



Volume 15

Number 1

2020

ISSN: 1935-8156

<https://www.aisej.com>

**Topics for Your Undergraduate
Accounting Information Systems (AIS) Course -
An Exploratory Study of
Information Technology (IT) Skills and Firm Size**

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Author Acknowledgements

The authors would like to thank the Editor-in-Chief, the associate editor, and three anonymous reviewers whose comments and suggestions greatly improved the quality of our original manuscript.

Published by the AIS Educator Association

www.aiseducators.org

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Topics for Your Undergraduate Accounting Information Systems (AIS) Course- An Exploratory Study of Information Technology (IT) Skills and Firm Size



*Volume 15,
Number 1
2020
pages 58-89*

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ABSTRACT

Given the wide range of technologies that businesses employ, and the rapid changes in technology, it is important to assess periodically the critical IT skills students need to prepare them for the work environment. This study presents results from over 100 practicing accountants regarding the IT skills they feel are most important for an undergraduate AIS course. The top ten IT skills for small firm (SF) respondents, respectively, are: spreadsheets, Microsoft Word, Internet research, Internet, QuickBooks, ensuring privacy, Cloud Computing, preventing and responding to cybercrime, software security, and managing and retaining data. The top ten IT skills for medium-large firm (MLF) respondents, respectively, are: spreadsheets, Internet, Internet research, ensuring privacy, Microsoft Word, preventing and responding to cybercrime, managing and retaining data, file systems, Cloud Computing, and Business Intelligence Tools. While SF respondents perceive QuickBooks and software security are more important, respondents from MLF think file systems and Business Intelligence Tools are more important. When determining AIS course content it is important to include the most relevant IT skills, based on what practice thinks students need, and this study indicates firm size is a factor for some IT skills. Designers of undergraduate AIS courses, therefore, need to consider the importance of the IT skills in conjunction with the size of the firms that will employ their students when selecting topics for inclusion.

Keywords

Accounting Information Systems (AIS), Undergraduate AIS Courses, Information Technology (IT) Skills, Firm Size, Practitioner Views

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INTRODUCTION

Since the mid-1980s, there has been growing interest regarding the most important topics to include in an undergraduate AIS course. Researchers such as Theuri and Gunn (1998), Badua, Sharifi, and Watkins (2011), Dillon and Kruck (2008), and Apostolou, Dorminey, Hassell, and Rebele (2014) explore topics on AIS course and textbook content and articles in accounting education and information systems journals (employers' needs, academic versus practitioners' views, and accounting students' perceptions). Rebele and St. Pierre (2015) note, however, that the body of literature is relatively small. Franklin's (2017) review of articles in the 2015 issues of five leading accounting education journals (*Issues in Accounting Education*, *Journal of Accounting Education*, *Accounting Education: An International Journal*, *Advances in Accounting Education*, and *The Accounting Educators' Journal*) also supports this view since only five percent of the articles relate to technology. Rebele and St. Pierre (2015) further point out that there is little agreement about the most important topics to cover, partly due to the rapid changes in technology. As a result, they maintain that researchers can make an important contribution by focusing on topics to cover and integration of them into the accounting curriculum. Furthermore, since technological innovations are rapid and ever occurring it is important, periodically, to assess what accounting practitioners think are the most important IT skills for an undergraduate AIS course.

In response to the Pathways Commission on Accounting Higher Education Report (AAA, 2012), researchers (Behn et al. 2012; Bloom, 2013) continue to call for more academic/practitioner collaboration to ensure accounting education and research keeps pace with practice. Harper and Dunn (2018) further encourage accounting educators to expose students to current and emerging technologies they will need in the work environment. As Drew (2012) notes, the future for accountants may be 100 percent virtual, that is, no offices, employees will work remotely, clients will be digital (no paper anymore), and technology will facilitate all of this.

Qian, Ward, and Blaskovich (2012) maintain IT has revolutionized business and created new expectations for the accounting profession since the need for technology-based knowledge and skills is ever increasing. Similarly, Bradbard, Alvis, and Morris (2014) suggest, "IT in general and spreadsheets in particular have a significant impact on changing the accountant's role in business organizations. Specifically, accounting practitioners are expected to play a much larger role in institution-wide problem solving and managerial decision making" (p. 25). Coyne, Coyne, and Walker (2016) also conclude there is a need to integrate IT within and across organizations, and information security and data integrity are a prerequisite.

Sledgianowski, Gomaa, and Tan (2017) suggest the increase in AIS emphasis since 2002 is due to Section 404 of the Sarbanes-Oxley Act (SOX) and the work of professional accrediting bodies. They point to the importance of QuickBooks, Quicken, SAP, ERP, XBRL, Generalized Audit Software, Tableau Software (visualization and data analytics), Microsoft Project, Visio, Access, flowcharts, Databases, and Presentation Software (PowerPoint) and provide an extensive discussion on incorporating various software into existing courses.

The Uniform CPA Examination Blueprints, effective January 2019, indicates IT skills will be part of the Business, Environment, and Concepts (BEC) section of the exam. BEC consists of five areas, one of which is IT and represents 15-25 percent of the BEC section (AICPA, 2019). By 2020, Part 1 (Financial Planning, Performance, and Analytics) of the CMA exam will contain six competencies, one of which is technology and analytics and represents 15 percent of Part 1 (IMA, 2019). Lawson et al.'s (2014) review of suggestions for accounting education reform leads them to recommend accounting education focus on 1) long-term career needs, 2) organizations beyond

public accounting, 3) how accountants add value, and 4) the use of accounting competencies in the workplace. The Framework for Accounting Education by Lawson et al. (2014) identifies three competencies (foundational, accounting, and broad management). One of the components under accounting competencies is information systems. Regarding information systems Lawson et al. (2014) note:

Technology competencies include the use of software, including proficiency in the development and use of spreadsheet models and the use of technology to enhance communication. Also vital is knowledge of the purpose and design of information systems (IS), system architecture, processing modes, network types, hardware components (including mobile devices), operating and application software (including cloud computing), system security, and IS continuity (p. 301).

The purpose of this research, however, is to identify IT topics for inclusion in an undergraduate AIS course, not to provide suggestions for IT deployment across the accounting curriculum.

Much of the employer needs research relies on surveys of Certified Public Accountants (CPAs) primarily in large public accounting firms. Lee, Kerler, and Ivancevich (2018) indicate their respondents are CPAs in “public accounting since it represents entry-level job placement for many graduates of Accounting Master’s programs” (p. 47). The majority of undergraduate accounting students, however, do not go into, or do not stay in, large public accounting firms and addressing their needs is important when identifying topics for an undergraduate AIS course (Schea, 2008; Siegel, Sorensen, Klammer, & Richtermeyer, 2010). Also, Gabbin (2019) finds only 43 percent of his school’s 2018 undergraduate students are in the seven largest CPA firms while 34 percent and 23 percent, respectively, are with other CPA firms or non-CPA firms. Additionally, Tatikonda (2004) notes that, while the majority of accounting programs focus on curricula issues in relation to the CPA exam “two-thirds of accounting graduates take jobs outside public accounting and have no interest in taking the CPA exam” (p. 63).

Accounting graduates’ declining interest in public accounting as a career choice is evident in the year-by-year comparison of new CPA exam candidates. The American Institute of Certified Public Accountants’ (AICPA) 2019 Trends Report indicates the number of new CPA candidates in 2018 (36,827) is only slightly higher than the 2006 number (36,078). For the period 2006-2018 the largest number of new CPA candidates is in 2010 (49,597) revealing a 26 percent decline from 2010 to 2018. A similar comparison by the Institute of Management Accountants (IMA) indicates the number of new candidates (49,862) joining the Certified Management Accounting (CMA) program as of June 30, 2019 represents a 26 percent increase over the previous year (IMA, 2019). Analyzing these numbers reveals that new CMA exam candidates in 2018 (39,513) exceeds the number of new CPA exam candidates by 2,686. Since the CPA credential is generally recognized as the “public accounting credential,” while the CMA is not, the increasing number of new CMA exam candidates suggests more accounting graduates are pursuing careers outside of public accounting.

This research takes a deep dive into IT skills by asking accountants to indicate the importance of 62 distinct IT skills used in practice to inform undergraduate AIS course curriculum. This study attempts to overcome previous studies’ limitations by surveying practicing accountants who are not working primarily in large public accounting firms and focusing solely on IT skills for an undergraduate AIS course. The respondents’ demographics (Table 1: Respondent Characteristics) indicate 64 percent (71/111) are in SF. The questionnaire includes IT skills from

undergraduate AIS textbooks, as well as journal articles. This research adds to the existing literature since 16 of the 20 Top IT Skills shown in Table 3 (Firm Size and Top 27 IT Skills) are new; previous studies did not rank, most likely due to changes in technology. The 16 new IT skills this study ranks are: Internet, ensuring privacy, preventing and responding to cybercrime, QuickBooks, Cloud Computing, managing and retaining data, software security, file systems, Password Management Tools, preventing and responding to computer fraud, Virtual Office Technology, IT controls, Information Security Technology, data loss prevention, software implementation, and Business Intelligence Tools.

