. This feedback can be used to inform both the teaching and learning investment by organisations in order to understand which specific technologies are the most effective and which ones can be seen as a sound strategic personal investment by students (Castillo-Manzano et al., 2017). Previous studies have investigated student device choice (Cassidy et al., 2014; Dahlstrom & Warraich, 2012); however, fewer studies have looked specifically at which devices students choose for certain academic tasks. This study aims to provide a more comprehensive account of the technological devices students prefer to use to complete specific academic tasks within a university context, and also to examine whether students preferred learning with traditional tools like books and paper instead of technological tools like phones and laptops for specific

educational tasks. This study also seeks to evaluate student attitudes towards using technology for learning, in order to provide recommendations on the most effective way to integrate digital technology into the classroom. It is hoped that this study will be of use for both university instructors and management alike when making decisions about classroom and institutional technology policies.

Definition of technology

In this paper, the use of the word 'technology' will include physical devices such as laptops, tablets, and phones, as well as computer software. This software can include: productivity applications (e.g. Microsoft Office Suite); cloud computing (e.g. Google Drive); collaborative tools (e.g. Google Docs); Learning Management Systems (e.g. Blackboard); web search engines (e.g. Google Search); and web-based tools for learning (e.g. Quizlet). Educational technology will be defined in this paper as "the study and practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources" (Robinson, Molenda, & Rezabek, 2008, p. 15). For our study, these resources that "facilitate learning" and "improve performance" are the devices and types of software mentioned above.

Context of the Two Universities

University program

The participants in this study were enrolled in either the Foundation Studies program or the General Studies program at their respective universities. In one of these institutions, referred to below as the "Post-implementation" University, technology has been systemically implemented throughout all pre-sessional and undergraduate programs. In the other, referred to below as the "Pre-implementation" University, moves to implement technology at a systemic level are still ongoing.

The Foundation Studies program in both universities is a pre-degree English-language program that prepares students for university study. The General Studies program is a first- and second-year university program where students take required courses before enrolling in major-specific courses. The General Studies program at the Post-implementation University offers more humanities and social sciences courses, whereas at the Pre-implementation University the courses are more STEM-related in preparation for their majors in engineering. Both universities have well-equipped classrooms with electronic whiteboards which project information from computers.

Post-implementation University

The Post-implementation University is involved in an institutional mobile enhanced learning project that seeks to integrate mobile learning into both teaching and learning. This started as an iPad initiative in 2011 for students in the English-language Foundation Studies program, and since then, the use of iPads in the Foundation Studies program has continued. The university seeks to integrate mobile learning throughout all levels of the university, but as learners move into their undergraduate studies, there is less prescription regarding the type of device required. However, practical considerations (including the requirement to produce more text) mean that students generally use laptops more often in class as they move from Foundations Studies into General Studies. Despite the more prevalent use of laptops, it is not uncommon for students in the General Studies program to use multiple mobile devices, including smartphones and tablets, to access course materials or participate in learning activities. In recent semesters, the institution has placed increasing emphasis on the use of its virtual learning environment (e.g. Blackboard) in course delivery, assessment of course learning outcomes and course evaluation/feedback.

Recently the Post-implementation University appears to have adopted a more flexible 'bring your own device' (BYOD) policy to satisfy both student desires and curricular objectives related to technology-enhanced learning. Regardless of device and/or program, technology is an essential compo-

nent to both teaching and learning at this university, and training and support are frequently provided for faculty members to best utilize technology in the classroom.

Despite the promotion of technology use at this university, the courses in the Foundation Studies program and the General Studies program are not based on a blended learning model. Although courses might include project-based tasks that encourage autonomous online learning, the majority of courses conform to Maxwell's (2016) description of 'Tech-rich instruction', where learning occurs at the same time and place, and traditional instruction is supported with technological devices.

Pre-implementation University

In the spring of 2016, this university's Foundation Studies program piloted the use of laptops within four classrooms. Prior to the pilot program, no institution-wide policy had been in place to regulate and/or support the use of laptops or smaller handheld devices (e.g. tablets and phones) within the classroom. Whilst individual lecturers and students had been using online learning programs and apps on computers or handheld devices to aid learning, there was no uniformity of approach or onus on lecturers/students to use electronic devices or digital tools for teaching and learning in prescribed ways. Course material was mostly presented to students through traditional formats such as lectures, notes, paper worksheets, and language-learning textbooks. There was no formal expectation that teachers or learners use technological devices or computer software programs in the classroom. The exception to this was an online reading program called Achieve3000® and a newscast project involving the use of video in the Foundation Studies program.

LITERATURE REVIEW

DEVICE OWNERSHIP/USAGE

Mobile device ownership amongst the general population of America has been increasing. In 2015, 45% of adult Americans owned tablets, 68% owned smartphones, and 73% owned desktops and/or laptops (Pew Research Center, 2015). As of January 2018, 53% owned tablets, 77% owned smartphones, and 73% owned desktop or laptop computers (Pew Research Center, 2018). In the UAE, device usage was in line with the global average, and significantly higher than the world average in regards to mobile phone usage, according to the Connected Life study done by research firm TNS (Staff Report, 2015). The increase in device ownership, especially smartphones, has provided considerable flexibility in terms of the selection of particular devices to perform specific tasks, which in turn, has prompted a sharp increase in this area of device ownership.

The recent increase in both professional and private technological device usage around the world has changed the landscape of work and social interaction, as well as education. Indeed, research (e.g., Cassidy et al., 2014; Pew Research Center, 2015, 2018) has shown that within the field of education, device ownership is considerably higher than that within the general population, particularly within the context of colleges and universities. Research carried out by Crux Research Inc. found that smartphone and laptop ownership amongst American college students was 78% and 86% respectively in July 2014 (Marketing Charts, 2014). Furthermore, Cassidy et al.'s (2014) study, which involved approximately 1000 student participants, showed that 96% of respondents owned laptops. This is compared to 68% of adult Americans who owned smart phones and 73% of adult Americans who owned either a laptop or a desktop in 2015 (Pew Research Center, 2015). Despite the significantly higher ownership of smartphones and laptops amongst the college population in America, research suggests that tablet ownership is, in fact, lower than that within the general population. Interestingly, Cassidy et al. (2014) found that only 34% of the students within their study owned tablets/iPads (11% lower than within the general population in 2015, according to Pew Research Center, 2015).

Selection of Devices for Specific Tasks

As with device-usage within the general population, research evidence shows that within the context of education, university students are also employing a fair degree of discernment regarding the devices they select to perform particular tasks. For example, unsurprisingly given the comparatively low ownership of tablets and iPads, whilst valuable to the users, these devices are used only for a small range of educational tasks. According to Dahlstrom and Warraich's (2012) study involving 2300 university students in Qatar, such devices are being used predominantly to source information and to maintain contact with peers, tutors, and professors and not to address computing needs. Indeed, Utah State University's 2011 survey, involving 3074 students, investigated respondents' use of iPads and found that only 3.9% of the students used an iPad daily (Dresselhaus & Shrode, 2012). Also, Cassidy et al. (2014) found that, despite increased ownership of tablets, only five respondents out of 941 relied exclusively on a tablet to address their computing needs.

While there is a perceived limitation to the usefulness/flexibility of tablets and iPads, laptops are prized for their functionality (Dahlstrom & Warraich, 2012). Despite the fast increasing popularity of mobile devices within the general population, within a university environment, these devices are not eclipsing the functionality of standard tools, such as laptops, which students use more for academic work (Dahlstrom & Warraich, 2012). Amongst the reasons cited for this preference of laptops over tablets are the limitations of the 'soft' keyboard (Marmarelli & Ringle, 2011), and the smaller screen/smaller keyboard offered by these mobile devices (Dahlstrom, 2012). Indeed, the usability that comes from laptops' larger screens and keyboards is more important than the more portable nature of tablets (Dahlstrom, 2012). Having said this, with ever-evolving technological developments, many students in Dahlstrom's study (2012) felt that the lines between the tablet/laptop were beginning to blur.

Reading on Screen and on Paper

In addition to electronic devices, this study is concerned with student preferences for learning with traditional mediums like paper. In terms of reading, a number of studies have sought to examine whether university students prefer to read course materials on screens or on paper. Research carried out by the Pew Research Center (2012) indicates that amongst the general population, reading on screen is increasing in popularity, particularly for specific reading purposes. They stated that between 44% and 55% of those who were regular readers of the *New York Times*, *USA Today*, and the *Wall Street Journal*, reported that they tended to read the news online, rather than from a paper copy. However, the same study also found that only 20% of respondents who had read a book the previous day had read from a screen, and only 9% of those who had read a magazine the day before had read this online or digitally. Within the general population, it seems that the question of whether one reads online or from a screen depends upon the type of reading one is doing. Factual reading appears to be a more popular screen-based activity than reading for pleasure and as Liu (2005) suggests screen-based reading behavior is characterized by browsing and scanning, keyword spotting and one-time/non-linear reading.

Similarly, within the context of university education, it is known that students tend to use e-books for quite a specific set of tasks pertaining to research rather than for more general reading tasks (Wexelbaum & Parault, 2011). Ownership and usage of e-books is high amongst university students (Van der Velde & Ernst, 2009). In a white paper published by Springer (2008), 73% of respondents reported having used e-books, and the majority also stated that they used them on a weekly basis. However, a number of studies show that paper-based reading and materials are still considerably valued by students. One recent study, carried out by Davidovitch (2017), involving 252 student respondents from Ariel University in Russia, found that students from each of the academic faculties examined preferred to read printed materials rather than read from a screen. This is supported by Liu and Stork (2000) who suggest that paper-based materials are still an important academic resource.

It also appears that the type of reading students engage in through a screen medium differs from the type of reading routinely engaged in whilst reading from paper sources. A study done by Nicholas et al. (2008) revealed that respondents did not spend a sustained amount of time on full-text articles. Rather, two-thirds of article views lasted less than three minutes, which suggested very brief and cursory viewing of articles. Instead of employing reading skills needed for sustained, detailed reading, Nicholas et al. (2008) reported that respondents tended to skim and move from source to source by implementing "horizontal information seeking" (p. 189) and "power browsing" (p. 196) strategies. This behavior mirrors online reading behaviors from within the general population, where access to the Internet and other applications allow individuals the opportunity to multitask and switch rapidly between screens and applications (Levine, Waite, & Bowman, 2012).

The Impact of Mobile Technology on University Learning

The impact of mobile technology on university learning is closely associated with student attitudes towards technology in general. The Technology Acceptance Model (TAM) was developed by Davis, Bagozzi and Warshaw (1989) to explain why users accept different information systems based on their perceived usefulness and the perceived ease of use. 'Perceived usefulness' is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" and the 'perceived ease of use' is defined as the "degree to which a person believes that using a particular system would be free of effort" (Davis et al., 1989, p. 320). In other words, the user will accept a new form of technology if they believe it will be both useful for work and easy to use. There is no doubt that advances in information and communication technologies have had a significant effect on the way in which learning takes place. As Cavanagh (2012) states, the mass uptake of mobile devices within university learning contexts has enabled the implementation of blended-learning techniques and has prompted a 'postmodality era' in which instruction is a nuanced mingling of the traditional and nontraditional; face-to-face and online. The flexibility afforded by the introduction of mobile technology not only allows students to access course content and input from instructors both on- and off-campus, it also allows for a different kind of engagement with their studies (Mayisela, 2013). Such flexibility has changed the way in which students access information and learn (Cassidy et al., 2014). Rather than engaging only in sustained periods of learning, this is being complemented by brief spurts of activity in the hallways, at coffee shops, or during lunch (Cassidy et al., 2014). Essentially, mobile learning has put students firmly in the driving seat, and this autonomy has a positive motivational impact. As Jones and Issroff (2007) suggest, this is largely because students have better control over setting their own goals, can take more ownership of their own learning, can communicate more efficiently with peers and tutors alike, and are able to experience learning-in-context as well as continuity between different learning contexts.

