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ICT Self-Efficacy: Gender and Socioeconomic Influences Among First-Year Students

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ABSTRACT
Colleges and universities in the US have integrated Information and Communication Technology (ICT) into almost all disciplines, curricula, and activities, hoping both to prepare students for future careers and to engage so-called "digital natives". Despite the ubiquity of ICT and higher education's integration of these technologies, studies show incoming students often fall short in their ICT skills. The purpose of this study is to extend prior research to explore the ICT exposure, use, and access factors that influence students' ICT self-efficacy, and to identify any gender- or income-based group differences. Using a two-year sample of incoming first-year students at a public research university in the United States, the study shows significant relationships between ICT access, prior academic exposure, and internet use on perceptions of ICT skills. The study also finds students are confident in many ICT skills, though student self-efficacy in their content creation skills was limited. While parental income was not found to be a significant factor, some gender differences in ICT self-efficacy continue to exist. The findings, along with movement in higher education towards distributed and electronic learning, suggest that it is important for universities to emphasize and integrate digital content creation into courses and curricula.

KEYWORDS: technology; computing; gender; socioeconomics; self-efficacy

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INTRODUCTION

Information and Communication Technology (ICT) has become ubiquitous in modern society. Colleges and universities have integrated ICT into almost all disciplines, curricula, and activities, hoping to prepare students for their future careers and academic pursuits. These institutions also use ICT to engage students, hoping to meet students at their level by providing computing-focused content and services. However, despite the societal ubiquity of ICT and higher education's documented integration of these technologies, studies continue to show students coming to college and university without an expected level of ICT skills (Stone & Madigan, 2007; Gross & Latham, 2012; Edgar et al., 2012).

Undergraduate students entering college or university are expected to be proficient users of ICT, not only in terms of technical skill but also in applications of technology involving higher order thinking skills (e.g. problem solving, critical thinking). As a result, a number of colleges and universities have considered reducing or refining so-called 'computer literacy' courses, arguing that the skills often taught in such courses are unnecessary. The move towards reducing outlets for general computer literacy instruction conflicts with the existing research suggesting incoming first-year students lack the ICT skills often assumed of them. Students who do not enter college or university with the necessary ICT skills are at risk of lower academic outcomes and, consequently, at risk of not being prepared for the modern workforce. Given the long history of studies reporting disparities in ICT access or skills by gender and other factors, this may be a significant concern for some groups (Busch, 1995; Madigan, Goodfellow, & Stone, 2007; De Wit, Heerwegh, & Verhoeven, 2012; Aesaert & van Braak, 2015).

The study described in this paper extends the existing literature on first-year student ICT skills by updating and extending two prior studies on student perceptions of their ICT skillsets (Madigan, Goodfellow, & Stone, 2007; Stone & Madigan, 2007) and the factors which influence those perceptions. The study explores students' perceptions of their ICT skills in a two-year sample of incoming first-year students at a public research university in the northeastern United States. The purpose of this study is to extend prior research regarding the ICT exposure, use, and access factors that influence students' perceptions of their ICT skills, and to identify gender- or income-based group differences which may exist or have persisted since prior studies were performed. The study also updates the instruments of these earlier studies in light of existing literature and technology trends.

CONCEPTUAL FRAMEWORK

The definition of Information and Communications Technology (ICT) is not uniform; generally speaking, ICT is considered to be not only the technologies that permit information transfer in a digital form (e.g. telecommunications networks) but also those technologies which permit the production, storage and manipulation of digital information (e.g. computers, storage devices, software). In both the modern workforce and in academia, ICT skills are considered an essential element of success. ICT skills provide a foundation for the collaborative, multidisciplinary knowledge-based work so often found in these sectors (Stone & Madigan, 2007; Ratliff, 2009; Verhoeven et al., 2010; Aesaert & van Braak, 2015).

Defining ICT Literacy

The concept of *literacy* involves competence in and knowledge of a particular subject. Literacy, as it applies to computing technologies, falls under a number of terms intended to illustrate specific skill sets and/or knowledge bases. Often these different terms are used interchangeably in research literature. Though universal definitions are nonexistent, generally accepted elements are common. *Computer literacy* includes conceptual knowledge of both computer hardware and software as well as technical skill in word processing, spreadsheets, databases, presentation graphics, and basic operating system tasks (Ciampa, 2013; Mishra et al., 2015). Some definitions of computer literacy include knowledge of the social, ethical, and global issues associated with computing (Hindi et al., 2002; Ciampa, 2013; Mishra et al., 2015).

Computer literacy is seen as a foundation of *information literacy.* Information literacy involves not only the ability to access and locate information, but also to effectively use, critically assess, and competently manage the information streams available for specific problems (Ciampa, 2013; Partnership for 21st Century Learning, "Computer Literacy", n.d.). *Digital literacy* encompasses elements of both computer and information literacies. Digital literacy focuses on the use of digital tools to locate, assess, create, synthesize and communicate information, including through multimedia (Jones-Kavalier & Flannigan, 2008; Casey & Bruce, 2011; Mishra et al. 2015).