LITERATURE REVIEW AND RESEARCH QUESTIONS

Due to rapid changes in technology, it is likely that the importance of at least some IT skills for accountants will change over time. Since the purpose of this study is to identify the IT skills accounting practitioners think are currently important for an undergraduate AIS course, the following literature review provides an in-depth review of the various IT skills assessed in previous research (2008-2016). A historical perspective on the distinct IT skills and their rankings is necessary since it provides the basis for particular IT skills inclusion in this study's questionnaire¹ and a comparison of this study's results with previous ranking studies to determine if there are changes in the importance of IT skills over time (Appendix B—Rankings of IT Skills²). Additionally, this study replicates previous ranking studies, includes analysis of 62 distinct IT skills,³ and provides an update on the IT skills practicing accountants think are important for an undergraduate AIS course.

Textbooks and Syllabi

Badua et al. (2011) maintain textbooks may be a major factor in AIS courses' topical coverage. Their review of four textbooks (2010-2012) reveals 15 broad areas ranging from AIS and Accountants to Electronic Commerce and the Internet, and 119 specific topic areas. Additionally, their surveys of AIS faculty indicate 90 percent use a textbook, 30 percent have an AIS concentration at their school, 34 percent prefer one AIS course, and 58 percent prefer two AIS courses. Given the large number of diverse topics in AIS textbooks and the expanding role of IT and IT topics, Badua et al. (2011) conclude it may be impossible to agree on AIS topics for a single course and a second course may be necessary. Many accounting programs, however, may not have the ability to offer two AIS courses, so the question of what topics to cover remains important.

Coyne et al.'s (2016) analysis of 19 Current and Proposed IT topics reveals "current AIS curricula teach few technologies" (p. 165) and future AIS curricula need to focus more on practical tools and software since the separation between IT functions and accounting is rapidly disappearing. Traditional Management Information Systems (MIS) courses do address these more technical IT functions so some accounting programs may be able to take advantage of MIS courses if their school has them. Murthy and Ragland's (2009) comparison of topics in AIS and MIS classes reveals similar coverage for Database/Data Management Systems, Systems Analysis and Design/Development, DBMS/Access Projects, and E-Business, while the more technical IT topics (security, hardware and software, networking, and outsourcing) are not generally covered in AIS courses. Other studies also look at topics in AIS journals. For instance, Apostolou et al.'s (2014) review of AIS articles identifies six general areas (software implementation, software security, system controls, system design, transaction processes and controls, and XBRL), that indicates some increasing interest in more technical IT topics with the passage of time.

Student Perceptions

AIS course research also analyzes accounting students' perceptions. For example, Harrast, Strong, and Bromley's (2010) study indicates students desire more integration of technology in their curriculum and prefer to have more hands-on practice. Kearns' (2010) survey of accounting majors reveals students believe IT knowledge and skills are important and will help them perform better during their career. The validity of this perception receives support from Cory and Huttenhoff's (2011) analysis suggesting information systems skills are very important for undergraduate accounting majors since Information Systems ranks fifth, ahead of Auditing, Strategy, Cost/Managerial Accounting, Business Law, and Financial Accounting Research.

Unfortunately, student perceptions of their IT abilities may not match that of their employers. Yu, Churyk, and Chang's (2013) results reveal accounting student interns rate their IT capabilities higher than their employers do. Strong and Portz's (2015) analysis of student perceptions finds significant differences across three universities for 36 technologies, leading them to conclude the finding is likely due to the lack of a set curriculum for AIS courses and future research should help determine what IT skills undergraduate accounting majors need upon entering the profession.

Employers, Academics, and Practitioners

Dillon and Kruck's (2008) employer survey of 56 core content areas includes both IT and non-IT items. Excluding the non-IT items provides rankings for 25 IT Skills (Appendix B—Rankings of IT Skills). The top 15 IT areas, respectively, are: spreadsheets, AIS Auditing/Generalized Audit Software, operating systems, network security, Project Management, ERP, Databases, input/output devices, Electronic Commerce, IT gathering techniques, disaster recovery and contingency planning, Data Modeling, Local Area Networks, systems implementation and testing, and system maintenance. Chen et al.'s (2009) analysis of 29 IT competencies, using employer recruiters, reveals the top 15 IT skills are, respectively: spreadsheets, Business Graphics Software, Word Processing Software, Presentation Software, Audit Software, Tax Preparation Software, Small Business Systems, Databases, Computerized Accounting Packages, IT assurance, Communication Software, operating/managing own system, network security, operating systems, and Decision Support Software.

Welch, Madison, and Welch's (2010) survey of accountants in CPA firms and Industry/Government (IG) provides rankings for 24 IT skills. Their results indicate both groups agree on the top three skills (spreadsheets, Word Processing Software, and Windows Software). While the CPA group's fourth, fifth, and sixth rankings, respectively, are Internet research, Presentation Software, and AIS Auditing/Generalized Audit Software, the IG group's rankings are Databases and Presentation Software, Internet research, and technology terminology. For rankings seven to 15 both groups rank network security, Computer Hardware, Intranet, Project Management, system evaluation, IT operations, data analysis, Telecommunication Software, technology management, and Collaboration Software in this range, although where they rank them varies. While the CPA group ranks technology terminology (7), Databases (8), and Business Graphics Software and client/server management (15), the IG group ranks AIS Auditing/Generalized Audit Software (11) and does not rank Business Graphics Software and client/server management in the seven to 15 range.

Cory and Pruske's (2012) survey utilizing public and non-public accountants identifies six IT skills both groups think are important; Excel, Word, Windows, Internet research, Presentation

Software, and Database Software. A later study (Kearns, 2014), surveying CPAs reveals the following ranking of eight IT skills: Spreadsheet Tools, Governance/Internal Controls, Database Tools, fraud detection and prevention, Computer Networks, IT Security, XBRL, and Audit Software Tools. Winstead and Wenger's (2015) survey of academicians and practicing accountants indicates both groups agree on the importance of operating systems, Software Packages, and Report Software, while practitioners feel Business Cycles, Data Sharing, XBRL, Problem Solving Technology, E-Commerce, and safeguarding electronic accounting records are less important. Lee et al.'s (2018) survey of graduates from a Masters of Accountancy program regarding the importance of Software Tools for new hires reveals Excel is the most important tool, followed by Adobe Acrobat, FASB Codification, and PowerPoint.

IT and Firm Size

Research investigating firm size and use of IT is somewhat limited. Kagan, Lau, and Nusgart (1990) report large firms use more sophisticated information systems than smaller ones. Burke's (2005) exploration of firm size, use of the Internet, websites, e-mail, online research, and non-Internet-based computer systems reveals small businesses are less likely to use the Internet, websites, and non-Internet-based computer systems than large businesses, and significant differences exist in relation to firm size for all variables except e-mail. Additionally, Thong (1999) finds firm size relates to both the likelihood of and extent of information systems adoption. Fordham and Hamilton's study (2019) also reveals the majority of small businesses rely on manual rather than computer-based systems.

Cloud Computing makes possible three types of services, Software-as-a-Service (SaaS), Platform-as-a-Service (PaaS), and Infrastructure-as-a-Service (IaaS). Gupta, Seetharaman, and Raj (2013) suggest small businesses adopt Cloud Computing because it provides cost savings, is easy to use, convenient for work outside the office, reliable, improves the ability for sharing and collaboration, and provides better security and privacy. Low and Chen (2011) and Oliveria, Thomas, and Espadanal (2014), however, note firm size has a positive effect on the decision to adopt Cloud Computing and large firms have an advantage over small firms. On the other hand, Gupta et al. (2013) suggest size may not be an important factor since the decision to adopt Cloud Computing relates positively to perceptions of cost savings, ease of use, security and privacy, and negatively to issues surrounding reliability, sharing, and collaboration.

Similarly, Seethamraju (2015) maintains SaaS makes it cost effective for small and medium size enterprises to use SaaS Enterprise Resource Planning so firm size should not be a consideration. The key factors in the adoption decision are reputation of the vendor, willingness of the vendor to work with the customer from beginning to end, ability to shift capital expenditures to operating expenses, functionality of the software, and ease of use (Seethamraju, 2015). Likewise, Loukis, Arvanitis, and Kyriakou (2017) indicate firm size has no impact on the decision to use Cloud Computing, and Smith (2016) suggests managed analytics as a service makes Big Data analysis affordable for even smaller companies.