Studies have been carried out on the use of tablets in the classroom that enhance learning. Research completed at Oklahoma State University (2011), which fully integrated the iPad in a college course, stated that 75% of participants strongly agreed or agreed that the iPad was enhancing the learning environment of that course. Also, college students, who may not have used an iPad for a university course, believe that it can improve learning. A study conducted by the education company Pearson (2014), using data from the Harris Poll, found that 81% of respondents believe tablets will change the way university students learn, and 74% said tablets could make learning more fun. A study carried out by El-Gayar and Moran (2007) implementing the Unified Theory of Acceptance and Use of Technology (UTAUT) model indicates that students may look favorably on the use of Tablet PCs (TPC). However, they suggest that to take full advantage of specific TPC features in the classroom they need more direct support from the university itself.

Student Beliefs about the Impact of Technology on Learning

Research appears to suggest a number of factors that may influence student perceptions of educational technologies. Amongst two of the most influential factors are the frequency with which stu-

dents use a particular device (Martínez, 2017) and a particular device's overall functionality (Edmunds, Thorpe & Conole, 2012). It would seem that the more a particular device is used, the more positive the students' response towards that device (Martínez, 2017). It also appears that 'functionality' is prized over convenience, in relative terms (Edmunds et al., 2012). Interestingly, it would also seem that a number of contextual factors may play a minimal role in device preferences. For example, in Martínez's (2017) study, there was no real difference in attitudes towards technology between different faculty affiliations, or between genders.

As Edmunds et al. (2012) point out, it would also be a mistake to assume that student attitudes towards educational technology can be considered homogenous in nature. According to Prensky's (2001) construct of the 'Digital Native', it would be easy to assume that all students of current university age approach the use of technology within an educational setting with the same ease and expertise (Kennedy, Judd, Churchward, Gray, & Krause, 2008). This, according to Edmunds et al. (2012) is not the case; rather, first-year university students differed a great deal from one another in terms of their knowledge of, and ease with, using technologies for educational purposes. They also had a range of responses with regard to the use of technology for educational purposes, with some students being far more responsive and open to the use of technologies than others.

Although students may differ in terms of their ability to use technology, and their attitudes towards technology, overall, students consider educational technologies and mobile devices as having a positive impact on their learning within university contexts. The current study sought to further investigate student attitudes towards digital technology and which tools or devices students preferred for learning by asking the following research questions.

Research Questions

1. What are student attitudes towards using digital technology for learning in regards to enjoyment and perceived usefulness?
2. What do students prefer to use to assist their learning?
3. How do student opinions about digital technology and preferred learning tools and devices differ?

The research questions were investigated at two universities (based on their level of technology implementation) and in two programs (Foundation Studies and General Studies), so comparisons could be made.

METHODS

Overview of Research Design

A mixed method design was employed using a survey and focus group interviews to collect data from students studying at two universities in the UAE. An explanatory sequential design (Creswell, 2014) was used and included a survey with both closed-ended and open-ended questions. The closed-ended questions were used to gather quantitative data and included a four-point Likert type scale for some questions. Two open-ended questions were used at the end of the survey to, as Creswell states, "explain the quantitative results in more depth" (2014, p. 6). The use of focus-group interviews a few weeks after the survey also provided qualitative data to help explain responses to the closed-ended survey questions.

Quantitative data were tested for statistically significant differences using a one-way analysis of variance (ANOVA) followed by Tukey's Honest Significant Difference (HSD) post hoc analysis, and t-Tests. Qualitative data were coded, grouped into themes, and counted.

Participants were asked to sign consent forms before taking part in the study and were informed that the survey was anonymous and confidential. The researchers received ethical clearance from the re-

search ethics committee at the Post-implementation University. The Office of Sponsored Research at the Pre-implementation University approved the questionnaire, interview questions, and consent forms.

Participants

This study consisted of 1102 Arabic-speaking students enrolled in two English-medium universities in the United Arab Emirates in both the English-language Foundation Studies program and the first-year and second-year General Studies program. The majority of students at both universities first enter the Foundation Studies programs because of not meeting the English language requirement for direct entry into first-year university studies. Students who meet the English language requirement when first enrolled, or who graduate from the Foundation Studies program, start their undergraduate study in the General Studies program.

The beginning of the survey (Appendix A) included demographic questions to gather information about the participant gender and age. A total of 83% of the participants were female (17% males), and the vast majority (99.5%) of the students were between 17-24 years old. The survey also asked participants about their program of study. Table 1 shows the breakdown of students by program across the two universities.

Table 1. Number of participants by university and program

Institution	*N*	Program
Pre-implementation University (*N*=483)	295	Foundation Studies
	188	General Studies
Post-implementation University (*N*=619)	394	Foundation Studies
	225	General Studies

Survey Design and Development

The survey was designed by the authors and included four-point Likert-scale questions, yes/no questions, a ranking of preferred learning tools for specific educational tasks, and two open-ended questions at the end of the survey. A decision was made to implement a four-point scale, omitting a response midpoint. Weijters, Cabooter and Schillewaert (2010) maintain that "offering a midpoint simply states that respondents with a truly neutral stance need to have the possibility of choosing the middle option and not to be forced to choose a polar alternative by allowing respondents to indicate neutrality or ambivalence and thereby making people more comfortable when selecting a response option" (p. 238). However, Garland (1991) reports that by removing the midpoint option one is minimizing respondents' attempts to "please the interviewer or appear helpful or not be seen to give what they perceive to be a socially unacceptable answer" (p. 70).

Since the survey was the main instrument of data collection in this study, its design had to be carefully developed. The writing of the survey items went through a series of validation stages: (1) two authors from the project collaborated to create the survey items; (2) the other three authors provided feedback about the initial survey questions; (3) changes were made to the survey based on the feedback; (4) the survey was piloted with three students; (5) a faculty member not associated with the project reviewed the survey; and (6) final revisions were made based on student feedback from the pilot and the review from the faculty member.

Sampling Methods and Survey Administration

The population of this study is higher education students who use technological devices (laptops, tablets, smart phones), as well as traditional resources (paper, books) to aid their learning while at university. In order to sample this population, the authors of the study used convenience sampling to

access students who were studying in their respective programs. The five co-authors in this study taught in four different departments - two authors taught in the Foundation Studies program of the Pre-implementation University, one author taught in the General Studies program of the Pre-implementation University, one author taught in the Foundation Studies program of the Post-implementation University, and one author taught in the General Studies program of the Post-implementation University. Each author asked the students they taught in class to complete the survey. Also, to increase participant numbers, each author asked for volunteers among colleagues in their respective departments to distribute surveys to students. Essentially, each author served as a central distributor of surveys among the teachers in their department, who administered a set of surveys to their own students. As surveys were administered, it was emphasized that student participation in the survey was to be voluntary and anonymous.

Focus-group Interviews

Three focus-group interviews (n=4,3,2) took place a few weeks after the survey was completed to provide some possible explanations for the quantitative data gathered by the survey. Each focus-group consisted of volunteers from a particular class - three groups for three different classes. One author in this study interviewed two groups (n=3,2) of male students aged 18-20 at the Pre-implementation University. Another author in this study interviewed one group (n=4) of female students aged 18-20 at the Post-implementation University. The reason for the separation of male and female students in the interview is that both universities have gender-segregated campuses. All participants completed the survey before participating in the interviews, except for one male participant who was not yet enrolled when the survey was administered. He volunteered to take part in the interview and was thus included in the focus group.

The interview questions (Appendix B) closely mirrored the survey questions, but their semi-structured design allowed for the interviewer to ask follow up questions to pursue related areas of inquiry based on participant responses. Only three focus-group interviews occurred because some of the authors in this study were not able to conduct interviews with their students due to time constraints. Although qualitative interview data were obtained from only nine participants, this was expected to provide additional information to explain the survey responses.

Data Analysis

Data entry

Survey data for each participant was entered into Microsoft Excel by two authors at a time - one author read the responses, and the other author entered the responses. Survey data was organized by participant number, and each possible answer to a survey item was assigned a numeric code (e.g. laptop= 2; tablet =3). To check for accuracy, the author entering the data would stop periodically to read back the data to ensure the entered information was correct.

Tests for differences between means

Mean scores and standard deviations were calculated for survey items consisting of a four-point Likert scale. A one-way analysis of variance (ANOVA) was used to test for significant difference between means of three or more groups, and post hoc analyses using the Tukey Honest Significant Difference (HSD) test was used to further test for differences between groups using pairwise comparisons. These analyses were used in our study to test for differences in survey items - for example, to see if there was a significant difference between survey items: "I enjoy technology"; "Technology is useful for learning"; "Technology is useful for future jobs". In this example, using ANOVA and post-hoc analysis helped the researchers in this study analyze whether respondents believed that technology is more useful for future jobs than it is for learning.

All 1102 survey responses were entered onto one spreadsheet. Using the 'sort' function on Microsoft Excel, the data was organized by university and program (Foundation Studies or General Studies). Thus, comparisons were able to be made between the two universities, and between programs within each university using a t-Test (Two-Sample Assuming Unequal Variances). The defined level of significance was established at $p<0.05$.

Survey results as percentages

Descriptive statistics were used for survey responses not on a four point-Likert scale, and percentages were calculated in Microsoft Excel.

Qualitative data analysis from survey

For the qualitative data from the open-ended survey questions, "preliminary jottings" of code were first written down on a separate piece of paper during data entry to explore later in more depth (Saldana, 2009, p. 17). Then, these codes were entered onto the 'find' function in Excel, which generated the number of times a code was mentioned. The codes were then grouped into themes. For example, when asked "why does technology improve learning", the word "easy" was repeated in multiple responses. After reading these responses, and excluding any responses not related to the theme "easy", the number of responses was counted. Some themes were organized into subthemes; for example, "easy to use", "makes learning easier", and "find information easier".

The analysis from the "preliminary jottings" generated many important themes, but to provide a more comprehensive analysis, the hundreds of open-ended survey comments were printed out and any repeated codes were highlighted, counted, and grouped into themes. Counting emerging themes provided data to help investigate student attitudes towards the use of technology.

Results

The results section is divided into three parts. The first part will establish some background and context for this study by showing participant data related to student device ownership and usage. Then data is presented to address research question #1, "What are student attitudes towards using digital technology for learning in regards to enjoyment and perceived usefulness?" Lastly, data is presented relevant to research question #2, "What do students prefer to use to assist their learning?", by looking at student enjoyment of using different learning tools, and what students prefer to use for specific educational tasks.

Data which addresses Research Question #3 (differences between universities and programs) will be embedded in the Research Question #1 section and Research Question #2 section as it deals with comparisons of attitudes towards technology and preference for learning tools/devices.

The major findings show that the majority of participants enjoy using technology, believe it is useful for learning and their future jobs, prefer to learn with books/paper and laptops more than tablets and smartphones, and prefer a combination of learning with traditional tools (e.g. books/paper) and technological tools (laptops, tablets, smartphones). In addition, responses between participants at the Pre-implementation University and Post-implementation University were quite similar despite different stages of technology implementation. In contrast, significant differences were found between the Foundation Studies program and the General Studies program in relation to attitudes towards technology and preference for learning tools/devices.

Device Ownership and Usage

In order to establish a context for our research on attitudes towards technology and device preferences, participants were asked on the survey to complete questions related to device ownership. All participants owned their device(s) - the two universities did not lend out devices for student use. Students in the Pre-implementation University received a stipend to cover the costs of a laptop or tablet.

In the Post-implementation University, Foundation Studies students who were not able to afford a tablet could apply for financial support to have the university cover the costs of the device. For the vast majority of the student population, affordability is not a problem as most students come from high socioeconomic backgrounds and can afford ownership of multiple devices.