ICT literacy definitions from industry groups such as the Partnership for 21st Century Learning ("ICT Literacy", n.d.) and the International ICT Literacy Panel (2002) include the technical knowledge and skills found in the aforementioned literacies. Regardless of chosen major, all college or university students require ICT skills to complete many assignments (Eyitayo, 2011). For purposes of this study, the term *ICT literacy* refers to the knowledge and skills commonly found in definitions of computer literacy, information literacy, and digital literacy. Specifically, the term *ICT literacy* will be used to refer to (a) conceptual computer hardware and software knowledge; (b) technical skill with digital devices, including but not limited to word processing, spreadsheets, databases, and presentation graphics; and (c) the use of digital tools to search, critically assess, create, synthesize and communicate information.

Self-Efficacy and ICT Skills

Self-efficacy is all about belief. Specifically, it involves belief that one can successfully complete a given task, based on motivation, prior knowledge, and available alternatives (Bandura, 1986; Bandura & Wood, 1989; Moos & Azevedo, 2009). Individuals with higher self-efficacy tend to have higher levels of persistence when challenges arise, while those with lower self-efficacy are less likely to seek out challenging activities (Moss & Azevdeo, 2009). In terms of ICT skill perceptions, Potosky (2002) found that prior computing experience consistently has a positive relationship with computing self-efficacy, thus supporting Bandura's (1986) contention that prior experience is the most reliable indicator of self-efficacy (Hasan, 2003).

Computer self-efficacy is seen as one's perception of their ability to use a computing device, including the ability to apply these abilities across multiple application domains (Compeau & Higgins, 1995; Grant et al., 2009; Ciampa, 2013). In order to assess computer literacies, prior studies have often used both a survey of perceived skills (pre-test, post-test, or both) as well as an objective evaluation of actual skills. Comparisons between the two data streams frequently show a misalignment between perceived ICT skills and actual ICT skills, echoing the Dunning-Kruger Effect in Psychology. Students whose skill perceptions do not align with their actual abilities may be less likely to seek assistance or remediation, even after being presented with evidence of the misalignment (Gross & Latham, 2010).

Common methodological patterns and results are prevalent in the research literature on ICT self-efficacy. Studies often assess students' perceived ICT skills in some combination of internet fluency and/or application skills, such as with word processing, presentation, and spreadsheet software (e.g. Hilberg & Meiselwitz, 2008; Grant et al.,2009; Kilcoyne et al., 2009; Gross & Latham, 2012, Mishra et al., 2015; Eichelberger and Imler, 2015, 2016). These perceptions are often compared over time or are assessed against a measurement of actual skills in the specific domain areas of the study. Statistically significant differences between perceived and actual skills are not uncommon (e.g. Madigan, Goodfellow, & Stone, 2007; Gross & Latham, 2012). While custom instruments for measuring *actual* ICT skills are offered by professional organizations (e.g. iSkills from ETS, SAM from Cengage), custom survey instruments are often used to assess *perceived* ICT self-efficacy. It is important to note that while custom survey instruments are often used to measure perceptions of ICT skills, a number of formal instruments have also been constructed (Aesaert & van Braak, 2015).

First-Year Students and ICT Literacy

First-year students are perceived as *digital natives,* having been exposed to ICT from an early age and, therefore, are assumed proficient in its use (Prensky, 2001). As a result, many higher education faculty and administrators naturally assume that incoming students are ICT literate. The assumption of 'native' ICT skills is a factor in curriculum and service design. Edgar et al. (2012) found that the perceived ICT self-efficacy of faculty and the specific course level influenced the level of curricular integration of ICT tasks. More confident ICT faculty may assign more diverse and complex ICT task to students, perhaps assuming that students have the requisite skills to complete them. Feeding into this cycle is the fact that incoming college students expect ICT to be important for their academic experience (Rodrigue et al., 2016; Brooks, 2016).

Given the assumption of students with native ICT skills, some colleges, universities, and curriculum guidelines have questioned the utility of traditional computer literacy courses (Eyitayo, 2011; Ciampa, 2013). In contrast, some researchers have argued that these courses should be maintained or amended to reflect modern IT environments, teaching methods, and expected skill sets. For example, Ciampa (2013) found that students are interested in computer security and argued for inclusion of security topics in computer literacy courses. Nataraj (2014) argued that computer literacy courses still provide value to students, using the results from a pre-test / post-test evaluation of students in a first-year literacy course. The study assessed knowledge in traditional computer literacy topics (word processing, internet, spreadsheets, database, and presentation graphics) to show that students had significant learning gains over the course of the semester. Mishra et al. (2015) argued that computer literacy courses should involve more active learning and flipped classroom methods, based on a post-test survey of students enrolled in an introductory information systems course. Hindi et al. (2002) found that students entering an introductory computing course had most often studied word processing and basic computer concepts but had lesser exposure to databases and spreadsheets.