Research Question One (RQ1)

Research results analyzing firm size and use of IT are mixed. For instance, previous research reveals large firms are more likely to use sophisticated information systems than smaller ones, and while some studies indicate size is a factor for Cloud Computing adoption, others indicate it is not. This study's respondents' written comments suggest firm size may be important for accountants with respect to some IT skills:

- For smaller employers, proficiency in software (QB, tax, excel, etc.) is the most important.
- I work for a small, local CPA firm. Our CPAs wear many hats—accounting, tax, financial planning, Excel, QB, Word.
- Most small businesses and local CPA firms do not have IT Specialists. Accountants need to know how to trouble shoot problems and talk in plain language about technology issues. When helping my clients with their accounting software adjustments and accounting questions, the answer is sometimes related to the operating system.
- Great that you ask all these questions about tech and emerging tech. In reality most firms I know contract out IT services and would never have a new hire handling these issues. Also, while some large firms may need many of these remote areas for a few big clients, most small businesses are not willing to pay a CPA firm to do data mining etc. Clients want us to perform using the core programs they use (MS products, QBooks, etc.) so we can get the work they need out quickly and cost effectively.
- From the tone of your questions, you seemed to be interested only in large firms. Smaller firms will have varying degrees of importance related to your questions. I have a small firm and while all of these questions were relevant to large firms, a lot of them were not so relevant to small firms. But being able to adapt to any IT is a plus for any future accountant.
- We are a small office with myself as CFO with 1 full time and 1 part time assistant. Our IT department takes care of security and software issues, including upgrading our software, and the majority of electronic commerce issues. I look at new technology for assisting with accounting and work with our IT for feasibility and implementation. There is a lot of ""stuff"" out there that either does not or cannot work, or is not needed within the realm of our government entity.
- Responses are from an owner of a single person CPA firm that only uses help on an as needed basis. Any staffing needed would be done through a part time staffing agency. However, responses were made on the basis of qualities and attributes desired IF permanent staffing was being considered.
- I own and run a small CPA office with 2 individuals plus myself. We primarily do payroll, bookkeeping and tax returns.
- Understanding how databases work has been one of the most important things I learned in college. I am an average small business accountant and it has been invaluable knowledge.
- I honestly didn't know what many of these terms are referring to. So I checked not important on most of them. Survey didn't seem applicable to a small CPA firm. Maybe I should have checked ""regional CPA firm"" instead of ""other"" as my organization type?

Since 40 percent (10/25) of the respondents that provided written comments indicate size may be a factor in the importance of an IT skill for accountants, RQ1 is: Does the size of the respondent's firm impact the perception of an IT skill's importance?

Research Question Two (RQ2)

There is one point of commonality in the preceding accounting IT research; all the studies identify spreadsheets as the most important IT skill. The ranking of other IT skills varies by study. For instance, hardware, Project Management, Databases, ERP, system design and maintenance, Programming Languages, and system implementation and testing rankings change over time (Appendix B—Rankings of IT Skills). The change in IT skills' importance over time is not surprising given the rapid changes in technology. As a result, it is important to take the pulse of practice periodically and identify IT skills undergraduate accounting majors need. Since most accounting programs offer at least one undergraduate AIS course to expose their students to necessary IT skills the purpose of this research is to assess what practicing accountants think are the most important IT skills, currently, for an undergraduate AIS course, RQ2 is: What are the important IT skills for an undergraduate AIS course?

RESEARCH METHODOLOGY

Questionnaire Design

The questionnaire's sections include basic demographic information, organizational and employment characteristics, and 62 IT skills representing six categories employing a typical MIS classification scheme (data acquisition, retention and use, infrastructure, system development and/or acquisition, tools, Internet, and governance). The questionnaire utilizes a traditional five-point Likert Scale ranging from Not Important (1) to Very Important (5) for all questions except those in the demographic and organizational and employment characteristics sections. Two questions regarding the importance of IT/accountant cooperation and COBIT are beyond the scope of this paper and are in the questionnaire to gather initial information for future research. The last item asks respondents to share any additional information they feel is important (Appendix A—Questionnaire).

The questionnaire's IT skills are primarily from previous AIS survey research ranking IT skills (Dillon & Kruck, 2008; Chen et al., 2009; Welch et al., 2010), textbook topics (Badua et al., 2011), and current and proposed AIS course topics (Coyne et al., 2016). Additionally, 11 IT skills (managing and retaining data, software security, Password Management Tools, data loss prevention, Social Media, HTML, managing vendors and service providers, Block Chain Accounting, Value Added Networks, governing/managing IT investment/spending, and Open Source Software) the authors think might be important to provide an up-to-date ranking of IT skills (Appendix B—Rankings of IT Skills) were added.

Questionnaire Administration

The questionnaire using Survey Monkey was available on the North Carolina Association of Certified Public Accountants' (NCACPA) Open Forum. The NCACPA's Open Forum requires members have a user name and password and is available through the Connect function on their website. The Open Forum⁴ is essentially a place where NCACPA members can go to pose questions they need help with and other members can respond if they have something to say; during the period the questionnaire was available the NCACPA estimates they had 1131 users on the Open Forum (NCACPA staff member in charge of the Open Forum, personal communication, January 29, 2018). The solicitation of NCACPA members' participation used the following two messages in the Open Forum:

The initial posting (October 26, 2017)

I teach accounting courses and recently had an Accounting Information Systems (AIS) course added to my load. I think it is important to make sure students are adequately prepared for the work environment they will be entering. The AIS needs survey (contained in link below) asks questions related to information technology skills you think accounting graduates need and will take about 10 minutes. Your input is very important in helping me design an AIS course that meets the needs of the current accounting environment. Thank-you for your help.

[Link was here](#)

The reminder posting (January 11, 2018)

YOUR INPUT IS NEEDED- PLEASE Complete this Accounting Information Needs Survey (if you have not done so already).

I teach accounting courses and recently had an Accounting Information Systems (AIS) course added to my load. I think it is important to make sure students are adequately prepared for the work environment they will be entering. The AIS needs survey (contained in link below) asks questions related to information technology skills you think accounting graduates need and will take about 10 minutes. Your input is very important in helping me design an AIS course that meets the needs of the current accounting environment.

[\[Link was here\]](#)

Thank-you for your help and please complete the entire survey (for the Information Technology skills questions the response I don't know has been provided so that you can complete all items).

Sample

Of the 154 survey submittals, 111 are usable,⁵ and the effective response rate⁶ ranges from 6.2 percent (70/1131) to 9.8 percent (111/1131) due to item nonresponses on the 62 IT skills. The basis of testing for response bias is to divide the 111 surveys into two distinct groups (early and late responders). The first group consists of respondents from October 26, 2017, to December 11, 2017 (early responders), and the second group is from January 11, 2018, to January 16, 2018 (late responders). There are no responders after January 16, 2018. A possible reason for the gap (December 12–January 10) between the two groups may be due to the Christmas/New Year's holidays falling during this period. A Chi Square Column Proportions Test using the 63 early responders and 48 late responders for each of the variables indicates no significant differences; thus, the following analysis uses the combined data.

Although a Don't Know response is a valid response, Don't Know responses are not included because only the Likert Scale responses are usable for the statistical analysis. Therefore, the number shown for each IT skill is the number of respondents who answered the IT skill question using the Likert Scale. Any difference between 111 and the number shown in the tables that follow is due to nonresponses and Don't Know responses. Although some researchers impute values for nonresponses, imputing is not viable if nonresponses exceed ten percent (Lodder, 2013); there is no imputation in this study. Nonresponses and Don't know responses are the highest amongst the Data Acquisition, Retention, and Use IT skills⁷ (22-37%), with the exception of managing and retaining data (17%), followed by System Development and/or Acquisition (13-

18%), Internet (13-16%), Governance (16%), System Development and/or Use (12%), Tools (12%), and Infrastructure (1-11%).

Furthermore, it does not appear that significantly fewer respondents answered questions near the end of the questionnaire. For example, 92 answered question 16 (managing and retaining data—1st set of questions related to IT skills), 98 answered question 19 (spreadsheets—4th set of questions related to IT skills), and 94 answered question 21 (preventing and responding to computer fraud—last set of questions related to IT skills). Thus, it seems reasonable to suggest respondents simply went through the questionnaire and answered those IT skills they had knowledge of.

Data Acquisition, Retention, and Use is the first set of IT questions and the number of responses for these specific IT skills are: Data Mining (87), Data Warehouses (75), Database Management Systems (85), managing and retaining data (92), Relational Databases (75), Business Intelligence Tools (70), data loss prevention (75), and file systems (76). Based on the number of responses to these IT skills, it seems reasonable to suggest individuals answered only those IT skills questions that were familiar to them. Many of the IT skills in the Data Acquisition, Retention, and Use section relate to complex IT skills that are more likely to be familiar to MLF respondents. However, the sample includes only 40 MLF respondents, so some of the SF respondents also answered these IT skills questions. Because the purpose of this study is to identify topics for an undergraduate AIS course, it is important to use only those responses indicating the practitioner had an opinion on, or knowledge of, the IT skill. Therefore, the 111 respondents include individuals who did not answer all of the 62 IT skills questions, since disregarding responses that did not answer all the IT skill questions⁸ is throwing away data that is useful for the analysis.