A comparison of data about device ownership between the participants studying at the two universities is shown in Table 2. Laptop ownership was higher at the Pre-implementation University, whereas tablet ownership was higher at the Post-implementation University. This is not surprising considering this latter university's mobile-enhanced learning project and the iPad initiative in 2011. Smartphone ownership was the highest among all devices, and very similar between the two universities. Since smartphone ownership is approximately 99% at both universities, the rest of this paper will use the terms 'phone' and 'smartphone' interchangeably to refer to a mobile phone with computer capabilities and internet access.

Table 2. Comparison of device ownership (percentage of respondents who said 'yes')

	N	Laptop (%)	Tablet (%)	Smartphone (%)
Pre-implementation University	480	85	58	99
Post-implementation University	609	68	89	99

With regards to device preference for learning, Table 3 shows how participants responded when asked what they mostly use to study in class, meaning when they were physically present in class while the teacher was conducting a lesson.

Table 3. Breakdown of learning tools and device usage by program. Which do you mostly use to study with in class?

	N	Books/Paper (%)	Laptop (%)	Tablet (%)	Phone (%)
Pre-implementation University					
Foundation Studies	279	89	5	2	4
General Studies	180	81	16	1	2
Post-implementation University					
Foundation Studies	340	45	10	44	1
General Studies	215	18	79	2	1

The two programs in the Pre-implementation University had the highest use of books/paper. This is most likely because of not yet having implemented the systematic use of technology in the two programs of the university. The Foundation Studies program in the Post-implementation University had a fairly even mix of use between books/paper and tablets. This mix suggests the use of traditional teaching materials to complement the formal integration of iPads in the program. Except for this high use of tablets, tablet use was low among the other three programs, and smartphone use was very low among all programs. In the General Studies program of the Post-implementation University, laptop use was by far the highest.

To further establish context for the study, participants were asked how often they use technology in the classroom. Table 4 shows the mean (M) and standard deviation (SD) for the four-point Likert scale survey item about technology use for both universities. A mean of 3 or above indicates a positive rating, and for this question, the higher the mean the more often technology is used.

Table 4. How often technology is used

I often use technology in the classroom.			
	N	M	SD
Pre-implementation University	482	2.78	0.76
Post-implementation University	604	3.09	0.81

Although technology use was relatively high at both universities, participants from the Post-implementation University used technology more often (M=3.09, SD=0.81) than participants at the Pre-implementation University (M=2.78, SD=0.76), t(1084) = 6.42, p = <0.001.

Student Attitudes Towards Using Digital Technology for Learning in Regards to Enjoyment and Perceived Usefulness

The combined results in Table 5 from both universities (mean of 3 or higher indicates a positive rating), show that students enjoyed learning how to use new kinds of technology (M=3.20) and believe that learning how to use technology would help them at university (M=3.28). Responses for the usefulness of technology in future work was significantly higher (M=3.63) than the other two survey items. (For a breakdown of responses by university, see section "Comparisons between universities" below.)

Table 5. Student enjoyment and perceived usefulness of using technology

	N	M*	SD
I enjoy learning how to use new kinds of technology (e.g. new apps).	1086**	3.20	0.76
Learning how to use technology will help me learn in university.	1092	3.28	0.64
Learning how to use technology will help me in my future job.	1095	3.63	0.56

*An ANOVA showed that the effect of each survey item was significant, $F(2,3270) = 129.01$, $p = <0.001$. Post hoc analyses using the Tukey HSD test for significance indicated mean scores were significantly different for every relationship between groups at $p < 0.05$.

**The number of responses varies as a result of some participants choosing not to answer every survey item.

To further investigate student attitudes, participants were asked to what degree they believed technology improved learning. As shown in Table 6, 70.3% of respondents believed that technology improved learning a lot, which aligns with the high mean score in Table 5 for participants' responses for whether technology helped their learning (M=3.28). A very small percentage (1.7%) of respondents from both universities believed that technology did not improve learning.

Table 6. The degree to which technology improves learning

	N	A lot (%)	A little (%)	It does not (%)
Technology improves learning	1082	70.3	28.0	1.7

To provide greater understanding, participants were asked to answer an open-ended survey question asking why they believed technology improved or did not improve learning. Sixty-six percent or 718 participants responded. Table 7 depicts the most common themes that emerged rated in order of highest to lowest number. (Only themes that occurred at least five times are included in the results.)

Table 7. Reasons why participants stated that technology helped or didn't help learning (number of times themes emerged across both universities)

	Theme	Number
Positive	Easy: easy to use; makes learning easier; find information easier	173
	Fast / saves time / quick	64
	Necessary for the future ("future job" mentioned 25 times)	52
	Learn new: information; things; technology; ways of learning	48
	Helps find "a lot" or "more information"	47
	Interesting / fun / not boring	46
	Videos, visuals help learning	38
	Improves / develops skills	25
	Helps understanding of content	20
	Enables creativity	8
	Gain knowledge	8
Negative	Distracting / hurts concentration	12
	Hurts eyes	6
	Causes problems	5
Neutral	Depends on use of technology; depends on user	9
Other themes	Sharing work; modern; keeping up with the changing world; use anywhere; interactive; communication; variety of activities	

It appears that many respondents believe that technology improves learning because it makes learning easier, faster, and more interesting and, as one participant stated, "it saves time and effort and adds a little excitement to the class". Finding information was also an important theme, as many respondents said that technology either allows faster access to information, or allows access to more information. Other frequently recurring themes were: the ability of technology to help users learn something new (e.g., information, apps, and ways of learning); aid learning through videos and visuals; and develop and improve skills.

In addition, many respondents stated that technology was necessary for the future (25 participants mentioned "jobs"), which again supports the findings in Table 5 where the mean of participant responses for the survey item related to technology helping in their future job (M=3.63) was significantly higher than the means related to enjoyment (M=3.20) and perceived usefulness for learning (M=3.28). Data from the focus group interviews further explain why participants believe technology will be useful for their professional lives, as one respondent stated that all jobs presently use technology, so students should use technology in schools and universities to learn more about it and make it easier for students in the future. A similar theme emerged in the interviews that students need to learn technology so they can keep up with all of the changes in the world. One participant suggested learning technology is necessary because:

> "… the world is in progress, and technology is taking over, and it will be a big part of our…actually, it will be the only thing you will be doing later on."

Some of the open-ended responses were negative when asked why technology improves or does not improve learning. Some respondents stated that technology distracted them, and some were doubtful of the learning benefit of technology, as one participant stated: "I don't think it has much of an im-

pact but it sometimes might be interesting." The suggestion that technology may only be good because it is interesting and fun is echoed in other participant comments.

- "Technology can be used for fun and activities only. It can't improve my learning";
- "I find that useless for learning--good for having fun only."

Although these more skeptical ideas about the usefulness of technology may have been in the minority, it is interesting to note that 28% of respondents, as shown in Table 6, said that technology only improves learning a little.

Comparison between universities for student attitudes towards using technology

To answer Research Question #3 about differences in general attitudes towards technology in regards to enjoyment and perceived usefulness, responses were compared between participants at the Pre-implementation University and Post-implementation University (see Table 8). A mean of 3 or higher indicates a positive rating. Participants at the Post-implementation University believed that technology helped them learn more at university (M=3.33) than participants at the Pre-implementation University (M=3.21). This was the only significant difference in means between the two universities (p=0.002). Other results show that responses from both universities were similar in regards to enjoying how to learn new kinds of technology and how technology will help in their future job.

Table 8. Technology enjoyment and usefulness for Pre-implementation and Post-implementation Universities

		I enjoy learning new kinds of tech		Learning how to use tech will help me learn at university		Learning how to use tech will help in my future job	
	N	M	SD	M	SD	M	SD
Pre-implementation University	481	3.17	0.79	3.21	0.64	3.60	0.54
Post-implementation University	605	3.23	0.72	3.33	0.63	3.64	0.58
P value		0.18		0.002**		0.251	

**Level of significance p<0.01

Comparison between Foundation Studies and General Studies programs for student attitudes towards using technology at both universities.

Comparisons were also made for responses provided by students from the two programs - Foundation Studies and General Studies. These comparisons might be meaningful because the Foundation Studies programs at both universities consist of mostly language-learning and academic skills development, while the General Studies programs deal more with content-based learning. Investigating comparisons between the different levels of study could shed light on how technology use differs between language learners, where the focus is on oral and written activities, and learners in a program where students interact more with subject content. Table 9 shows a comparison between mean scores and standard deviations for the two programs at the Pre-implementation University.

As shown in Table 9, a significant difference was found for two aspects of learning with technology. Participants in the Foundation Studies program at the Pre-implementation University enjoy learning new technology (M=3.23) more than participants in the General Studies program (M=3.06). Also,

Foundation Studies participants believe that learning how to use technology (M=3.27) is more useful for learning compared to General Studies participants (M=3.12).

Table 9. Technology enjoyment and usefulness for Foundation Studies and General Studies participants at the Pre-implementation University

Pre-implementation University		I enjoy learning new kinds of tech		Learning how to use tech will help me learn at university		Learning how to use tech will help in my future job	
	N	M	SD	M	SD	M	SD
Foundation Studies	293	3.23	0.76	3.27	0.64	3.62	0.53
General Studies	188	3.06	0.84	3.12	0.63	3.57	0.55
P value		0.022*		0.014*		0.343	

Table 10 shows a comparison between mean scores and standard deviations for the two programs at the Post-implementation University. Unlike the two programs in the Pre-implementation University, there were no significant differences between means for Foundation Studies participants and General Studies participants at the Post-implementation university in regards to enjoyment of technology and perceived usefulness. Therefore, at the Post-implementation University, general attitudes towards technology were not influenced by the program level.

Table 10. Technology enjoyment and usefulness for Foundation Studies and General Studies participants at the Post-implementation University

Post-implementation University		I enjoy learning new kinds of tech		Learning how to use tech will help me learn at university		Learning how to use tech will help in my future job	
	N	M	SD	M	SD	M	SD
Foundation Studies	384	3.27	0.70	3.35	0.65	3.63	0.57
General Studies	221	3.15	0.76	3.31	0.61	3.66	0.59
P value		0.056		0.484		0.60	

*Level of significance p<0.05

What do Students Prefer to Use to Assist Their Learning?

Research Question #2 in this study is concerned with what learning tools or devices students prefer to use to assist their learning. In the survey, participants were asked a number of questions to ascertain their enjoyment and preferences for using different tools and devices when learning.

Comparisons were also made between participants at the two universities and between the Foundation Studies and General Studies participants within each university.

Enjoyment of using different tools to learn

Table 11 shows the mean and standard deviation of participant responses in regards to enjoyment of using books/paper/pencils, laptops, tablets, and phones to learn. A rating of 3 or above indicates a positive response. Participants enjoyed using books/paper/pencil to learn the most (M=3.21), and laptops less so (M=2.97). Tablets and phones were less preferred for learning (M = 2.69 and 2.41, respectively).

Table 11. Student enjoyment of using different learning tools

	N	M*	SD
I enjoy using books, paper, and pens/pencils to learn	1083	3.21	0.82
I enjoy using laptops to learn	1088	2.97	0.83
I enjoy using tablets (e.g. iPads) to learn	1081	2.69	0.94
I enjoy using phones to learn	1086	2.41	1.03

*An ANOVA showed that the effect of each survey item was significant, $F(3, 4334) = 157.74$, $p = <0.001$. Post hoc analyses using the Tukey HSD test for significance indicated mean scores were significantly different for every relationship between groups at $p < 0.01$.

To further investigate differences in opinions about technology, the enjoyment of learning with books/paper/pencil, laptops, tablets, and phones were compared between the different universities and programs. Figure 1 shows the means for all four programs. As shown in Figure 1, all four programs had the highest mean score for enjoyment of learning with books/paper/pencil. Laptops had the second highest mean for each program except for Foundation Studies at the Post-implementation University where tablets were preferred. Phones were the device students enjoyed least in each of the four programs.