Even as some have argued that computer literacy courses are still necessary, a shift away from traditional computer literacy topics has been noted. Judd and Kennedy (2010), in their five-year study of biomedical students, noted the changing communication patterns among students. E-mail was becoming less important to students, while Social Media was gaining more importance. Access to and proficient use of social media is taken for granted among first-year students, as studies show that students are frequent social media users (Ratliff, 2009; Edgar et al. 2012).

Difference Factors

There has been a significant amount of research into gender-based differences in computer use, self-efficacy, and prior exposure. Research into gender differences in computing skills has a long history, though some have argued that the results are inconsistent (Aesaert & van Braak, 2015) while others have pointed to the wealth of studies which show men with higher computing self-efficacy, confidence, and prior exposure; computing access is no longer considered a differentiator (Hargittai & Shafer, 2006). Busch (1995) reported significant differences between genders in terms of confidence with computers and in perceived self-efficacy for some word processing and spreadsheet tasks. Participating men were also found to have significantly more prior experience with programming and significantly more encouragement from family and friends to use computers. In a three-year study of incoming first-year students, Hoffman and Vance (2007) found women students perceive themselves as more proficient than men with communications-oriented tasks (e.g. e-mail, instant messaging) while men students perceive themselves as more proficient than women with technically oriented tasks (e.g. searching, file management). Stone and Madigan (2007) found first-year students of both genders had greater perceived ICT skills than actual skills, with no significant differences in actual ICT skills between men and women. Jackson et al. (2008) found that while men and women do not significant differ in their internet skills, women tend to have lesser self-efficacy.

Socioeconomic status (income) and ethnicity have also been identified as potential barriers for ICT skills and access. Some studies have suggested that minorities on the lower end of the socioeconomic scale are less likely to have either sufficient computer and internet access or the ICT skills necessary to use them (Ritzhaupt, Liu, Dawson, & Barron, 2013). This 'digital divide' has been recognized by both researchers and policymakers. In 2016 the *ECAR Study of Undergraduate Students and Information Technology* recommended an increase in "technology enhanced opportunities" for women, minorities, and first-generation students, for purposes of engagement, empowerment, and academic success (Brooks, 2016). Many studies that assess the role of socioeconomic status and ethnicity focus on the primary or secondary educational environment (e.g. Claro et al., 2012; Ritzhaupt et al., 2013). Exposure and frequent use of ICT has also been linked to academic success and self-efficacy (e.g. Hasan, 2003; Jackson et al., 2008).

RESEARCH QUESTIONS

This study acts as a follow-up to previously published studies (Madigan, Goodfellow, & Stone, 2007; Stone & Madigan, 2007) and is informed by more recent literature (e.g. Claro et al., 2012; Ritzhaupt et al., 2013). The purpose of this research study was to determine the perceived ICT skills of incoming students at one campus of a public research university in the northeastern United States. These perceptions were assessed for group differences often cited in the existing literature (gender and income status). In order to investigate the impact of gender and income status on student ICT skill perceptions, two research questions were investigated:

- $RQ_{1:}$ Are there significant differences between men and women students in perceived ICT skill levels, for all domains?
- $RQ_{2:}$ Are there significant differences between students with different parental income levels in perceived ICT skill levels, for all domains?

In order to investigate the impact of ICT access, use, and prior academic exposure on student ICT skill perceptions, four research questions were investigated:

- $RQ_{3:}$ What is the relationship between the level of internet use and students' perceived ICT skill levels, for all domains?
- $RQ_{4:}$ What is the relationship between the level of ICT access and students' perceived ICT skill levels, for all domains?
- $RQ_{5:}$ What is the relationship between the number of prior academic levels in which computers were used and students' perceived ICT skill levels, for all domains?
- $RQ_{6:}$ What is the relationship between the number of High School computing courses taken and students' perceived ICT skill levels, for all domains?

The study aimed to act as an update and a re-evaluation of prior studies, in the expectation that changes in ICT self-efficacy over time would be evident. It was also expected that the study results would provide some element of guidance for future general education curriculum modifications.