Respondent Characteristics

Table 1 provides basic demographic, organizational, and employment characteristics. In terms of firm size, 64 percent (71/111) of the respondents are in SF. The Organization for Economic Cooperation and Development's (OECD, 2019) classification is the basis for firm size (SF \leq 50 employees and MLF $>$ 50 employees). As Table 1 indicates, the respondents are fairly evenly split between female (SF 52.1%, MLF 47.5%) and male (SF 47.9%, MLF 52.5%), and the majority are White/Caucasian (SF 93%, MLF 90%). More than half are 45-64 years old⁹ (SF 32.4% + 29.6%, MLF 25% + 50%), most are CPAs (SF 93%, MLF 92.5%) and have a bachelor's (SF 60.6%, MLF 52.5%) or master's (SF 38%, MLF 47.5%) degree in accounting (SF 77.5%, MLF 72.5%).

With respect to their current position (length in firm), the highest percentage have been with their firm ten years or less (SF 23.9% + 23.9%, MLF 30% + 22.5%), in their current position (length in position) ten years or less (SF 26.8% + 21.1%, MLF 45% + 20%), and are in top management (SF 67.6%, MLF 60%). Regarding type of firm, the majority of SF respondents are in Regional CPA firms (40.8%) or other (43.7%), and MLF respondents are in private industry (47.5%) or other (35%). Of the SF respondents indicating other, 80.6 percent (25/31) are in local CPA firms (Table 1 notes provide more details on the private industry and other categories and are the result of how respondents classified themselves in their answers to Appendix A—questionnaire items 7 and 8).

Table 1: Respondent Characteristics

Category		Small Firm (SF) Number and (Percent)	Medium-Large Firm (MLF) Number and (Percent)	Chi Square Test
Gender	Female	37 (52.1%)	19 (47.5%)	$\chi^2 = 0.218$ $p > 0.05$
	Male	34 (47.9%)	21 (52.5%)	
		71 (100.0%)	40 (100.0%)	
Age	25 – 34	8 (11.3%)	4 (10.0%)	$\chi^2 = 6.434$ $p > 0.05$
	35 – 44	10 (14.1%)	5 (12.5%)	
	45 – 54	23 (32.4%)	10 (25.0%)	
	55 – 64	21 (29.6%)	20 (50.0%)	
	65 – 74	8 (11.3%)	1 (2.5%)	
	Over 75	1 (1.4%)	0 (0.0%)	
		71 (100.0%)	40 (100.0%)	
Certification	CPA	66 (93.0%)	37 (92.5%)	$\chi^2 = 1.945$ $p > 0.05$
	No Certification	0 (0.0%)	1 (2.5%)	
	Other	5 (7.0%)	2 (5.0%)	
		71 (100.0%)	40 (100.0%)	
Highest Degree	Associate's	1 (1.4%)	0 (0.0%)	$\chi^2 = 0.733$ $p > 0.05$
	Bachelor's	43 (60.6%)	23 (52.5%)	
	Master's	27 (38.0%)	17 (47.5%)	
		71 (100.0%)	40 (100.0%)	
Highest Degree Field	Accounting	55 (77.5%)	29 (72.5%)	$\chi^2 = 0.343$ $p > 0.05$
	Other	16 (22.5%)	11 (27.5%)	
		71 (100.0%)	40 (100.0%)	
Ethnicity*	WC	66 (93.0%)	36 (90.0%)	$\chi^2 = 0.541$ $p > 0.05$
	BAA	2 (2.8%)	1 (2.5%)	
	PTNA	3 (4.2%)	3 (7.5%)	
		71 (100.0%)	40 (100.0%)	
Type of Firm	Big 4 / National	0 (0.0%)	1 (2.5%)	$\chi^2 = 17.367$ $p < 0.001$
	Regional CPA	29 (40.8%)	6 (15.0%)	
	Private Industry	11 (15.5%) ¹	19 (47.5%) ³	
	Other	31 (43.7%) ²	14 (35.0%) ⁴	
		71 (100.0%)	40 (100.0%)	
Management Level	Top	48 (67.6%)	24 (60.0%)	$\chi^2 = 0.649$ $p > 0.05$
	All Others	23 (32.4%)	16 (40.0%)	
		71 (100.0%)	40 (100.0%)	
Length in Firm	< 5 Years	17 (23.9%)	12 (30.0%)	$\chi^2 = 4.395$ $p > 0.05$
	5 – 10 Years	17 (23.9%)	9 (22.5%)	
	11 – 15 Years	10 (14.1%)	9 (22.5%)	
	16 – 20 Years	7 (9.9%)	5 (12.5%)	
	> 20 Years	20 (28.2%)	5 (12.2%)	
		71 (100.0%)	40 (100.0%)	
Length in Position	< 5 Years	19 (26.8%)	18 (45.0%)	$\chi^2 = 9.288$ $p = 0.054$
	5 – 10 Years	15 (21.1%)	8 (20.0%)	
	11 – 15 Years	13 (18.3%)	8 (20.0%)	
	16 – 20 Years	5 (7.0%)	4 (10.0%)	
	> 20 Years	19 (26.8%)	2 (5.0%)	
		71 (100.0%)	40 (100.0%)	

Notes:

*WC = White/Caucasian, BAA = Black or African-American, PTNA = Prefer to Not Answer, no respondents chose American Indian or Alaskan, Native Hispanic or Latino, Asian or Pacific Islander, or Other as their ethnicity.

¹ manufacturing (2), retail (2), consulting (3), government (1), education (2), and not indicated (1)² local CPA firm (25), financial services (1), real-estate (3), motorsports (1), and professional services (1)³ manufacturing (7), retail (2), government (7), consulting (1), and education (2)⁴ banking (1), communications (1), education (1), financial services (2) healthcare (4), publishing (1), motorsports (1), real-estate (2), and technology (1)

DATA ANALYSIS AND FINDINGS

RQ1: Does the size of the respondent's firm impact the perception of an IT skill's importance?

A five-point Likert Scale Not Important (1) to Very Important (5) determines the 62 IT skills' importance in the questionnaire. Table 2, however, focuses on the number of SF and MLF respondents, so the coding is 1 Not Important (1 or 2 in the original scale reflecting Not Important) and 2 Important (3, 4, 5 in the original scale reflecting Important). A column proportion Chi Square Test assesses the association between firm size (SF vs MLF) and the importance (1-Not Important vs. 2- Important) of an IT skill.

Of the 62 IT skills, 14 have significant differences for firm size, and seven (Data Mining, managing and retaining data, Business Intelligence Tools, Data Flow Diagrams, Document Flowcharts, System Flowcharts, and QuickBooks) are new IT skills (not ranked in previous studies). QuickBooks (Panel D—question 19 in the questionnaire) and the Database Management Systems (Panel A—question 16 in the questionnaire) are the most significant of the 14 IT skills. QuickBooks is significantly more important to SF respondents, and the Database Management Systems is significantly more important to MLF respondents. While none of the SF respondents indicate QuickBooks is not important, 23.1% of MLF respondents think it is not important. For the Database Management System, the highest percentage of SF respondents think it is not important, while the opposite is true for MLF respondents. There is also a significant association between firm size and Data Mining, Data Warehouses, Relational Databases, and Business Intelligence Tools. That is, a greater proportion of MLF respondents view Data Mining, Data Warehouses, Relational Databases, and Business Intelligence Tools to be more important than do SF respondents.

In fact, the largest percent of SF respondents think Data Mining and Relational Databases are not important, while the opposite is true for MLF respondents. For Data Warehouses a higher percentage of SF respondents think it is not important than MLF respondents and for Business Intelligence Tools a higher percentage of MLF respondents think it is important compared to SF respondents. Additionally, there is a marginally significant association between firm size and managing and retaining data. Both groups think managing and retaining data is important, with only a slightly larger percentage of MLF respondents viewing it as more important than do SF respondents.