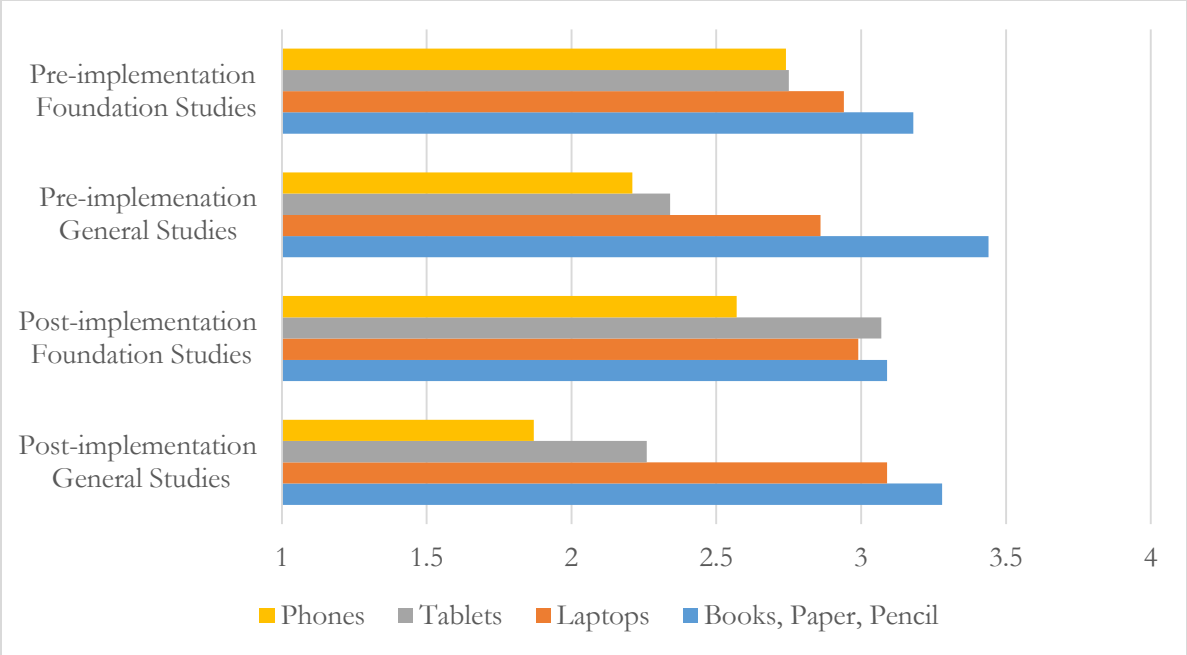


Figure 1. Enjoyment of different tools/devices for learning (Mean)

Comparisons were made between the two universities, and for both programs, using t-Tests to evaluate any significant differences between two group means. Firstly, in Table 12 mean scores of participants from the Pre-implementation University and the Post-implementation University are compared to show enjoyment of different learning tools and devices. Participants in the Pre-implementation University appeared to enjoy learning with books/paper/pencil (M=3.28) more than participants in the Post-implementation University (M=3.16). For laptops the opposite was true. Participants from the Post-implementation University enjoyed learning with laptops (M=3.03) more than participants at the Pre-implementation University (M=2.91). In regards to enjoying using tablets and phones to

learn, participants from the Post-implementation University enjoyed learning more with tablets (M=2.78) than Pre-implementation University participants (M=2.59), while those from the Pre-implementation University (M=2.53) enjoyed learning more with phones than participants from the Post-implementation University (M=2.31). These differences in enjoyment could reflect how often participants use these learning tools at their institution. For example, the Post-implementation University participants might enjoy working with laptops and tablets more because of their increased exposure to these learning tools.

Table 12. Comparisons between universities for enjoyment of different learning tools/devices

		I enjoy using books, paper, and pens/pencils to learn		I enjoy using laptops to learn		I enjoy using tablets (e.g. iPads) to learn		I enjoy using phones to learn	
	N	M	SD	M	SD	M	SD	M	SD
Pre-implementation University	480	3.28	0.78	2.91	0.79	2.59	0.92	2.53	0.99
Post-implementation University	608	3.16	0.85	3.03	0.86	2.78	0.95	2.31	1.06
P value*		0.012*		0.017*		0.001**		<0.001***	

*Level of significance p<0.05; ** Level of significance p<0.01; ***level of significance p<0.001

When comparing the most enjoyed learning tools within each university, it is important to point out that books/paper/pencil and laptops were enjoyed more for learning than tablets and phones. In the Pre-implementation University, books/paper/pencil were enjoyed the most, followed by laptops. (ANOVA and Tukey HSD revealed significant differences for all treatment pairs, $F(3,1908)=74.28$, $p<0.001$, Tukey HSD significant at $p<0.01$, except for iPads and phones (Tukey HSD $p=0.75$). In the Post-implementation University, although there were no significant differences between books/paper/pencil and laptops (Tukey HSD $p=0.065$), there were significant differences between all other relationships (ANOVA $F(3,2442)=96.88$, $p<0.001$, Tukey HSD significant at $p<0.01$). This suggests that in the Post-implementation University, enjoyment of books/paper/pencils and laptops were quite similar, and both learning tools were enjoyed more than tablets and phones when all pairwise comparisons were made.

Secondly, comparisons were made between the Foundation Studies and General Studies programs for each university participating in the study (see Table 13). Within both universities, no significant difference was found for enjoyment using laptops in either program. However, a significant difference was found for enjoyment of learning with the other tools for both Foundation Studies and General Studies at each university. For example, participants in the General Studies programs, within both universities, enjoy learning more with books/paper/pencil (M=3.44, Pre-implementation; M=3.28 Post-implementation) than Foundation Studies participants (M=3.18, Pre-implementation; M=3.09 Post-implementation). In contrast, participants from the Foundation Studies program enjoy learning more with tablets (M=2.75, Pre-implementation; M=3.07 Post-implementation) and phones (M=2.74, Pre-implementation; M=2.57 Post-implementation) than the General Studies participants (M=2.34, Pre-implementation, tablets; M=2.26 Post-implementation, tablets; M=2.21, Pre-implementation, phones; M=1.87, Post-implementation, phones).

Table 13. Comparisons for enjoyment of learning tools between programs at the Pre-Implementation University and Post-implementation University

Pre-implementation University		I enjoy using books, paper, and pens/pencils to learn		I enjoy using laptops to learn		I enjoy using tablets (e.g. iPads) to learn		I enjoy using phones to learn	
	N	M	SD	M	SD	M	SD	M	SD
Pre-implementation Foundation Studies	293	3.18	0.84	2.94	0.82	2.75	0.91	2.74	0.97
Pre-implementation General Studies	188	3.44	0.65	2.86	0.74	2.34	0.89	2.21	0.94
P value		<0.001***		0.253		<0.001***		<0.001***	

Post-implementation University		I enjoy using books, paper, and pens/pencils to learn		I enjoy using laptops to learn		I enjoy using tablets (e.g. iPads) to learn		I enjoy using phones to learn	
	N	M	SD	M	SD	M	SD	M	SD
Post-implementation Foundation Studies	386	3.09	0.90	2.99	0.90	3.07	0.85	2.57	1.04
Post-implementation General Studies	222	3.28	0.73	3.09	0.78	2.26	0.90	1.87	0.94
P value		0.006**		0.180		<0.001***		<0.001***	

*Level of significance p<0.05; ** level of significance p<0.01; ***level of significance p<0.001

What students prefer to use for specific educational tasks

Participants' first choices of learning tools and devices preferred for specific educational tasks are shown in the following figures. In Figures 2A and 2B, choices at the Pre-implementation University for each of the programs are shown (as percentages).

In Figures 3A and 3B, preferred choices of learning tools and devices at the Post-implementation University for each program are depicted.

The data reveals that all four programs showed similar results. Except for reading information outside of class for fun on phones, books/paper and laptops had the highest percentage of first preferences among all tasks. Overall books/paper seemed to rate higher for enjoyment, reading information for class, and doing in-class activities, and laptops were higher for doing an infographic and making a video. Tablets were never selected as a first preference for doing educational tasks. Although, 32% of Foundation Studies students at the Post-implementation University (where iPads were required for learning) selected tablets as their first choice for reading information in class, and 29% said they enjoyed learning the most on tablets. Among the four programs across the two universities, phones rated as the lowest preference for all academic tasks.

The Foundation Studies program at each university had a higher percentage of students choosing books/paper for writing paragraphs or essays, while the General Studies participants preferred laptops.

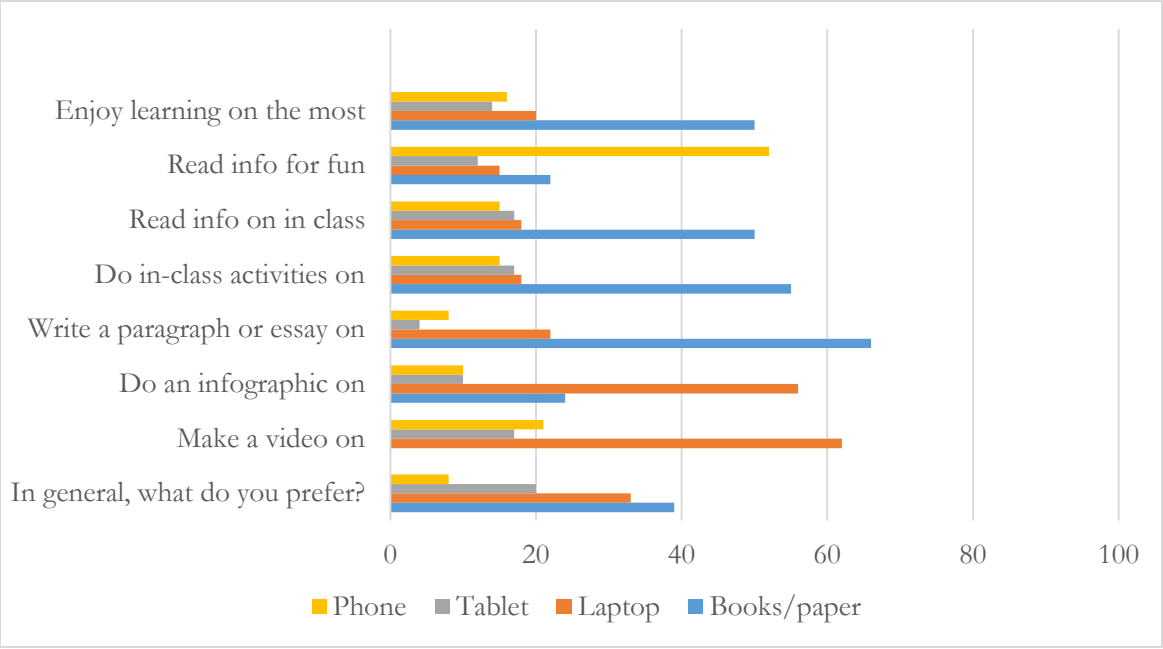


Figure 2A. Preferences for different devices for specific tasks (percentage of participants who indicated first preference). Pre-implementation University: Foundation Studies (n=287, %)