Table 1: ICT Skills Listed by Domain

Basic Computing
- Change the display properties on a computer (e.g. wallpaper, color)
- Scan a document or file for a virus
- Install and remove programs on a computer
- Install and remove apps on a mobile device
- Move, copy and delete files on a drive (storage device)
- Connect your computer to a wireless network

Applications
- Create and edit a presentation (e.g. PowerPoint)
- Create and edit a spreadsheet (e.g. Excel)
- Use formulas on a spreadsheet (e.g. Excel)
- Create charts in a spreadsheet (e.g. Excel)
- Create and edit a word processing document (e.g. Word)
- Change the format (font, style, and size) of a word processing document (e.g. Word)

Internet
- Find an Internet site using a URL
- Download files from the Internet
- Upload files to the Internet
- Attach a file to an e-mail message
- Search the Internet using a search engine
- Bookmark a Web site
- Create and edit files on cloud-based storage (e.g. Google Docs, Dropbox)

Research
- Accessing and searching a library database
- Using a citation style correctly to cite references (e.g. MLA, APA)
- Evaluating the quality and relevance of internet search results
- Performing an advanced internet search using a search engine

Social Media
- Making a post to Social Media
- Posting photos to Social Media
- Posting videos to Social Media
- Sharing other people's posts on social media
- Conducting a search on Social Media sites

Content Creation
- Create a Web Page using HTML
- Build and Maintain a Blog (or Video Blog)
- Create a computer program using a programming language (e.g. Python, C++, Java)
- Create and/or edit images on a computer
- Create and/or edit audio content on a computer
- Create and/or edit video content on a computer

MATERIALS AND METHODS

A survey instrument was created to collect information on the perceptions of incoming first-year students on their ICT skills, their access to and use of ICT, and their prior academic exposure to ICT. The survey queried students on their perceived skill levels, using a list of 34 ICT skills spread across six skill domains. Four of these domains (*Basic Computing, Applications, Internet,* and *Research*) were updated from Madigan, Goodfellow, and Stone (2007) to be more current, while two others (*Social Media* and *Content Creation*) were constructed based on the literature review. Students were asked to rate their perceived skill level for all 34 skills using a five-level scale, where 1=*No Knowledge*, 2=*Beginner*, 3=*Good*, 4=*Intermediate*, and 5=*Expert*. the specific domain skills are listed in Table 1.

Sample and Data Collection

All students attending new student orientation (NSO) sessions at one campus of a public research university were asked to complete the survey. The survey was open to all attending students 18 years or age or older, regardless of intended major. The survey was provided during the regularly scheduled orientation sessions, and participants were provided time to complete the survey during that session. No student took more than 15 minutes to complete the survey. The survey was delivered electronically via SurveyMonkey and all data analysis was performed using SPSS software. A total of 260 students completed the survey, representing 75.56% of the 344 eligible participants in two separate NSO cycles (2017 and 2018).

Data Analysis

In order to investigate the impact of gender and income status on student ICT skill perceptions, a series of Factorial Analysis of Variance (ANOVA) tests were performed, one ANOVA per ICT skill domain. The dependent variable was the mean score for the specific ICT domain (*Basic Computing, Applications, Internet, Research*, *Social Media* and *Content Creation*). The independent variables for these analyses involved two categorical variables. Participants were separated into groups based on their responses to a binary gender question (male or female) and a question for parental income. For parental income, participants were asked to give their best estimate of their parent(s)' total income from the previous year. Students responded using a nine-level scale of different income ranges. The responses were then recoded into a three-level proxy measure for socioeconomic status. The proxy measure (*PI*) was created using a three-level scale: *High* (combined parental income of more than 100000 USD), *Middle* (60000-100000 USD), and *Low* (less than 60000 USD). Census classifications for socioeconomic status were not used due to a lack of data on household size.

ICT Access, Use and Prior Academic Exposure

In order to investigate the impact of ICT access, use, and prior academic exposure on student ICT skill perceptions, a series of bivariate correlation analyses were performed. In all but one case, Pearson's r and Spearman's Rho (ρ) were used as the statistics of choice. Mann-Whitney (U) was used in one case due to the need to use a dichotomous independent variable and a series of continuous dependent variables. Statistical significance is reported for results at the $p \leq 0.05$ level.

The dependent variable was the mean score for the specific ICT domain (*Basic Computing, Applications, Internet, Research*, *Social Media* and *Content Creation*). The independent variables for this analysis represented a mix of ordinal and continuous variables obtained from the student survey. The independent variable for RQ_3 involved responses to the survey question *During the course of one week, I use the Internet...* Students responded using a seven-level ordinal scale (1=*Do not use*, 2=*Less than 1 hour*, 3=*1-5 hours*, 4=*6-10 hours*, 5=*11-15 hours*, 6=*16-20 hours*, 7=*More than 20 hours*).

The independent variable for RQ_4 is a continuous proxy measure, obtained by counting the responses to the question *During the course of one week, I have regular access to…* Students were given a list of six technologies and asked to check all those to which they had access. The available technologies included a computer at home, a computer at school, internet access at home, internet access at school, mobile internet access, and a tablet computer.