Table 2: 14 IT Skills with Significant Differences by Firm Size

IT Skill	New Skill [NS]	* 1 (NI) 2 (I)	Small Firm (SF) Percent [N]	Medium-Large Firm (MLF) Percent [N]	Total Percent [N]	Chi Square Test
Panel A—Data Acquisition, Retention, and Use						
Data Mining	NS	1 (NI) 2 (I)	59.3% [32] 40.7% [22] 100.0% [54]	33.3% [11] 66.7% [22] 100.0% [33]	49.4% [43] 50.6% [44] 100.0% [87]	$\chi^2 = 5.508$ $p = 0.019$
Data Warehouses		1 (NI) 2 (I)	78.0% [39] 22.0% [11] 100.0% [50]	52.0% [13] 48.0% [12] 100% [25]	69.3) [52] 30.7% [23] 100.0% [75]	$\chi^2 = 5.299$ $p = 0.021$
Database Management Systems		1 (NI) 2 (I)	64.8% [35] 35.2% [19] 100.0% [54]	25.8% [8] 74.2% [23] 100.0% [31]	50.6% [43] 49.4% [42] 100.0% [85]	$\chi^2 = 11.989$ $p = 0.001$
Managing and Retaining Data	NS	1 (NI) 2 (I)	21.3% [13] 78.7% [48] 100.0% [61]	6.5% [2] 93.5% [29] 100.0% [31]	16.3% [15] 83.7% [77] 100.0% [92]	$\chi^2 = 3.326$ $p = 0.068$
Relational Databases		1 (NI) 2 (I)	65.2% [30] 34.8% [16] 100.0% [46]	31.0% [9] 69.0% [20] 100.0% [29]	52.0% [39] 48.0% [36] 100.0% [75]	$\chi^2 = 8.327$ $p = 0.004$
Business Intelligence Tools	NS	1 (NI) 2 (I)	40.4% [19] 59.6% [28] 100.0% [47]	13.0% [3] 87.0% [20] 100.0% [23]	31.4% [22] 68.6% [48] 100.0% [70]	$\chi^2 = 5.373$ $p = 0.020$
Panel B—Infrastructure						
Hardware		1 (NI) 2 (I)	18.6% [13] 81.4% [57] 100.0% [70]	35.0% [14] 65.0% [26] 100.0% [40]	24.5% [27] 75.5% [83] 100.0% [110]	$\chi^2 = 3.709$ $p = 0.054$
Intranet		1 (NI) 2 (I)	35.4% [23] 64.6% [42] 100.0% [65]	17.5% [7] 82.5% [33] 100.0% [40]	28.6% [30] 71.4% [75] 100.0% [105]	$\chi^2 = 3.881$ $p = 0.049$
Extranet		1 (NI) 2 (I)	38.7% [24] 61.3% [38] 100.0% [62]	16.2% [6] 83.8% [31] 100.0% [37]	30.3% [30] 69.7% [69] 100.0% [99]	$\chi^2 = 5.551$ $p = 0.018$
Panel C—System Development and/or Acquisition						
Data Flow Diagrams	NS	1 (NI) 2 (I)	42.9% [24] 57.1% [32] 100.0% [56]	23.7% [9] 76.3% [29] 100.0% [38]	35.1% [33] 64.9% [61] 100.0% [94]	$\chi^2 = 3.653$ $p = 0.056$
Document Flowcharts	NS	1 (NI) 2 (I)	42.1% [24] 57.9% [33] 100.0% [57]	21.1% [8] 78.9% [30] 100.0% [38]	33.7% [32] 66.3% [63] 100.0% [95]	$\chi^2 = 4.524$ $p = 0.033$
Software Purchase Decisions		1 (NI) 2 (I)	27.6% [16] 72.4% [42] 100.0% [58]	48.7% [19] 51.3% [20] 100.0% [39]	36.1% [35] 63.9% [62] 100.0% [97]	$\chi^2 = 4.515$ $p = 0.034$
System Flowcharts	NS	1 (NI) 2 (I)	49.1% [26] 50.9% [27] 100.0% [53]	21.1% [8] 78.9% [30] 100.0% [38]	37.4% [34] 62.6% [57] 100.0% [91]	$\chi^2 = 7.416$ $p = 0.006$
Panel D—Tools						
QuickBooks	NS	1 (NI) 2 (I)	0.0% [0] 100.0% [59] 100.0% [59]	23.1% [9] 76.9% [30] 100.0% [39]	9.2% [9] 90.8% [89] 100.0% [98]	$\chi^2 = 14.992$ $p < 0.001$

Notes:

Number [N] based on 111 usable surveys (don't know responses + nonresponses)

New Skill [NS] IT skills not ranked in previous studies

Original scale 1 (Not Important) to 5 (Very Important)

*adjusted scale 1 = NI (Not Important) since 1 or 2 in the original scale reflects Not Important and 2 = I (Important) since 3, 4, 5 in the original scale reflects Important.

Table 2 Panel B provides results for Infrastructure (Question 17 in the questionnaire). There is a significant association between firm size and the importance of the Intranet and Extranet. These results indicate that a greater proportion of MLF respondents views the Intranet and Extranet as more important than do SF respondents. There is a marginal significance for hardware, with a higher percentage of SF respondents indicating Important than MLF respondents.

Table 2 Panel C presents results for System Development and/or Acquisition (Question 18 in the questionnaire). A significant association exists between firm size and Document Flowcharts, software purchase decisions, and System Flowcharts. That is, a greater proportion of MLF respondents perceive Document Flowcharts and System Flowcharts to be more important than do SF respondents. Conversely, a higher percentage of SF respondents, in comparison to MLF respondents, think the software purchase decision is important. Data Flow Diagrams are marginally significant with a larger percentage of MLF respondents indicating Important as compared to SF respondents. There is no association for firm size and the IT skills in the Internet (Question 20) and Governance (Question 21) sections of the questionnaire.

In summary, SF respondents perceive QuickBooks and software purchase decisions as more important, while MLF respondents think Data Mining, Database Management Systems, Relational Databases, Business Intelligence Tools, Intranet, Extranet, and Document and System Flowcharts are more important. Additionally, the highest percentage of MLF respondents think that Data Mining, Database Management Systems, and Relational Databases are important, while the highest percentage of SF respondents indicate Not Important. These findings tend to support previous research suggesting large firms use more sophisticated information systems than small firms (Kagan et al., 1990; Burke, 2005; Thong, 1999).

The results in Table 2 suggest it is important for undergraduate AIS course designers to consider where their students' employment opportunities are. If the answer is SF, then spending time on Data Acquisition, Retention, and Use skills (Panel A), other than managing and retaining data, would not seem prudent given undergraduate AIS course constraints. Similarly, the Infrastructure skills (Panel B) Intranet and Extranet, and System Development and/or Acquisition skills (Panel C) involving Data Flow Diagrams, Document Flowcharts, and System Flowcharts are probably less important for students employed in SF. If students are likely to be in MLF, then course coverage recommendations would be the opposite of that for SF employment.

Table 3: Firm Size and Top 27 IT Skills
(Mean ≥ 3 for SF, or MLF, or Both)

IT Skill	New Skill [NS]	Overall Mean (SD) [N]	Small Firm (SF) Mean (SD) [N]	Medium -Large Firm (MLF) Mean (SD) [N]
Panel A—Data Acquisition, Retention, and Use				
Managing and Retaining Data	NS	3.57 (1.46) [92]	3.39 (1.54) [61]	3.90 (1.25) [31]
Business Intelligence Tools	NS	2.94 (1.56) [70]	2.66 (1.58) [47]	3.52 (1.38) [23]
Data Loss Prevention	NS	3.08 (1.69) [75]	3.00 (1.74) [51]	3.25 (1.59) [24]
File Systems	NS	3.42 (1.28) [76]	3.36 (1.32) [50]	3.54 (1.21) [26]
Panel B—Infrastructure				
Network Security		3.25 (1.27) [111]	3.38 (1.30) [71]	3.03 (1.19) [40]
Information Security Technology	NS	3.09 (1.19) [108]	3.12 (1.24) [68]	3.05 (1.11) [40]
Virtual Office Technology	NS	3.20 (1.25) [110]	3.25 (1.26) [71]	3.10 (1.23) [39]
Password Management Tools	NS	3.28 (1.24) [111]	3.31 (1.31) [71]	3.23 (1.12) [40]
Enabling Decision Support and Analytics		2.83 (1.27) [101]	2.73 (1.29) [62]	3.00 (1.21) [39]
IT Controls	NS	3.20 (1.05) [108]	3.18 (0.99) [68]	3.25 (1.15) [40]
Operating Systems		3.13 (1.00) [110]	3.17 (0.96) [71]	3.05 (1.09) [39]
Intranet		2.75 (1.28) [105]	2.60 (1.34) [65]	3.00 (1.13) [40]
Extranet		2.67 (1.26) [99]	2.44 (1.28) [62]	3.05 (1.15) [37]
Software Security	NS	3.43 (1.09) [108]	3.56 (1.06) [68]	3.20 (1.11) [40]
Input Devices		2.99 (0.99) [105]	3.10 (0.96) [67]	2.79 (1.04) [38]
Output Devices		2.95 (1.00) [104]	3.08 (0.99) [66]	2.74 (1.00) [38]
Panel C—System Development and/or Use				
Software Implementation	NS	2.96 (1.23) [98]	3.12 (1.21) [59]	2.72 (1.23) [39]
Panel D—Tools				
Spreadsheets (ex. Microsoft Excel)		4.71 (0.76) [98]	4.63 (0.81) [59]	4.85 (0.67) [39]
QuickBooks	NS	3.78 (1.26) [98]	4.31 (0.89) [59]	2.97 (1.33) [39]
Microsoft Word		4.32 (0.94) [98]	4.51 (0.82) [59]	4.03 (1.04) [39]
Panel E—Internet				
Electronic Commerce		2.91 (1.41) [93]	2.79 (1.46) [56]	3.11 (1.33) [37]
Ensuring Privacy	NS	4.13 (1.19) [96]	4.15 (1.19) [59]	4.08 (1.21) [37]
Cloud Computing	NS	3.74 (1.27) [95]	3.86 (1.25) [58]	3.54 (1.30) [37]
Internet Research		4.36 (1.02) [97]	4.42 (0.99) [59]	4.26 (1.08) [38]
Internet	NS	4.34 (1.03) [97]	4.36 (1.01) [59]	4.32 (1.07) [38]
Preventing and Responding to Cybercrime	NS	3.85 (1.26) [94]	3.76 (1.29) [58]	4.00 (1.22) [36]
Panel F—Governance				
Preventing and Responding to Computer Fraud	NS	3.28 (1.29) [93]	3.36 (1.26) [56]	3.16 (1.36) [37]