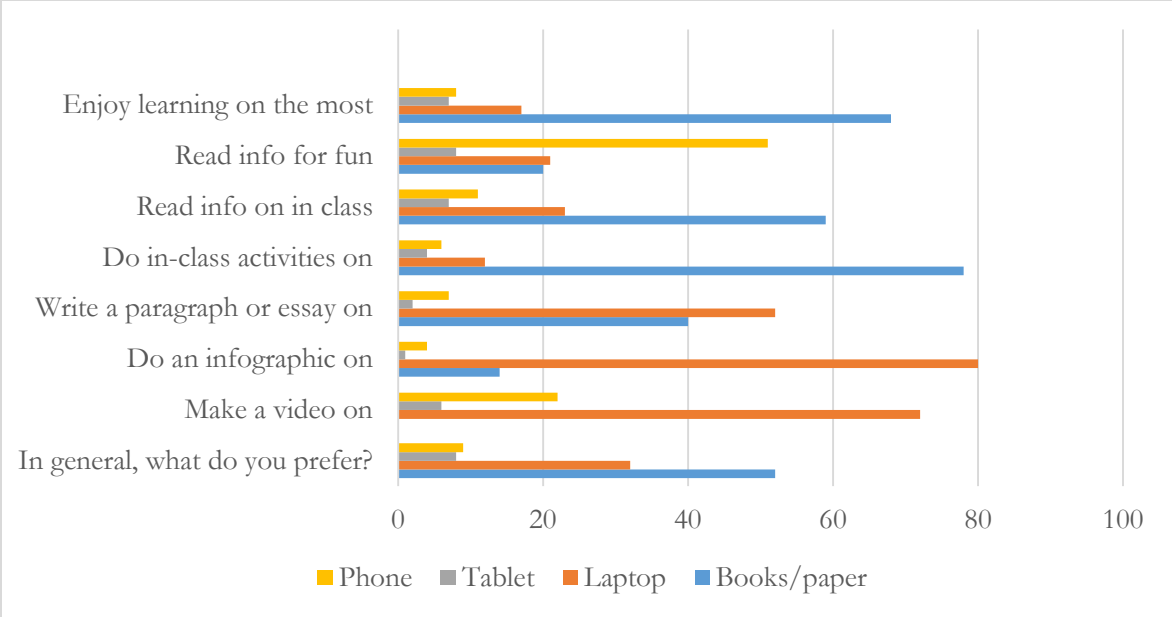


Figure 2B. Preferences for different devices for specific tasks (percentage of participants who indicated first preference). Pre-implementation University: General Studies (n=179, %)

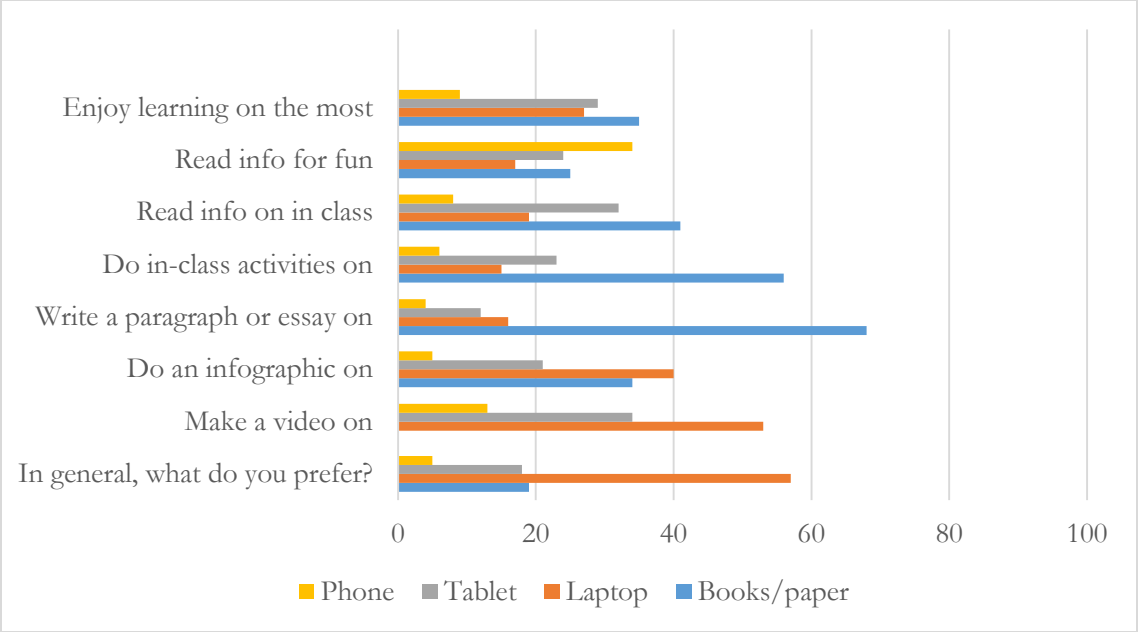


Figure 3A. Preferences for different devices for specific tasks (percentage of participants who indicated first preference). Post-implementation University: Foundation Studies (n=387, %)

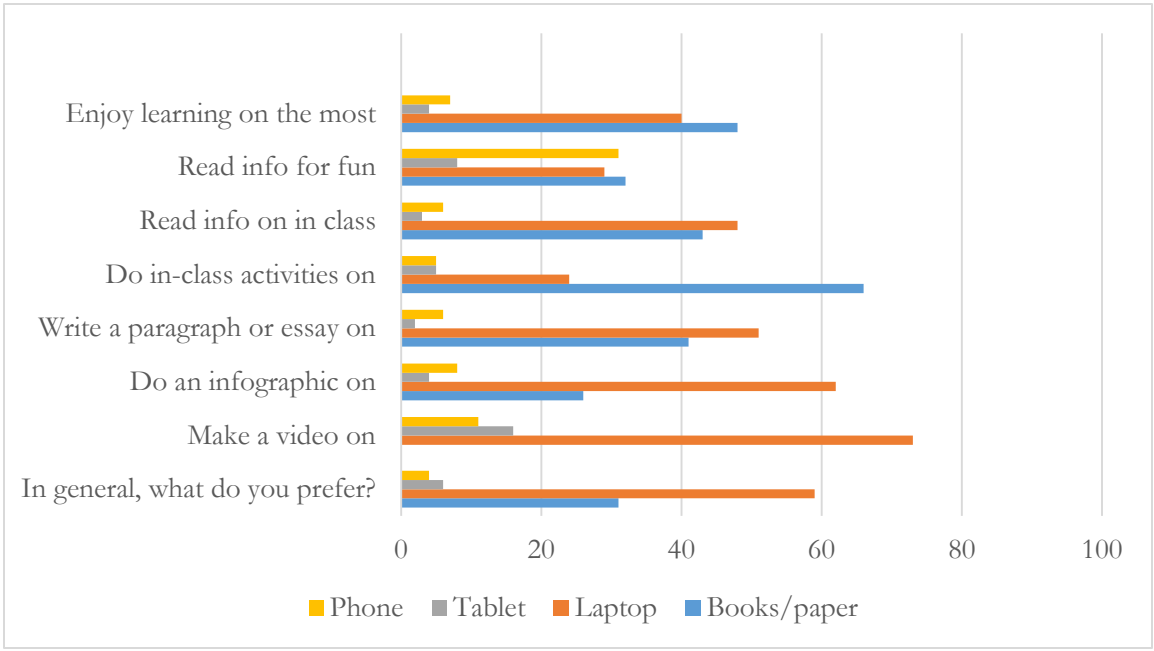


Figure 3B. Preferences for different devices for specific tasks (percentage of participants who indicated first preference). Post-implementation University: General Studies (n=204, %)

For each university, participants' preferred tools for learning and what they prefer to use, in general, are shown as percentages in Table 14. Both the Pre-implementation University and the Post-implementation University had a higher percentage of respondents choosing books/paper as their first choice for enjoyment (followed by laptops). This supports the findings in Table 13 which also showed books/paper and laptops as being the most enjoyed tools/devices for learning (for most programs) when comparing mean scores for enjoyment with smaller handheld devices. For prefer-

ences in general, a higher percentage of respondents from the Pre-implementation University chose books/paper as their first preference, whereas a higher percentage from the Post-implementation University chose laptops as their first preference.

Table 14. Preferences for different tools/devices as a percentage of participants who indicated first preference

Enjoy learning on the most					
	N	Books/paper	Laptops	Tablets	Phones
Pre-implementation University	480	57%	19%	11%	13%
Post-implementation University	608	39%	32%	20%	8%
In general, what do you prefer?					
	N	Books/paper	Laptops	Tablets	Phones
Pre-implementation University	480	44%	32%	16%	8%
Post-implementation University	608	23%	58%	14%	5%

Participants were also asked an open-ended question on the survey about their use of books/paper, laptops, tablets, or phones for learning at university. The extracted themes are shown in Table 15.

Table 15. Reasons why participants preferred books/paper, laptop, tablet, or phone (number of times themes emerged) (n =691)

Laptop	N	Books / paper	N
Easy / easy to use	127	Easy / easy to use	44
Portable	26	Remember / memorize / save information in mind	41
Search / find information	23	Taking notes	39
Type / writing is better on laptop	22	Better / easier for learning and understanding information	38
Save work	20	Writing: Easier to write; prefer writing; writing helps me learn better	32
Better / easier for learning	16	Not distracting / better focus	20
Big screen	13	Highlight / underline	13
Future or future job	11	Screen hurts eyes	8
Tablet	N	Phone	N
Easy / easy to use	44	Easy / easy to use	9
Portable	44	Portable	9

Easy/easy to use was the most prevalent theme specifically for laptops, and to a lesser extent for tablets and books/paper. A similar theme emerged when participants were asked why they believe technology improved learning (see Table 7).

Portability was the second most common theme specifically for tablets, followed by the use of books/paper for remembering and memorizing information. Books/paper was also considered better for taking notes. The benefit of using paper for taking notes is reflected in one participant's comment: "I believe that writing on paper and looking on what you write helps you understand more."

Another benefit of paper was reported in the focus-group interviews. One participant stated that paper is better because you can learn from your mistakes when writing. Another participant stated that learning math on paper is better because "we will know how to make the steps". Similarly, a respondent in a different focus-group interview said math was better on paper because solving a problem by going through all the details, the "1, 2, 3, 4" as he stated, takes too long on laptops. For these participants, paper as a medium facilitates the process of doing tasks that involve revision or steps like writing and math.

Some common themes emerged in response to why some participants preferred learning with laptops in comparison to books/paper, tablets or phones. The ability to search for information better on laptops was mentioned 23 times, the benefit of typing or writing on laptops appeared 22 times, followed by themes such as the ability to save work (20), better for learning (16), and the larger screen (13). A participant in the focus group interview explained their preference for laptops by stating that laptops are the best tool for learning because "the screen is big and you can have a keyboard to write…it's easier than the iPad."

Comparison of what participants use in class, and what they would like to use

To further investigate preferences for different tools and devices, participants were asked on the survey what devices they were mostly using to study with in class, and what device they wanted to use. In Figures 4A to 4D, the responses are shown for each university and for each program with the overall percentages for each learning tool shown in Figure 4E.