The independent variable for RQ_5 is a continuous proxy measure, obtained by counting the number of responses to the question *During my K-12 education, I used computers in my…* Students were given three levels (*Elementary*, *Middle*, or *High* Schools) and asked to check all levels in which they used computers.

The independent variable for RQ_6 is a continuous proxy measure, obtained by counting the responses to the question *In High School I took a course(s) on…* Besides a 'no' option (*I did not take any computer courses*), students were given a list of five course types and asked to check all those they had taken. These course types included computer programming, basic computer/office skills, digital publishing, graphic arts or digital photography, and other. Students who responded *I did not take any computer courses* were assigned a zero value.

RESULTS

Demographic Results

The respondents were not very diverse in terms of binary gender identity, with 59.92% women (n=247) and 40.08% men. 97.98% (n=247) reported an age in the 18-30 years range and 80.57% (n=247) identified as White/Caucasian. The remaining respondents reported a race/ethnicity of African-American/Black (12.55%, n=247), Latino/Hispanic (7.69%), Asian-American/Asian (5.26%), or "Other" (1.62%). 6.48% of respondents reported more than one race/ethnicity. A majority of the respondents identified as commuter students, i.e. not planning to live in the on-campus residence halls (73.58%, n=246).

Diversity was seen in reported community background, with 28.74% (n=247) coming from a rural community, 33.60% coming from suburbia, 35.63% coming from an urban community (city or town), and 2.02% coming from the international community. A majority of respondents (61.54%, n=247) reported a mother with at least some post-secondary education, while 41.98% (n=243) reported the same for their father. In terms of economic background, 52.50% (n=240) reported a household income of less than 60000 USD, 30.00% reported a household income between 60000 and 99999 USD, and 17.50% reported a household income of 100000 USD or greater.

ICT Access and Use

Students varied in their reported weekly internet use. Students most often reported using the Internet for more than 20 hours each week (29.57%, n=257), followed by 1-5 hours per week (20.23%), 11-15 hours per week (18.29%), 6-10 hours per week (17.51%), and 16-20 hours per week (11.67%). Only 2.72% reported using the Internet for less than one hour per week.

In order to assess whether the level of internet use is related to perceptions of ICT skills (RQ_3), a series of bivariate analyses were performed. Significant bivariate correlations were found between the level of internet use and mean scores for the *Basic Computing* ($r=0.19$, $p < 0.01$; $\rho=0.17$, $p < 0.01$; $n=253$) and *Internet* ($r=0.18$, $p < 0.01$; $\rho=0.17$, $p < 0.01$; $n=249$) domains.

Most students reported having access to a computer at home (89.49%, n=257) and a computer at school (61.87%). Access to the Internet was also common, with 87.94% reporting access at home (n=257), 65.76% reporting access at school, and 91.05% reporting mobile internet access. Tablet computers were far less common. Only 35.41% (n=257) reported having access to a tablet computer (e.g. Amazon Kindle, Samsung Galaxy, iPad). The mean number of technologies accessible was 4.31 (median=5.00, SD=1.47).

Bivariate analyses were performed to assess whether the level of access to ICT is related to perceptions of ICT skills (RQ_4). As can be expected, the level of ICT access significantly determines perceptions of ICT skill, though not in all domains. Significant bivariate correlations were found between the level of technology access and mean scores for the following domains: *Basic Computing* ($r=0.18$, $p < 0.01$; $\rho=0.17$, $p < 0.01$; $n=254$), *Internet* ($r=0.19$, $p < 0.01$; $\rho=0.19$, $p < 0.01$; $n=250$), *Applications* ($r=0.21$, $p < 0.01$; $\rho=0.23$, $p < 0.01$; $n=246$) and *Content Creation* ($r= 0.15$, $p < 0.05$; $\rho=0.17$, $p < 0.01$; $n=245$).

Prior Academic ICT Exposure

In terms of academic use of computers, most students reported using computers in High School classes (93.80%, n=258) and Middle School classes (87.60%), but fewer reported use in Elementary School classes (58.91%). Only 1.55% reported never using computers in K-12 classes. Bivariate analyses were performed to assess whether the number of prior academic levels in which computers were used is related to perceptions of ICT skills (RQ_5). Significant bivariate correlations were found between the number of prior academic levels in which computers were used and mean scores for the *Basic Computing* ($r=0.17$, $p < 0.01$; $\rho=0.15$, $p < 0.05$; $n=254$), *Social Media* ($r=0.22$, $p < 0.01$; $\rho=0.18$, $p < 0.01$; $n=249$), *Internet* ($r=0.22$, $p < 0.01$; $\rho=0.21$, $p < 0.01$; $n=250$), *Applications* ($r=0.29$, $p < 0.01$; $\rho=0.27$, $p < 0.01$; $n=246$), and *Research* ($r=0.18$, $p < 0.01$; $\rho=0.17$, $p < 0.01$; $n=247$) domains. As can reasonably be expected, frequent educational exposure to computing should translate into greater confidence in the use of computer technology.