Notes:

Number [N] based on 111 usable surveys and Mean based on Original scale 1 (Not Important) to 5 (Very Important)

New Skill [NS] IT skills not ranked in previous studies

Of the 14 IT skills with significant differences by firm size, five of them (managing and retaining data, Business Intelligence Tools, Intranet, Extranet, and QuickBooks) are in Table 3. Since firm size affects the importance of some IT skills, Table 3 presents the 27 of the 62 IT skills that have means greater than or equal to three for SF, or MLF, or both. Sixteen of the 27 IT skills are new and not ranked in previous studies, likely due to changes in technology and/or changes in the technology's importance to accountants.

RQ2: What are the important IT skills for an undergraduate AIS course?

The top 15 IT skills (Table 4) for SF respondents indicates three are from the Tools category, five from Internet, four from Infrastructure, two from Data Acquisition, Retention and Use, and one

from Governance. The ranking from one to 15, respectively, is: spreadsheets, Microsoft Word, Internet research, Internet, QuickBooks, ensuring privacy, Cloud Computing, preventing and responding to cybercrime, software security, managing and retaining data, network security, preventing and responding to computer fraud, file systems, Password Management Tools, and Virtual Office Technology. Of the top 15 IT skills 11 are new skills (Internet, ensuring privacy, preventing and responding to cybercrime, QuickBooks, Cloud Computing, managing and retaining data, software security, file systems, Password Management Tools, preventing and responding to computer fraud, and Virtual Office Technology), which are not in previous ranking studies, likely due to changes in technology and/or changes in the importance of the technology for accountants.

Table 4: Firm Size and Top 15 IT Skills

(Mean ≥ 3 for SF, or MLF, or Both)

Category	IT Skill	Overall Mean (SD)	Rank Order	Small Firm (SF) Mean (SD)	Rank Order	Medium-Large Firm (MLF) Mean (SD)	Rank Order
Tools	<i>Spreadsheets (ex. Microsoft Excel)</i>	4.71 (0.76)	1	4.63 (0.81)	1	4.85 (0.67)	1
Internet	<i>Internet Research</i>	4.36 (1.02)	2	4.42 (0.99)	3	4.26 (1.08)	3
Internet	<i>Internet*</i>	4.34 (1.03)	3	4.36 (1.01)	4	4.32 (1.07)	2
Tools	<i>Microsoft Word</i>	4.32 (0.94)	4	4.51 (0.82)	2	4.03 (1.04)	5
Internet	<i>Ensuring Privacy*</i>	4.13 (1.19)	5	4.15 (1.19)	6	4.08 (1.21)	4
Internet	<i>Preventing and Responding to Cybercrime*</i>	3.85 (1.26)	6	3.76 (1.29)	8	4.00 (1.22)	6
Tools	<i>QuickBooks*</i>	3.78 (1.26)	7	4.31 (0.89)	5	2.97 (1.33)	
Internet	<i>Cloud Computing*</i>	3.74 (1.27)	8	3.86 (1.25)	7	3.54 (1.30)	9
Data Acquisition, Retention, & Use	<i>Managing and Retaining Data*</i>	3.57 (1.46)	9	3.39 (1.54)	10	3.90 (1.25)	7
Infrastructure	<i>Software Security*</i>	3.43 (1.09)	10	3.56(1.06)	9	3.20 (1.11)	14
Data Acquisition, Retention, & Use	<i>File Systems*</i>	3.42 (1.28)	11	3.36 (1.32)	13	3.54 (1.21)	8
Infrastructure	<i>Password Management Tools*</i>	3.28 (1.24)	12	3.31 (1.31)	14	3.23 (1.12)	13
Governance	<i>Preventing and Responding to Computer Fraud*</i>	3.28 (1.29)	13	3.36 (1.26)	12	3.16 (1.36)	15
Infrastructure	<i>Network Security</i>	3.25 (1.27)	14	3.38 (1.30)	11	3.03 (1.19)	
Infrastructure	<i>Virtual Office Technology*</i>	3.20 (1.25)		3.25 (1.26)	15	3.10 (1.23)	
Infrastructure	<i>IT Controls *</i>	3.20 (1.05)	15	3.18 (0.99)		3.25 (1.15)	11
Data Acquisition, Retention, & Use	<i>Business Intelligence Tools*</i>	2.94 (1.56)		2.66 (1.58)		3.52 (1.38)	10
Data Acquisition, Retention, & Use	<i>Data Loss Prevention*</i>	3.08 (1.69)		3.00 (1.74)		3.25 (1.59)	12

Notes:

*New Skill, those IT skills not ranked in previous studies

Rank Order for IT skills with means ≥ 3 based on original scale 1 (Not Important) to 5 (Very Important)

In the case of tied, the SD is used as the tiebreaker

The top 15 IT skills for MLF respondents indicates two are from Tools category, five are from Internet, three are from Infrastructure, four are from Data Acquisition, Retention, and Use, and one from Governance. The ranking from one to 15, respectively, is: spreadsheets, Internet, Internet research, ensuring privacy, Microsoft Word, preventing and responding to cybercrime, managing and retaining data, file systems, Cloud Computing, Business Intelligence Tools, IT controls, data loss prevention, Password Management Tools, software security, and preventing and responding to computer fraud. Of the top 15 IT skills, 12 are new skills and the differences from SF respondents are MLF respondents include IT controls, Business Intelligence Tools, and data loss prevention and do not include QuickBooks and Virtual Office Technology.

Comparing the top 15 IT skills for SF and MLF reveals three differences for each. SF respondents think QuickBooks, network security, and Virtual Office Technology are more important and MLF respondents perceive Business Intelligence Tools, data loss prevention, and IT controls are more important. The rankings for 16 and above (Table 3) also reveal three differences for each group. While SF respondents indicate input devices, output devices, and software implementation are more important, MLF respondents think enabling decision support analysis, Intranet, and Extranet are more important.

In terms of undergraduate AIS course design, Table 4 indicates it is more important for students who are likely to be in SF to have QuickBooks, network security, and Virtual Office Technology skills, and for students going to MLF it is more important to have Business Intelligence Tools, data loss prevention skills, and IT Controls. Furthermore, all students need skills related to spreadsheets, Internet research, Internet, and Microsoft Word based on the rankings in Table 4. Which of the other skills to include in an undergraduate AIS course will depend on time constraints and where (SF vs. MLF) the majority of the students in the accounting major will be employed. Additional suggestions for undergraduate AIS course design and SF versus MLF considerations are in the following section.

DISCUSSION

Limited research exists with respect to firm size and the importance of IT skills for accountants. Tables 2 and 3 provide evidence that there is a relationship between firm size and the importance of some IT skills. For example, SF respondents perceive QuickBooks and software purchase decisions to be more important, which seems reasonable given their work environment. SF are more likely to use QuickBooks, and small CPA firms are more likely to have clients who use QuickBooks. The type of software to buy is also an important question for SF, and they may look to their CPA for help because they are not likely to have IT staff.

MLF respondents think enabling decision support and analytics that deal with Big Data (Data Mining, Data Warehouses, Database Management Systems, Relational Databases, and Business Intelligence Tools) and their supporting technologies (Intranet, Extranet, Document Flowcharts, and Systems Flowcharts) are more important. The greater importance attached to the more sophisticated IT tools by MLF respondents seems reasonable because MLF or CPA firms with large clients will have work environments that are more complex and require the maintenance and analysis of significant amounts of data.