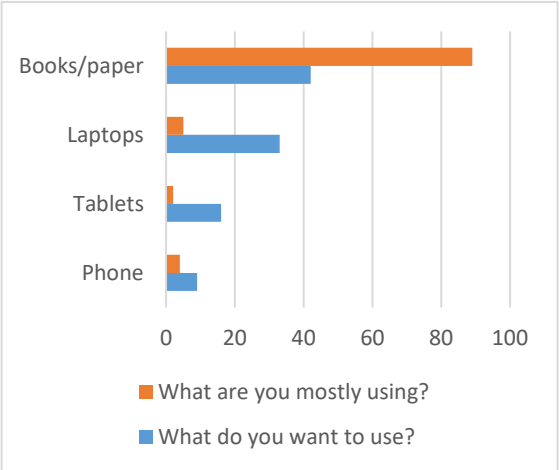


Figure 4A. Use of Learning tools, Pre-implementation University: Foundation Studies (n=279, %)

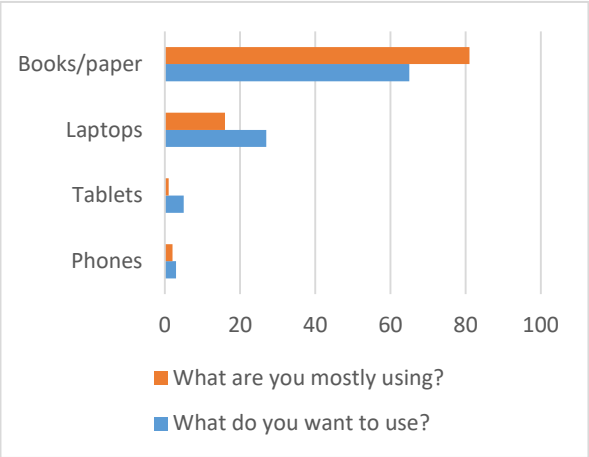


Figure 4B. Use of learning tools, Pre-implementation University: General Studies (n=184, %)

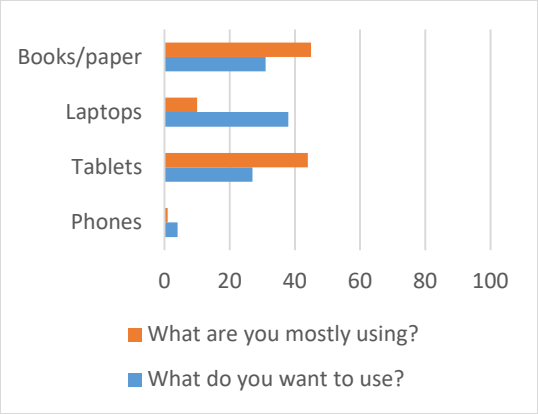


Figure 4C. Post-implementation University: Foundation Studies (n=354, %)

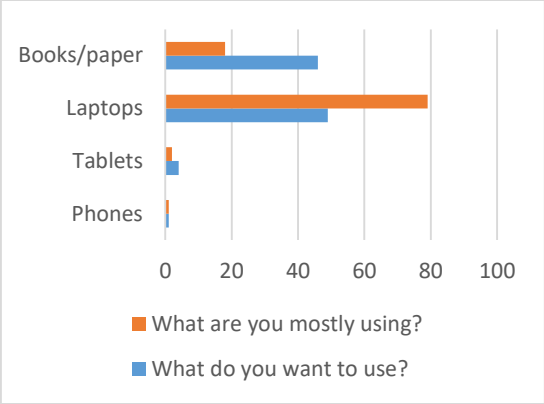


Figure 4D. Post-implementation University: General Studies (n=215, %)

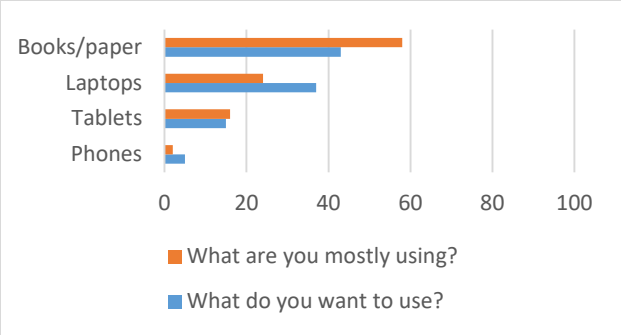


Figure 4E. Overall Totals (n=1027, %)

The highest percentage of participants wanted to use books/paper for their study (43%), followed by laptops (37%), tablets (15%), and phones (5%). Again, the preference for books/paper and laptops over handheld mobile learning devices (tablets/phones) seems to be consistent throughout this study.

Preferences for learning with books, paper, and pencil vs laptops, tablets, and phones

Survey responses for preferred learning tools at the two universities are shown in Table 16.

Table 16. Preferences for learning with books, paper and pencil vs laptops, tablets, and phones

1. Do you prefer learning with … ?				
	N	Books, paper and pencil (%)	Laptops, tablets and phones (%)	Both (%)
Pre-implementation University	474	27.43	11.60	60.97
Post-implementation University	599	18.53	13.86	67.61
Total overall	1073	22.46	12.86	64.68

Although more respondents chose books, paper, and pencil over laptops, tablets, and phones, a majority of participants prefer learning with a combination of both traditional resources (books, paper, and pencil), and more modern technological tools (laptops, tablets, and phones). These results were

similar for both universities as 61% of respondents from the Pre-implementation University reported that they preferred learning with both, and 68% of respondents from the Post-implementation University preferred both.

DISCUSSION

A discussion of the findings is organized to align with the three research questions.

RESEARCH QUESTION #1: WHAT ARE STUDENT ATTITUDES TOWARDS USING DIGITAL TECHNOLOGY FOR LEARNING IN REGARDS TO ENJOYMENT AND PERCEIVED USEFULNESS?

Participant responses at both universities were high in regards to how often students use technology, how much they enjoy technology, and how useful they believe technology to be. The results seem to show a connection between how often participants use technology, and their enjoyment and perceived usefulness of technology. This correlation between frequency of use and positivity towards technology (increased comfort/increased usage) mirrors the findings of Martínez (2017) amongst undergraduate students at the American University of Puerto Rico. In regards to usefulness, survey data suggested that a majority of participants believe that learning how to use technology is helpful in the classroom because it makes the process of learning easier, faster, and more interesting. Another significant perceived benefit of technology was the ability to find information faster and in greater quantities. This latter result mirrors Dahlstrom and Warraich's (2012) findings that technology is often used as a tool for information gathering and research.

Although students believe using technology is helpful in the classroom, an even greater majority agreed that learning how to use technology is useful for work. It is clear in this study that students believe technology can be most helpful for workplace contexts. This aligns with Edmunds et al.'s (2012) finding that students perceive Information and Communications Technology (ICT) to be more useful in a professional context compared to course study. These results can be used to make recommendations for the incorporation of digital learning outcomes in higher education curricula - to not only help students in the classroom learn, but also prepare them for their future professional lives.

Although a majority of the participants reported that technology improves learning 'a lot' (70.3%), a significant percentage reported that it only improved learning a little (28%). This is interesting, as the findings from the Edmunds et al., (2012) study would suggest that it would be wrong to consider student cohorts as a homogenous group with the same levels of technological proficiency and the acceptance of Prensky's (2001) concept of the 'Digital Native'. It is perhaps therefore possible to conclude that both acceptance of, and reliance on, technology depends on a number of factors, that is, a student's level of comfort, their learning style, and the type of device being used.

Finally, the way technology is used can determine its usefulness, as one participant responded when asked about whether technology improves learning: "it depends how you use it." This quotation seems to embody some of the positive and negative findings in this study as to the reasons why participants believe technology is beneficial or not. Technology's ability to function as an information portal may be seen by students as a major advantage by allowing them to get 'more' information and 'faster', but it may also be a disadvantage as it can be a 'distraction'. This 'distraction' could be one reason why many participants in this study prefer learning with books and paper.

RESEARCH QUESTION #2: WHAT DO STUDENTS PREFER TO USE TO ASSIST THEIR LEARNING?

Overall, books and paper were the most preferred tool to assist learning, followed by laptops. Smart phones and tablets were much less preferred for learning.

Students enjoyed learning with books and paper the most, which suggests that some of the more recent technological tools for learning (e.g., laptops, tablets, and smartphones) may not be as enjoyable for learners as traditional resources. Also, many participants preferred books and paper for specific educational tasks such as reading or doing in-class activities (e.g., worksheets). Participants stated that using paper aided memory and the process of working through writing or mathematics tasks that involved revision or steps. It appears that the medium of paper is a more useful tool for certain types of learning. This is mirrored in the findings of Davidovitch (2017) and Liu and Stork (2000) whose respondents also noted the usefulness and value of books and paper learning.

Laptops were the second most preferred tool to assist learning. Data from the surveys revealed that students enjoyed learning more on laptops than on smaller handheld devices such as tablets and smartphones, particularly for specific academic tasks such as writing essays and creating infographics. A smaller percentage of students chose tablets and phones as their first preference for the educational tasks. Even in the Foundation Studies program at the Post-implementation University where students often use tablets in the classroom (and are required to do so), either books/paper or laptops were preferred to tablets. This preference for laptops over smaller mobile devices such as phones and tablets supports Dahlstrom and Warraich's (2012) finding that smaller mobile devices are not taking over the functionality of laptops for student academic work - despite their increased popularity in the general population. One reason why participants preferred laptops in this study was because of their larger screen size, and the ability to type better on them. This supports Marmarelli and Ringle's (2011) finding of the limitations of a 'soft' keyboard, and Dalhstrom's (2012) report that students preferred laptops over smaller devices because of the larger screen and keyboard.

Ease of use appears to be one of the reasons why participants preferred laptops, tablets, or phones in general, and this aligns with Davis et al.'s (1989) technology acceptance model which states that users will accept a certain information system if it is easy to use. Device portability also appeared to be an important factor from primary school (Henderson & Yeow, 2012) to data collection in a university library context (Jones & Sinclair, 2011).

Learning with both traditional resources (books, paper, and pencil), and more modern technological tools (laptops, tablets, and phones) is preferred at both universities depending on the task. For example, laptops were regarded as efficient tools for accessing information but also a distraction due to the enormous range of information and communication tools available. "Hyper-extensive" screen-based reading seems to be associated with shallower and less sustained reading practices, and perhaps students consider this activity to be not effective learning (Liu, 2005 p. 707). On the other hand, where learning tasks require more sustained focus on a single text or a small range of texts, our results indicate some evidence that students would prefer these texts to be paper-based. This is perhaps due to fewer distractions and since paper appears to facilitate tasks related to memory and understanding, such as note-taking. The advantage of note-taking on paper aligns with Liu's (2005) finding that people are much more likely to annotate printed documents rather than digital documents. Additionally, the preference for learning with both books/paper and technological tools supports the ideology that new forms of technology do not replace older forms of technology, but rather "stimulate a synergy" between them as "electronic media and printed media complement, and in some ways even reinforce each other" (Liu & Stork, 2000, p. 97).

Finally, in addition to this synergy, using different mediums for learning can also benefit students because variety keeps learners better engaged. Using a new technological digital device for learning can introduce a different element into the classroom, as one participant stated that they preferred tablets because "it changes the routine". Another participant in an interview echoed this by saying technology "will break the routine" of using books and paper that they have used throughout their schooling. This suggests technology may engage students by 'mixing up' the different ways of learning. In addition, using a balance of tools for learning could be more advantageous than just using one type of tool or another. As one participant stated: "using a variety of methods can help the student learn better." The use of multiple tools for learning may be the best formula for acquiring knowledge as

effective learning requires the flexibility of using different resources/tools to meet different tasks, as Dahlstrom and Warraich (2012) state: "tasks at hand drive the selection of devices for learning" (p. 6).

It is possible to assume that all the learning tools mentioned may have their own advantages (and disadvantages), as one participant succinctly summarized: "Books and paper are easy to read and write. Laptops save work. Tablets are easy to carry. Phones are too small to use".

Research Question #3: How do student opinions about digital technology and preferred learning tools and devices differ?

In this section the differences in attitudes to and preferences for technology between the two universities and the Foundation Studies and General Studies programs are discussed.

Comparison between the universities: general attitudes towards technology

Overall, participants at both universities had favorable attitudes towards technology in regards to enjoyment, usefulness for learning, and usefulness for future work, and no significant differences were found apart from the usefulness of technologies for learning. Respondents at the Post-implementation University believed that technology helped them learn more than respondents at the Pre-implementation University. This could be attributed to the greater exposure of technology at the Post-implementation University or a curriculum that is more humanities-based than STEM-based. The former requires more skills like researching information online to write an essay or using digital technologies to create an infographic, make a website, or create presentation slides.

Comparison between the universities: what do students prefer to use to assist their learning?