Most students reported taking a course in basic computer skills, including Office-style applications, in High School (74.61%, n=256). Much smaller percentages reported taking a course in graphic arts, digital photography or digital video editing (26.95%), computer programming (11.72%), digital publishing (3.91%), or an unnamed 'other' computer course (13.67%). A non-trivial number of students (15.23%) reported never having taken a computer course in High School. The mean number of High School computing courses was 1.31 (median=1.00, SD=0.96).

Bivariate analysis found significant, positive relationships between the number of High School computing courses taken and students' perceived ICT skill levels (RQ_6) for five domains: *Basic Computing* ($r=0.23$, $p < 0.01$; $\rho=0.21$, $p < 0.01$; $n=252$), *Internet* ($r=0.19$, $p < 0.01$; $\rho=0.15$, $p < 0.05$; $n=248$), *Applications* ($r=0.21$, $p < 0.01$; $\rho=0.20$, $p < 0.01$; $n=244$), *Research* ($r=0.21$, $p < 0.01$; $\rho=0.19$, $p < 0.01$; $n=245$), and *Content Creation* ($r= 0.33$, $p < 0.01$; $\rho=0.26$, $p < 0.01$; $n=243$). These results align with the significant relationships between the number of prior academic levels in which computers were used and students' confidence in their use of computer technology. Further investigation uncovered that students who took graphic arts, digital photography or digital video editing in High School (median=3.83) had a significantly higher level of confidence than their counterparts (median=3.50) in *Basic Computing* skills ($U = 5169.50$, $Z = -2.12$, $p < 0.05$, $n=252$). These students were also found to have a significantly higher level of confidence than their counterparts (median=2.00 vs. median=1.83) in *Content Creation* skills ($U = 4472.50$, $Z = -2.72$, $p < 0.01$, $n=243$).

Group Differences: Gender and Income Level

Factorial ANOVA analysis was conducted to detect significant differences in perceived ICT skill levels based on gender and Parental Income (PI). Pre-analysis data screening consisted of checks for missing data and multicollinearity. Factorial ANOVA is robust in terms of deviations from normality, especially when the sample size is large. Tests for homogeneity of variance (homoscedasticity) were left to the actual model analysis. Chi-Square Analysis of the two independent variables suggested no problems with multicollinearity. After pre-analysis data screening, six Factorial ANOVAs were conducted to determine perceived ICT skill level differences in gender and PI. Mean scores for each ICT skill domain are reported in Table 2. The ANOVA results are listed by domain in Table 3.

Basic Computing

The Levene's test for Equality of Error Variances was non-significant, indicating that the homogeneity of variance assumption was fulfilled, $F(5, 234)=1.10$, $p = 0.36$. The ANOVA results indicated that the mean score for *Basic Computing* differed significantly by gender, $F(1, 234)=5.64$, $p < 0.05$, partial $\eta^2=0.02$. PI was not a significant factor. Interaction between factors was not significant. Men (mean=3.79, median=4.00, SD=1.04) were found to have a higher level of confidence in their *Basic Computing* skills than women (mean=3.48, median=3.50, SD=0.86). Deeper analysis found significant differences in confidence levels between men and women on three *Basic Computing* skills. Men (median=3.00) were significantly more confident than women (median=2.00) in scanning a document for a file or virus ($U = 4945.50$, $Z = -1.43$, $p < 0.01$, $n=240$). Men (median=4.00) were also significantly more confident than women (median=3.00) in installing and removing programs on a computer ($U = 4945.00$, $Z = -3.71$, $p < 0.01$, $n=243$) and men (median=4.00) were significantly more confident than women (median=4.00) in moving, copying, and deleting files on a storage device (U = 5957.50, Z = -1.98, $p < 0.05$, n=240).

Table 2: Descriptive Statistics by Gender and Parental Income (PI)

Skill Domain	Overall	Men	Women	Low PI	Middle PI	High PI
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Basic Computing	3.59 (0.93)	3.79 (1.04)	3.48 (0.86)	3.59 (0.96)	3.49 (0.94)	3.86 (0.87)
Applications	3.50 (0.93)	3.41 (0.98)	3.57 (0.91)	3.42 (0.97)	3.50 (0.82)	3.80 (0.96)
Internet	3.79 (0.99)	3.83 (1.05)	3.76 (0.96)	3.79 (0.97)	3.68 (1.05)	4.00 (0.90)
Research	3.06 (0.98)	3.02 (1.05)	3.09 (0.94)	3.07 (0.98)	2.94 (1.01)	3.28 (0.96)
Social Media	4.32 (0.98)	4.00 (1.13)	4.54 (0.80)	4.30 (0.97)	4.39 (0.89)	4.45 (1.05)
Content Creation	2.10 (0.92)	2.24 (0.99)	2.00 (0.86)	2.13 (0.96)	1.96 (0.87)	2.22 (0.90)