This study, like previous research, finds that three IT skills continue to be in the top five rankings regardless of whether or not firm size is a consideration:

- spreadsheets (Dillon & Kruck, 2008; Chen et al., 2009; Welch et al., 2010; Cory & Pruske, 2012; Kearns, 2014; Lee et al., 2018)
- Word Processing (Chen et al., 2009; Welch et al., 2010; Cory & Pruske, 2012)
- Internet research (Welch et al., 2010; Cory & Pruske, 2012).

This research's results also support previous findings that firm size is not a factor for Cloud Computing (Gupta et al., 2013; Seethamraju, 2015; Loukis et al., 2017). Note that Table 2 does not include Cloud Computing, and Cloud Computing ranks seventh and ninth, respectively, for SF and MLF respondents (Table 4).

Additionally, this research adds to the existing literature because 16 of the top 20 IT skills (Table 3) are new (not ranked in previous studies) and 13 made the top 15 IT skills list (Table 4) for SF, or MLF, or both. The 16 new IT skills are: Internet, ensuring privacy, preventing and responding to cybercrime, QuickBooks (SF only), Cloud Computing, managing and retaining data, software security, file systems, Password Management Tools, preventing and responding to computer fraud, Virtual Office Technology, IT Controls, Information Security Technology, data loss prevention, software implementation (SF only), and Business Intelligence Tools (MLF only).

Utilizing Tables 3 and 4 in conjunction with Appendix B (Rankings of IT Skills) should help AIS faculty decide what to include, what to discard, and what to do outside of an undergraduate AIS course. For example, spreadsheets are the top IT skill time after time, so coverage is essential. In fact, Brown and Pike (2010) indicate, "Excel is the default software for financial analysis and journal entry preparation in the United States and perhaps the world" (p. 26). Schools that lack sufficient AIS faculty might consider utilizing a separate course for spreadsheets taught by MIS faculty, if they have MIS faculty. Some of the 62 IT skills (Appendix B) that did not make this study's top IT skills (Tables 3 and 4) may be better in other accounting courses. For example, AIS Auditing/Generalized Audit Software, CASE Tools, and Document and System Flowcharts might be more useful in an undergraduate Auditing course than an AIS course.

Comparing the four studies' rankings (Appendix B) reveals that the importance of some IT skills for an undergraduate AIS course may decline over time¹⁰ (for example, input/output devices, Electronic Commerce, hardware, Intranet, Extranet, Project Management, AIS Auditing/Generalized Audit Software, Local Area Network, software purchase decisions, system implementation and testing, system design and maintenance, Database Management Systems, Databases, ERP, Data Warehouses, CASE Tools, Program Design, and Programming Languages). This study's results also support Winstead and Wenger's (2015) findings that the more complex topics, like Electronic Commerce, system implementation and testing, ERP, System Design, XBRL, and Programming Languages are less important to accounting practitioners. Because the majority of these topics are generally found in MIS courses (Murthy & Ragland, 2009), it may be better for undergraduate accounting majors to take MIS courses covering these topics rather than trying to put them in the undergraduate AIS course.

The IT skills shown in Table 3 should be up for consideration when designing an undergraduate AIS course. How many IT skills and which ones to include will depend on whether the accounting program has one or two undergraduate AIS courses. Many schools with only one AIS course should probably focus on the top 10 or 15 IT skills (Table 4) for either SF or MLF, depending on the size of the firms employing their students. Furthermore, 12 of the top 15 IT skills are important, regardless of firm size, and provide a good starting point for schools with only one undergraduate AIS course. The 12 IT skills are: spreadsheets, Internet research, Internet, Microsoft

Word, ensuring privacy, preventing and responding to cybercrime, Cloud Computing, managing and retaining data, software security, file systems, Password Management Tools, and preventing and responding to computer fraud. While some might suggest Internet research and Internet are the same, they probably are not. For many the Internet is now “the library.” Generally, one would not consider “using the library” and “library research” to be equivalent skills; the same logic should probably apply to Internet and Internet research.

Schools with two AIS courses might focus on the top 10 or 15 IT skills for SF (Table 4) in the first course and pick up the remaining IT skills for MLF (Tables 3 and 4) in the second course. Regardless of whether the accounting program has one or two AIS courses, the emphasis should be on practical tools and software (Coynes et al., 2016), as the IT skills in Tables 3 and 4 indicate. For example, most AIS textbooks contain chapters on business processes, and using QuickBooks in conjunction with these chapters can provide students with a hands-on experience using a practical tool that SF respondents favor.

Future Implications

The rapid technological innovations make it important for future research to assess emerging IT skills and their impact on the accounting profession. According to Robert Half’s 2020 Salary Guide, key IT skills for new accounting hires include cloud-based systems, data analytics and database management, ERP systems, Excel, industry-specific software, and QuickBooks for small and midsize businesses (Half, 2020). This study’s questionnaire covers all of Robert Half’s key IT skills except for industry-specific software.

While not accounting specific, Some (2019) indicates that the top 2019 technologies are: Artificial Intelligence (AI), Quantum Computing (faster computing), blockchain, Virtual Reality (VR) and Augmented Reality (AR), Intelligent Apps, and Big Data. Additionally, Gartner’s 2020 top ten strategic technology categories include hyper-automation (AI and machine learning), multi-experience (AR and VR), democratization (data models), human augmentation (technology enhancing cognitive and physical experiences), transparency and traceability (technology and the trust crisis), empowered edge (Internet of Things), distributed cloud (public cloud services), autonomous things (drones, robots, etc.), practical blockchain, and AI security (Panetta, 2019). This study’s questionnaire includes IT skills for only a few of those that Some and Gartner identify: blockchain, Big Data (Business Intelligence Tools and Data Mining), Cloud Computing, and the Internet. New technologies that future research should investigate will depend on how quickly and how much the new technologies impact accounting practice.

Since this study utilizes only two groups (SF vs. MLF), future research might utilize three groups (small, medium, and large) to determine the variation in the importance of IT skills between the three different firm sizes. Additionally, future research can continue to explore the relationship between firm size and the importance that accountants attach to IT skills because limited studies exist, with even fewer investigating a direct correlation to size. While this study collected data on age, it did not collect data on continuing professional education (CPE) or additional technology training. For example, the NCACPA holds two two-day technology conferences every year, so technology CPE is available for CPAs if they choose to do it. Future studies could improve upon this study by collecting data on technology training to determine if age and additional technology training, or the lack there of, have an impact on the importance of IT skills. Another avenue for future research would be to compare the IT skills in Table 3, especially the 16 new IT skills, to AIS syllabi and textbooks because the studies in this area are dated.

Limitations

The respondents in this study are entirely NCACPA members who use the Open Forum. While there is no reason to believe practitioners in North Carolina view IT skills differently than those in other geographic regions, the restriction to members of the NCACPA using the Open Forum is a limitation of this study. Additionally, the questionnaire's length (it includes questions related to demographic information and 62 IT skills) may have discouraged Open Forum users from participating. Because response rates vary for research utilizing surveys or questionnaires, they are always a study limitation. Unfortunately, low response rates for online surveys with professional accountants is likely to continue to be an issue. For example, a recent AICPA Trends Report (2019, p. 38) utilizing online surveys with accountants from universities and colleges and accounting firms indicates response rates, respectively, of 12 and 2.3 percent.

CONCLUSION

This research attempts to overcome previous studies' limitations by surveying practicing accountants who are not working primarily in large public accounting firms. The results provide the views of over 100 professional accountants: 93 percent are CPAs, 64 percent in SF, and many have been in the profession for a significant period of time (highest percentage are in the age range 45-64). Input from SF practitioners is important because the majority of undergraduate accounting students will not go into, or will not stay in, large public accounting practice; therefore, addressing their needs is important when identifying topics for an undergraduate AIS course (Schea, 2008; Siegel et al., 2010). Additionally, this study provides an important update on IT skills, their importance to accountants, and an SF versus MLF comparison.

The top IT skills (Table 3) this research identifies will help accounting educators decide what topics their undergraduate AIS course(s) should include. Of additional significance are the 35 IT skills (can be found in Appendix B—Rankings of IT Skills) that did not make the top 27 IT skills in Table 3. This research's ranking of the 62 IT skills allows AIS educators to evaluate the topics they currently cover and what they might want to change, depending on where the majority of their students' employment opportunities are (SF vs. MLF). Furthermore, the top 27 IT skills (Table 3) this study reveals provides an important update because it includes 16 skills that are not in previous ranking studies, due to lack of inclusion and/or changes in technology.