Although books/paper were the most preferred (followed closely by laptops) tool at both universities, participants at the Pre-implementation University preferred using books/paper more than participants at the Post-implementation University. Conversely, participants at the Post-implementation University preferred laptops and tablets more than their counterparts at the Pre-implementation University. These differences in responses could reflect the learning context of the universities themselves. Technology is much more embedded into the classroom practices of the Post-implementation University, so students may naturally prefer using a technological device like a laptop. Technological use is less widespread in the Pre-implementation University, so students could prefer using books and paper. Despite differences in technology implementation, books/paper and laptops were the most enjoyed and preferred resources for learning among participants at both universities.

Comparison between the programs: general attitudes towards technology

Comparisons between the Foundation Studies and General Studies participants in the Pre-implementation University revealed that Foundation Studies students had more favorable attitudes towards technology than students in the General Studies program at the same university. They enjoyed learning new kinds of technology more, and found technology more useful for learning. These differences could be due to benefits for participants in the Foundation Studies program when using interactive apps to learn language-related skills like vocabulary acquisition. In comparison, in the General Studies program, the curriculum consists of more STEM-related courses where students might interact more with content and be less likely to actively use digital tools to learn. Despite these differences, enjoyment of technology, and perceived usefulness of technology for learning were rated high for both programs. This suggests that participants at the Pre-implementation University value the use of technology for learning regardless of studying language or science and math-related courses.

In the Post-implementation University, there were no significant differences between the two programs for general attitudes towards technology in relation to enjoyment and perceived usefulness. It appears that the integration of technology in the curriculum, and student exposure to technology in the classroom, has positively affected both Foundation Studies and General Studies participants' beliefs about technology.

Comparison between the programs: what students prefer to use to assist their learning?

What students in different programs prefer to use to assist their learning appears to be fairly similar. Participants in the General Studies programs at both universities enjoy learning more with books/paper/pencil than Foundation Studies participants at the same universities. In contrast, participants in the Foundation Studies programs enjoyed learning more with tablets and phones than the General Studies participants. This suggests that enjoyment of different devices might have been determined by the program and the content of that specific program. For example, participants in the Foundation Studies programs focus on language learning and academic skills more than content, so learning on handheld mobile devices may be more beneficial. In comparison, in the General Studies program students might find handheld mobile devices less useful for content-based learning where they are required to read (and write) longer texts. For these General Studies participants, writing on a laptop rather than a tablet might be easier for longer essays. Also, reading for content-based classes might be more beneficial on paper, as Liu's (2005) study found that participants preferred doing in-depth reading on paper. These differences between students in the Foundation Studies and General Studies programs suggest that whilst 'faculty' does not seem to impact attitudes towards technology as found in Davidovitch's (2017) study, the 'level' of course and the 'functionality of the device' may well impact technology preferences.

Limitations of the Study

The way technology was used by instructors at each university could have been a limiting factor. This study investigated the technology use of 1102 students in four different programs across two universities. The participants in this study were part of different classes with different instructors - and these differences may have influenced the results. Some instructors at the Post-implementation University, where technology use was promoted on an institutional level, could have used technology to different degrees. For example, some instructors could have chosen to incorporate a blended learning element to their classes, which could influence the level of technology use as students used laptops more than books while learning. Some instructors could have used technology simply to support traditional instruction, and some instructors could have used very little technology in the classroom.

Conversely, educators at the Pre-implementation University could have required their students to frequently use technology both in and out of class. These differences in classroom instruction could have influenced the results of this study. For future studies, it would be interesting to investigate any impact that course set-up and delivery have on student attitudes towards technology by showing any correlations that may exist between how much technology use is required in the course, and student attitudes towards the use of technology.

Another limitation in this study is that the instruments for data collection were mostly concerned with investigating student usage of technology while physically present in the classroom. To have a more complete picture of student attitudes towards technology, additional items should have been included on the survey to examine student usage of technology for educational purposes while not present in the classroom. Also, additional open-ended survey items could have been used to more deeply investigate student attitudes towards technology, and reasons why participants prefer using certain tools for specific educational tasks. Finally, more focus-group interviews with questions that expand on the survey items instead of simply mirroring them could have added more insight into student beliefs about and preferences for technology use.

Future Research

Although this study investigated the attitudes of 1102 participants towards technology and their preferences for using learning tools and devices for specific educational tasks, they were all from one area of the world and shared a similar demographic background. Future research is needed to survey student attitudes about technology from higher education institutions in other parts of the world to see whether additional studies align with the findings in this paper.

Also, this study focused on universities with different institutional policies for the use of technology. Another study investigating the correlation between course setup and technology use could provide some other perspectives into how student attitudes towards technology may differ.

Finally, this study focused mostly on student perceptions of technology and devices in the classroom. Although it presents challenges because each learner is different, more research needs to be done on the impact technology has on learning - specifically how certain tools may help learners more effectively complete different educational tasks.

Conclusions and Recommendations

Based on the findings in this study, we can first conclude that there was little difference in responses among participants who studied at the university that has more formally adopted technology (Post-implementation University), and the university that is yet to do so (Pre-implementation University). Regardless of technology implementation and official policy, most participants at both universities had favorable attitudes towards the use of technology for learning as the majority of participants enjoyed learning how to use new technology. They believed it gave them easier and faster access to information and believed that learning how to use technology was important for their future jobs. The second conclusion in our study is that books/paper were the most preferred resources for learning, followed closely by laptops. Tablets and phones were least preferred. This preference seems to be related to our participants' perception that books/paper better facilitate note-taking and focused reading for memorization and understanding while providing fewer distractions. The third conclusion is that although books/paper and laptops were the most preferred tools for learning, many participants do enjoy using tablets and phones, and some prefer them for certain tasks. Similarly, participants in the Foundation Studies programs enjoyed learning more with tablets and phones than their counterparts in the General Studies programs, which may be a result of the benefits of smaller handheld devices for language learning. The final conclusion is that participants preferred a combination of learning with traditional tools (e.g. books/paper) and technological tools (laptops, tablets, phones).

Several recommendations have emerged from this study based on the findings.

Adopt learning outcomes related to digital literacy.

Implementing digital literacy into the curriculum can, not only help students become more effective students in the classroom, but also help to develop more skilled professionals in their working lives.

Utilize paper alongside digital tools for learning.

We recommend that when adopting an educational technology policy, higher education institutions should not fail to use one of the most effective resources of all time - paper. Paper-based resources may be preferable for more prolonged engagement with text, even for digital natives. Although books and paper may be the best resource for learning, students still need to be exposed to new forms of technology because of their perceived future jobs, and also because digital tools (especially laptops) provide access to an enormous breadth and depth of information.

Adopt a 'bring your own device policy' (BYOD)

Students have different preferences for learning with laptops, tablets, or phones. If formally implementing an education technology policy, we recommend adopting a 'bring your own device' (BYOD) policy which enables learners to choose their favorite device.

Use both traditional tools (e.g. books, paper) and technological tools (e.g. laptops, tablets) for learning.

Classroom practices that incorporate both traditional tools and newer digital technological tools for learning might be most effective because they provide flexibility to find the best learning tools for the task. A phone may work best for one task, while paper works best for another. This flexibility can also accommodate different learning styles because some learners may benefit more from the use of technology than others. Finally, using different tools for learning may better engage students by providing more variety in the classroom.

References

Al-Emran, M., Elsherif, H. M., & Shaalan, K. (2016). Investigating attitudes towards the use of mobile learning in higher education. *Computers in Human Education*, *56*, 93-102. https://doi.org/10.1016/j.chb.2015.11.033

Cassidy, E., Colmenares, A., Jones, G., Manolovitz, T., Shen, L., & Vieira, S. (2014). Higher education and emerging technologies: Shifting trends in student usage. *The Journal of Academic Librarianship, 40*(2), 124-133. https://doi.org/10.1016/j.acalib.2014.02.003

Castillo-Manzano, J. I., Castro-Nuño, M., López-Valpuesta, L., Sanz-Díaz, M. T., and Yñiguez, R., (2017). To take or not to take the laptop or tablet to classes, that is the question. *Computers in Human Behavior*, *68*, 326-333. https://doi.org/10.1016/j.chb.2016.11.017

Cavanagh, T. B. (2012). The postmodality era: How 'online learning' is becoming 'learning'. In D. Oblinger (Ed.), *Game dhangers: Education and information technologies* (pp. 215-228). Washington, DC: EDUCAUSE.

Creswell, J. W. (2015). *A concise introduction to mixed methods research*. Los Angeles, CA: SAGE.

Dahlstrom, E. (2012). *ECAR study of undergraduate students and information technology* [Research Report]. EDUCAUSE Center for Applied Research. Retrieved from https://net.educause.edu/ir/library/pdf/ERS1208/ERS1208.pdf

Dahlstrom, E., & Warraich, K. (2012). *Student mobile computing practice, 2012: Lessons learned from Qatar.* [Research Report]. EDUCAUSE Center for Applied Research. Retrieved from http://www.educause.edu/ecar

Davidovitch, N. (2017). The effect of technology on students' reading habits: Reading from a screen versus reading from paper. *Pedagogical Sciences*, *6*, 91-97.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, *35*(8), 982-1003. https://doi.org/10.1287/mnsc.35.8.982

Dresselhaus, A., & Shrode, F. (2012). Mobile technologies & academics: Do students use mobile technologies in their academic lives and are librarians ready to meet this challenge? *Information Technology & Libraries, 31*(2), 82-101. https://doi.org/10.6017/ital.v31i2.2166

Edmunds, R., Thorpe, M., & Conole, G. (2012). Student attitudes towards and use of ICT in course study, work and social activity: A technology acceptance model approach. *British Journal of Educational Technology*, *43*(1), 71-84. https://doi.org/10.1111/j.1467-8535.2010.01142.x

El-Gayar, O., & Moran, M. (2007). Evaluating students' acceptance and use of table PCs in collegiate classrooms. *AMCIS 2007 Proceedings*, *Paper 91*. Retrieved from http://aisel.aisnet.org/amis2007/91

Garland, R. (1991). The mid-point on a rating scale: Is it desirable. *Marketing Bulletin*, *2*, 66-70, Research Note 3.

Gikas, J., & Grant, M. M. (2013). Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media. *Internet and Higher Education, 19*, 18-26. http://dx.doi.org/10.1016/jiheduc.2013.06.002

Henderson, S., & Yeow, J. (2012). iPad in education: A case study of iPad adoption and use in a primary school. *45th Hawaii International Conference on System Sciences.* https://doi.org/10.1109/HICSS.2012.390

Jacob, S. M., & Issac, B. (2008). The mobile devices and its mobile learning usage analysis. *Proceedings of the International MultiConference of Engineers and Computer Scientists*, *Vol. I* (pp. 782-787). IMECS.

Jones, A., & Issroff, K. (2007). Motivation and mobile devices: exploring the role of appropriation and coping strategies. *Alt-J, Research in Learning Technology, 15*(3), 247-258. https://doi.org/10.1080/09687760701673675

Jones, J. L., & Sinclair, B. (2011). Assessment on the go: Surveying students with an iPad. *Journal of Library Innovation*, *2*(2), 22-35.

Kalinic, Z., Arsovski, S., Stefanovic, M., Arsovski, Z., and Rankovic, V. (2011). The development of a mobile learning application as support for a blended e-learning environment. *Technics Technologies Education Management, 6*(4), 1345-1355.