Table 3: Factorial ANOVA Results

Skill Domain	N	SS	df	MS	F	p	η^2
Basic Computing	240						
Gender		4.75	1	4.75	5.64	0.02**	0.02
PI		3.61	2	1.81	2.14	0.12	0.02
*Gender * PI*		2.51	2	1.26	1.49	0.23	0.01
Applications	239						
Gender		1.22	1	1.22	1.42	0.23	0.01
PI		3.53	2	1.76	2.06	0.13	0.02
*Gender * PI*		0.70	2	0.35	0.41	0.67	0.00
Internet	240						
Gender		0.03	1	0.03	0.03	0.86	0.00
PI		3.42	2	1.71	1.79	0.17	0.02
*Gender * PI*		2.99	2	1.50	1.57	0.21	0.01
Research	239						
Gender		0.21	1	0.21	0.21	0.64	0.00
PI		3.50	2	1.75	1.81	0.17	0.02
*Gender * PI*		2.47	2	1.24	1.28	0.28	0.01
Content Creation	238						
Gender		1.70	1	1.70	2.04	0.16	0.01
PI		2.48	2	1.24	1.48	0.23	0.01
*Gender * PI*		1.90	2	0.95	1.14	0.32	0.01

** Significant at the ($p \leq 0.05$) level

Applications
The Levene's test for Equality of Error Variances was non-significant, indicating that the homogeneity of variance assumption was fulfilled, $F(5, 233)=1.41$, $p = 0.22$. The ANOVA results indicated that neither gender nor PI were significant factors. Interaction between factors was also not significant.

Internet
The Levene's test for Equality of Error Variances was non-significant, indicating that the homogeneity of variance assumption was fulfilled, $F(5, 234)=0.72$, $p = 0.61$. The ANOVA results indicated that neither gender nor PI were significant factors. Interaction between factors was also not significant. See Table 3 for full ANOVA results.

Research
The Levene's test for Equality of Error Variances was non-significant, indicating that the homogeneity of variance assumption is fulfilled, $F(5, 233)=1.19$, $p = 0.31$. The ANOVA results indicated that neither gender nor PI were significant factors. Interaction between factors was also not significant.

Content Creation
The Levene's test for Equality of Error Variances was non-significant, indicating that the homogeneity of variance assumption was fulfilled, $F(5, 232)=1.60$, $p = 0.16$. The ANOVA results indicated that neither gender nor PI were significant factors. Interaction between factors was also not significant.

Table 4: Gender and Social Media Skills

Social Media Skill	U	r	p	N	Men (Median)	Women (Median)
Making a post to Social Media	4703.00	0.31	.00***	239	4.00	5.00
Posting photos to Social Media	4861.50	0.29	.00***	239	4.50	5.00
Posting videos to Social Media	4842.00	0.27	.00***	238	4.00	5.00
Sharing other people's posts on social media	5104.00	0.23	.00***	240	4.00	5.00
Conducting a search on Social Media sites	5616.00	0.18	.00***	242	4.00	5.00

** Significant at the ($p \leq 0.05$) level; *** significant at the ($p \leq 0.01$) level.

Social Media
The Levene's test for Equality of Error Variances was significant, indicating that the homogeneity of variance assumption was violated, $F(5, 234)=4.62$, $p = 0.00$. As a result, Welch's ANOVA was used for the analysis of PI. Welch's ANOVA results indicated PI was not a significant factor, Welch's $F(2, 104.61) = 0.58$, $p = 0.56$. For gender, Mann-Whitney (U) was used as the statistical method. The standard t-test was not employed, as the data did not meet the assumptions of normality or homogeneity of variance. Mean scores for *Social Media* were also found to be significantly different by gender ($U = 5306.50$, $p < 0.01$, $Z = -4.09$, $n=247$). Women (median=5.00) were found to have a higher level of confidence in their social media skills than men (median=4.00). Further analysis showed that women were more significantly more confident than men on all of the Social Media domain skills; see Table 4.

DISCUSSION

This study was designed to uncover the perceived ICT skills of a two-year sample of incoming university students. The results align with previous research, depicting a sample of students who have widespread access to ICT, who use the Internet frequently, and who have used computers frequently in their K-12 experience. The results also suggest that students are confident in many ICT skills, especially with regard to social media tasks. However, student self-efficacy in their content creation skills – which include computer programming, Web development, and multimedia – was found to be much lower than other skills. The results also show that some gender differences in ICT self-efficacy continue to exist.