Kennedy, G. E., Judd, T. S., Churchward, A., Gray, K., & Krause, K. L. (2008). First year students' experiences with technology: Are they really digital natives? *Australasian Journal of Educational Technology, 24*(1), 108-122. https://doi.org/10.14742/ajet.1233

Levine, L. E., Waite, B. M., & Bowman, L. L. (2012). Mobile media use, multitasking and distractibility. *International Journal of Cyber Behavior, Psychology and Learning, 2*(3), 15-29. https://doi.org/10.4018/ijcbpl.2012070102

Liu, Z. (2005). Reading behavior in the digital environment: Changes in reading behavior over the past ten years. *The Journal of Documentation, 61*(6), 700-712. https://doi.org/10.1108/00220410510632040

Liu, Z., & Stork, D. G. (2000). Is paperless really more? *Communications of the ACM, 43*(11), 94-97. https://doi.org/10.1108/00220410410534185

Marketing Charts. (2014). *Tech device penetration, among US college students.* Retrieved from http://www.marketingcharts.com/online/tech-device-penetration-among-us-college-students-44138/

Marmarelli, T., & Ringle, M. (2011). *The Reed College iPad study.* Portland, OR: The Reed Institute.

Martínez, J. G. (2017). Attitudes towards new technologies: A student perspective at Inter American University of Puerto Rico. *Ceiba. Etapa IV-Colección completa*, *3*(1), 85-95.

Mayisela, T. (2013). The potential use of mobile technology: Enhancing accessibility and communication in a blended learning course. *South African Journal of Education, 331*, 1-18. https://doi.org/10.15700/saje.v33n1a629

Maxwell, C. (2016). What blended learning is - and isn't. *BLU: Blended Learning Universe.* Retrieved from https://www.blendedlearning.org/what-blended-learning-is-and-isnt/

Nicholas, D., Huntington, P., Jamali, H. R., Rowlands, I., Dobrowolski, T., & Tenopir, C. (2008). Viewing and reading behaviour in a virtual environment: The full-text download and what can be read into it. *Aslib Proceedings: New Information Perspectives 60*, 185-198. https://doi.org/10.1108/00012530810879079

Oklahoma State University. (2011). *iPad study released by Oklahoma State University.* Retrieved from https://news.okstate.edu/articles/ipad-study-released-oklahoma-state-university

Park, Y., Nam, M-W., & Cha S-B. (2012). University students' behavioral intention to use mobile learning: Evaluating the technology acceptance model. *British Journal of Educational Technology*, *43*(4), 592-605. https://doi.org/10.1111/j.1467-8535.2011.01229.x

Pea, R. D., & Maldonado, H. (2006). WILD for learning: Interacting through new computing devices anytime, anywhere. In R. K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (pp. 427-443). Cambridge University Press: New York.

Pearson (2014). *Pearson student mobile device survey: College students.* Retrieved from http://www.pearsoned.com/wp-content/uploads/Pearson-HE-Student-Mobile-Device-Survey-PUBLIC-Report-051614.pdf

Pew Research Center. (2012). In changing news landscape, even television is vulnerable. Retrieved from http://www.people-press.org/2012/09/27/in-changing-news-landscape-even-television-is-vulnerable/

Pew Research Center. (2015). *Technology device ownership: 2015*. Retrieved from http://www.pewinternet.org/2015/10/29/technology-device-ownership-2015/

Pew Research Center. (2018). *Demographics of mobile device ownership and adoption in the United States: Mobile fact sheet.* Retrieved from http://www.pewinternet.org/fact-sheet/mobile/

Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon, 9*(5), 1-6. https://doi.org/10.1108/10748120110424816

Robinson, R., Molenda, M., & Rezabek, L. (2008). Facilitating learning. In A. Januszewski, & M. Molenda (Eds.), *Educational technology: A definition with commentary* (pp. 15-48). New York: Lawrence Erlbaum Associates.

Şad, S. N., & Gŏktaş, O. (2014). Preservice teachers' perceptions about using mobile phones and laptops in education as mobile learning tools. *British Journal of Educational Technology, 45*(4), 606-618. https://doi.org/10.1111/bjet.12064

Saldana, J. (2009). *The coding manual for qualitative researchers.* London: SAGE.

Sharples, M., Taylor, J., & Vavoula, G. (2005). *Towards a theory of mobile learning.* Paper presented at MLearn, Cape Town, South Africa. Retrieved from https://www.researchgate.net/publication/228346088_Towards_a_theory_of_mobile_learning

Spiegel, A., & Rodriguez, G. (2016). Students at university have mobile technologies. Do they do m-learning? *Procedia – Social and Behavioral Sciences*, *217*, 846-850. https://doi.org/10.1016/j.sbspro.2016.02.006

Springer (2008). *eBooks – The end user perspective*. Retrieved from http://www.springer.com/cda/content/document/cda_downloaddocument/eBooks+-+the+End+User+Experience?SGWID=0-0-45-608298-0

Staff Report. (2015). How many electronic devices do you own? Each UAE adult has 4: Survey. *Gulf News Technology.* Retrieved from http://gulfnews.com/business/sectors/technology/how-many-electronic-devices-do-you-own-each-uae-adult-has-4-survey-1.1440197

Taleb, Z., & Sohrabi, A. (2012). Learning on the move: The use of mobile technology to support learning for university students. *Procedia – Social and Behavioral Sciences*, *69*, 1102-1109. https://doi.org/10.1016/j.sbspro.2012.12.038

Van der Velde, W., & Ernst, O. (2009). The future of eBooks? Will print disappear? An end-user perspective. *Library Hi Tech, 27*(4), 570-583. https://doi.org/10.1108/07378830911007673

Weijters, B., Cabooter, E., & Schillewaert, N. (2010). The effect of rating scale format on response styles: The number of response categories and response category labels. *International Journal of Research Marketing, 27(3)*, 236-247. https://doi.org/10.1016/j.ijresmar.2010.02.004

Wexelbaum, R. S., & Parault, S. J. (2011). Ebooks and reading comprehension: Perspectives of librarians and educators. *Library Faculty Publications*, Paper 2. Retrieved from http://repository.stcloudstate.edu/lrs_facpubs/2

APPENDIX A: QUESTIONNAIRE

Student Attitudes towards Technology

Please fill out the questionnaire below. Participation in this survey is voluntary.

You do not have to write your name, but please write your student number.

Please fill in the information. For boxes with 'or', please circle the correct option

Student number: ___ ___ ___ ___ ___	PI or ZU	Age: 17-24 25-30 31-40 Over 40	Your course right now:
ABP **or** Freshman	Male **or** Female	Number of semesters at university: 1 2 3 4 5 6 7 8	Major you plan to do:

Please circle only one answer for #1-15 below

1	Do you own a laptop?	Yes	No		
2	Do you own a tablet (e.g. iPad)?	Yes	No		
3	Do you own a smart phone?	Yes	No		
4	Which do you mostly use to study in class?	Books/paper	Laptop	Tablet	Phone
5	What would you like to use to study in class?	Books/paper	Laptop	Tablet	Phone

	Lowest is 1 Highest is 4	Strongly Disagree	Disagree	Agree	Strongly Agree
6	I am NOT comfortable using technology	1	2	3	4
7	I often use technology in the classroom	1 ☹	2	3	4 ☺
8	I enjoy using books, paper, and pen/pencil to learn	1 ☹	2	3	4 ☺
9	I enjoy using laptops to learn	1 ☹	2	3	4 ☺
10	I enjoy using tablets (e.g. iPads) to learn	1 ☹	2	3	4 ☺
11	I enjoy using phones to learn	1 ☹	2	3	4 ☺
12	I enjoy learning how to use new kinds of technology (e.g. new apps)	1 ☹	2	3	4 ☺
13	Using technology to do activities DOESN'T help me learn in class	1	2	3	4
14	Learning how to use technology will help me learn in university	1 ☹	2	3	4 ☺
15	Learning how to use technology now will help me in my future job	1 ☹	2	3	4 ☺

For #16-23 below, please rank them 1 to 4. Please put a number in each box. 1 is for your first choice and 4 is for your last choice.

	1=first choice 2=second choice 3=third choice 4=fourth choice	Books/ printed paper	Laptop	Tablet	Phone
Ex:	*Example: What do you prefer to look at pictures on?*	*4*	*2*	*3*	*1*
16	What do you enjoy learning on the most?				
17	What do you prefer to read information on outside of class for fun?				
18	What do you prefer to read information on in class?				
19	What do you prefer to do in-class activities on (e.g., English worksheets, math problems)?				
20	What do you prefer to write a paragraph or essay on?				
21	What would you use to do an infographic (i.e. a poster with facts and charts) on?				
22	What would you use to make a video on?				
23	In general, what do you prefer to use for university?				
	Why? *write your answer here*				

Please circle only one answer for #24-26 below

24	Do you prefer your teachers to present information on….?	white boards	electronic boards	both
25	Do you prefer learning with…?	books, paper, and pencil	laptops, tablets, phones	both

26	Technology improves learning….?	a lot	a little	it does not
	Why? *write your answer here*			

APPENDIX B: INTERVIEW QUESTIONS

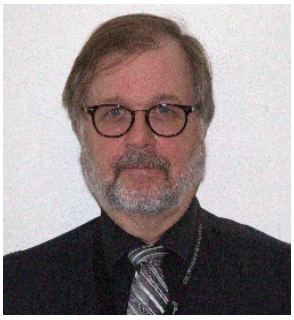
Student Attitudes towards Technology Interview Questions

1. How much do you use technology in the classroom?
2. Do you enjoy using technology to learn?
3. Do you think technology can help you learn?
4. Do you think learning how to use technology will help you in your future job?
5. What do you mostly use to study with in class—books and paper, laptop, tablet, or phone?
6. What do you prefer to read information on inside of class for school—books/paper, laptop, tablet, or phone?
7. What do you prefer to do in-class activities on (e.g. English worksheets, math problems, etc.)--books/paper, laptop, tablet, or phone?
8. What do you prefer to write a paragraph or essay on—books/paper, laptop, tablet, or phone?
9. What do you prefer to take notes on in class—books/paper, laptop, tablet, or phone?
10. What do you prefer to research information on—books/paper, laptop, tablet, or phone?
11. Do you prefer your teachers to present information on white boards or electronic boards?
12. Do you prefer traditional tools for learning like books, paper and pencil, or technological tools for learning like laptops, tablets, and phones?
13. PI is starting to use laptops in the classroom. Do you have any suggestions about using technology for learning?

BIOGRAPHIES

Matthew Andrew is an English language instructor in the Preparatory Program at Khalifa University of Science and Technology in Abu Dhabi. He has been teaching English Composition and English as a Second or Foreign Language for over 14 years at universities and colleges in the UAE, Australia, Korea, and China. In addition to teaching, he has worked as a Director of Studies at an English language school in Sydney where he took part in the design and delivery of curriculum. His research interests include attitudes towards technology, online collaboration tools (e.g. Google apps), prewriting, and multimodal composition.

Jennifer Taylorson is a Teaching Fellow with the Centre for International Foundation Programmes at the University of St. Andrews. She has been teaching English for Academic Purposes for the last 10 years, predominantly in the Middle East. Her research interests include academic discourse, assessment within higher education, teacher beliefs and education, and education technologies.



John Langille is a Senior Lecturer in the Communication Department at Khalifa University of Science and Technology. He has been teaching EFL for over 25 years at universities and colleges in the UAE, Australia and Finland. His research interests include language assessment, reading strategies and academic advising.

Aimee Grange has been teaching academic and general English language in the Academic Bridge Program at Zayed University since 2012. She has also taught in various capacities in Australia, South Korea, the United Kingdom and Ireland. Aimee holds a Masters in TESOL, and Post-Graduate Diplomas in Sociology and Teaching. Her interests include sociolinguistics, and culture and identity.

Norman Williams is an instructor and course coordinator in the Department of English and Writing Studies, University College, Zayed University, Abu Dhabi. He has worked with students for whom English is a second language for over 25 years and has been involved in the design and delivery of English for Academic Purposes (EAP) courses in both the UK and the UAE. For the past 15 years, he has also been involved in training teachers of English as a foreign language at both pre-service and in-service levels. His main areas of interest are writing in academic contexts, reflection in both teacher training and undergraduate study and information literacy.