The results show that ICT is highly available to students. Access to the Internet is commonplace, and mobile internet access is virtually ubiquitous. Mobile internet access was cited more frequently than computer access (at either home or school), perhaps suggesting a more central role in students' computing activities. This aligns with recent research by the Pew Research Center which found that an increasing number of U.S. adults - especially younger adults - use their smartphones as their primary online device (Anderson, 2019). A somewhat surprising finding is that tablet computers were reported as accessible by approximately a third of survey respondents. It is likely that smartphones are the primary vehicle for mobile internet and, as such, may be the main conduit for the high level of internet use reported by students: sixty percent of respondents reported using the Internet more than 10 hours in an average week. The level of weekly internet use was found to have a significant positive relationship with mean scores for both the *Basic Computing* and *Internet* skill domains, reinforcing the long-held idea that greater computing experience has a positive relationship with reported self-efficacy (Potosky, 2002).

Access to ICT was shown to be significantly related to mean scores for the *Basic Computing, Applications, Content Creation* and *Internet* skill domains. This positive relationship, though weak, is not unexpected – greater access often translates into greater experience, which can lead to greater self-efficacy (Hasan, 2003). Exposure to ICT in prior academic settings was also shown to have a significant relationship with perceived ICT skills. The number of academic levels in which computers were used were a significant, positive factor for students' perceived skills in five domains, as was the number of High School computing courses previously taken. A course in graphic arts, digital photography, or digital video editing was found to be especially important for higher perceptions of *Basic Computing* and *Content Creation* skills.

An area of concern moving forward is the lack of diversity in the computing courses students reported taking in High School. While a Microsoft Office style basic computing course was frequently reported, other courses focusing on content creation were reported in much smaller numbers. This result is not surprising, as many states and school districts do not mandate such courses. It is therefore not surprising that the self-efficacy scores for *Content Creation* skills were the lowest of the six domains, across all groups and levels. In order to prepare students for the modern workforce, it is important for educational institutions to not only offer courses in content creation - computer programming, graphic arts, and various forms of multimedia - but also to provide greater educational integration of digital content creation (e.g. computer programming, Web page development, multimedia editing). This is especially important as so much of the information students consume in both college/university and in everyday life arrives in digital form. For example, the growth of learning management systems in higher education, along with the growth of online education, means that students will be producing a variety of content (e.g. multimedia products, blogs) to satisfy course requirements. Future research should investigate the influence of K-12 coursework in content creation on collegiate success, choice of major, and other factors.

The ANOVA results suggest that gender differences persist in perceptions of some ICT skills, though the effect size was small. Men were significantly more confident than women in their *Basic Computing* skills, specifically in their perceived skills in installing and removing programs, file management, and scanning files for viruses. This echoes earlier research that found gender differences in a variety of basic computing tasks (see Madigan, Goodfellow, & Stone, 2007; Hoffman & Vance, 2007). Questions have been raised about the usefulness of 'traditional' file and program management topics in introductory computing / computer literacy courses (e.g. Eyitayo, 2011; Mishra et al., 2015), so it may be the case that some of the *Basic Computing* skills will become less academically important over time. The movement towards cloud-based computing, for both applications and communication, means that ICT skillsets are and will continue to change.

The greater confidence exhibited by women students in their *Social Media* skills stands in contrast to the differences in *Basic Computing* perceptions. However, self-efficacy scores for *Social Media* were the highest for the six domains, across both genders and all PI levels. This suggests that students are highly engaged in social media activities, more so perhaps than other 'traditional' computing activities like e-mail and desktop applications. The movement of students away from e-mail and towards social media has long been noted (Ratliff, 2009; Judd & Kennedy, 2010). The increasing ubiquity of social media outlets, along with the high level of confidence students have with their social media skills, provides further justification for educational institutions to integrate digital content creation into curricula. Such enhanced integration can be useful for both student engagement and for recruiting of women (and men) students.

LIMITATIONS

The study results should be considered in light of the research context. The focus on a single university limits external validity, though the results are consistent with prior research. The data collected is based on self-reports or perceived ICT skills and, thus, can be subject to the validity problems sometimes seen with self-reported data. Attempts were made to collect data on actual skills through a custom exercise, but insufficient volunteers (one, to be exact) were recruited to make the second set of data meaningful. Finally, the proxy measure used for socioeconomic scale – parental income – is not standardized due to a lack of household size data; this limitation will be corrected in future iterations of the survey.

CONCLUSION

The study described in this paper extends the existing literature on first-year student ICT skills by updating prior studies on student perceptions of their ICT skillsets as well as the factors that influence those perceptions. The study also adds to the existing literature on first-year students and ICT skills by providing additional data on self-efficacy. The results suggest that students are confident in many of their ICT skills, though gender differences still exist in domain areas both traditional (basic computing skills) and more modern (social media skills). Exposure, access and use of ICT were found to have significant relationships with ICT self-efficacy. As ICT skill expectations change in industry, academia, and society, educators must be careful to construct curricula appropriate for learning the skills of the modern (and future) environments that students will enter.

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