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Editor's Note: This article contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their devices and applications may be able to gain direct access to these linked pages. Readers are warned of the following caveats regarding these links.

1. The links existed as of the date of publication but are not guaranteed to be working thereafter.
2. The contents of web pages may change over time. Where version information is provided in the AISEJ published article, different versions may not contain the information, or the conclusions referenced.
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Appendix A – Questionnaire

Section I: Demographic Data

1. What is your gender?
Female _____
Male _____

2. What is your age?
Under 25 _____ 55 – 64 _____
25 – 34 _____ 65 - 74 _____
35 - 44 _____ Over 75 _____
45 - 54 _____

3. I am a:
CPA _____ CGMA _____
CMA _____ No Certification _____
CIA _____
Other (please specify) _____

4. My highest degree completed is a(n):
Associate’s _____
Bachelor’s _____
Master’s _____
Doctoral _____

5. My highest degree completed was in:
Accounting _____
Other (please specify) _____

6. My ethnic group is:
American Indian or Alaskan Native _____
Asian or Pacific Islander _____
Black or African-American _____
Hispanic or Latino _____
White / Caucasian _____
Prefer not to answer _____
Other (please specify) _____

Section II - Employment – Firm / Sector Information

7. I am currently employed by:
Big-Four Firm _____
Other National CPA Firm _____
Regional CPA Firm _____
Private Industry _____
Other _____

8. If you selected "Private Industry" or "Other" in Question 7, please indicate your sector:
Manufacturing _____
Wholesale _____
Retail _____
Consulting Services _____
Governmental Agency _____
Educational Institution _____
Other (please specify) _____

Section III – Length of Employment and Position

9. Number of employees in my current firm/organization is:
≤50 _____ 1001 – 2000 _____
51- 100 _____ 2001-3000 _____
101-500 _____ > 3000 _____
501-1000 _____

10. I have been in my current firm/organization for:
- < 5 years _____
 - 5 - 10 years _____
 - 11 - 15 years _____
 - 16 - 20 years _____
 - More than 20 years _____
11. I have been in my current position for:
- < 5 years _____
 - 5 - 10 years _____
 - 11 - 15 years _____
 - 16 - 20 years _____
 - More than 20 years _____
12. My current position is that of a:
- Upper-level manager _____
 - Middle-level manager _____
 - Lower-level manager _____
 - Non-manager _____

Section IV – Supervisory Information

13. Supervision is part of my job:
- Yes _____
 - No _____

Section V – Direct Supervision

14. If you answered "Yes" to Question 13, how many employees do you supervise directly:
- | | |
|----------------------------------|----------------------------------|
| <input type="checkbox"/> < 10 | <input type="checkbox"/> 31 – 50 |
| <input type="checkbox"/> 11 – 20 | <input type="checkbox"/> 51 – 70 |
| <input type="checkbox"/> 21 – 30 | <input type="checkbox"/> > 70 |

Section VI – Hiring Input

15. Please indicate the extent of your agreement with the following statement:
- | | | | | | |
|---|----------------------|-------|-------------------------------|-------|-------------------|
| | Strongly
Disagree | | Neither agree
nor disagree | | Strongly
Agree |
| I have input in my organization's hiring of accountants | _____ | _____ | _____ | _____ | _____ |

Section VII – Data Acquisition, Retention, & Use

16. Please indicate the importance of the following Information Technology (IT) Skills, knowledge, etc. listed below to your organization in terms of hiring a recent accounting graduate.

Don't Know (DK), Not Important (NI), Important (I), Very Important (VI)

	DK	NI	I	VI
Data Mining				
Data Warehouses				
Database Design				
Database Implementation				
Database Management Systems (ex. Microsoft Access, SQL)				
Managing and Retaining Data				
Relational Databases				
Business Intelligence Tools				
Data Loss Prevention				
File Systems				

Section VIII – Infrastructure

17. Please indicate the importance of the following Information Technology (IT) Skills, knowledge, etc. listed below to your organization in terms of hiring a recent accounting graduate.

Don't Know (DK), Not Important (NI), Important (I), Very Important (VI)

	DK	NI		I		VI
Network Security						
Local Area Networks						
Value Added Networks						
Information Security Technology						
Virtual Office Technology						
Password Management Tools						
Enabling Decision Support and Analytics						
IT Controls						
Hardware						
Operating Systems						
Intranet						
Extranet						
Software Security						
Input Devices						
Output Devices						

Section IX – System Development and/or Acquisition

18. Please indicate the importance of the following Information Technology (IT) Skills, knowledge, etc. listed below to your organization in terms of hiring a recent accounting graduate.

Don't Know (DK), Not Important (NI), Important (I), Very Important (VI)

	DK	NI		I		VI
Information Life Cycle						
Data Flow Diagrams						
Document Flowcharts						
Computer Program Design						
Programming Languages						
Software Purchase Decisions						
Software Implementation						
System Design and Maintenance						
System Implementation and Testing						
System Controls						
Entity Relationship Diagrams						
REA Diagrams						
Open Source Software						
Enterprise Resource Planning						
System Flowcharts						

Section X – Tools

19. Please indicate the importance of the following Information Technology (IT) Skills, knowledge, etc. listed below to your organization in terms of hiring a recent accounting graduate.

Don't Know (DK), Not Important (NI), Important (I), Very Important (VI)

	DK	NI		I		VI
Generalized Audit Software						
Spreadsheets (ex. Microsoft Excel)						
QuickBooks						
Microsoft Word						
eXtensible Business Reporting Language (XBRL)						
HTML						
Block Chain Accounting						
Computer-Assisted Software Engineering (CASE)						
Project Management Software						

Section XI – Internet

20. Please indicate the importance of the following Information Technology (IT) Skills, knowledge, etc. listed below to your organization in terms of hiring a recent accounting graduate.

Don't Know (DK), Not Important (NI), Important (I), Very Important (VI)

	DK	NI		I		VI
Electronic Commerce						
Ensuring Privacy						
Cloud Computing						
Internet Research						
Internet						
Social Media (Facebook, Twitter, etc.)						
Preventing and Responding to Cybercrime						

Section XII – Governance

21. Please indicate the importance of the following Information Technology (IT) Skills, knowledge, etc. listed below to your organization in terms of hiring a recent accounting graduate.

Don't Know (DK), Not Important (NI), Important (I), Very Important (VI)

	DK	NI		I		VI
Disaster Recovery						
Managing IT Risk and Compliance						
Preventing and Responding to Computer Fraud						
Governing and Managing IT Investment /Spending						
Leveraging Emerging Technologies						
Managing Vendors and Service Providers						

Section XIII – Cooperation between IT Personnel and Accountants

22. Please indicate the importance of the following Information Technology (IT) Skills, knowledge, etc. listed below to your organization in terms of hiring a recent accounting graduate.

Don't Know (DK), Not Important (NI), Important (I), Very Important (VI)

	DK	NI		I		VI
Please indicate the extent of importance of the cooperation between Information Systems Specialists and Accountants to your organization.						

Section XIV – COBIT

23. Please indicate the importance of the following Information Technology (IT) Skills, knowledge, etc. listed below to your organization in terms of hiring a recent accounting graduate.

Don't Know (DK), Not Important (NI), Important (I), Very Important (VI)

	DK	NI		I		VI
Please indicate the extent of importance of COBIT to your organization.						

Section XV – Anything Else?

24. Please indicate any additional information that you would like to share:

Appendix B – Rankings of IT Skills

	This Study*	Dillon & Kruck (2008)	Chen et al. (2009)	Welch et al. (2010)	Welch et al. (2010)
IT Skills	Rank Order (RO)	RO	RO	RO (CPA)	RO (IG)**
Spreadsheets or Excel	1	1	1	1	1
Internet Research	2			4	5
Internet ¹	3				
Word Processing Software	4		3	2	2
Ensuring Privacy ¹	5				
Preventing/Responding to Cybercrime ¹	6				
QuickBooks ¹	7				
Cloud Computing ¹	8				
Managing and Retaining Data ³	9				
Software Security ³	10				
File Systems ¹	11				
Password Manage Tools ³	12				
Network Security	13	4	13	9	8
Preventing/Responding to Computer Fraud ¹	14				
Virtual Office Tech ²	15				
IT Controls ¹	16				
Operating Systems	17	3	14	17	18
Information Security Technology ¹	18				
Data Loss Prevention (DLP) ³	19				
Input/Output Devices	20	8			
Software Implementation ¹	21				
Electronic Commerce	22	9			
Managing IT Risk and Compliance ¹	23				
Enabling Decision Support and Analytics ¹	24				
Disaster Recovery and Contingency Planning	25				
Hardware	26	11	28		
Intranet	27			9	10
Business Intelligence Tools ²	28			14	13
System Controls ¹	29				
Extranet	30				
Social Media ³	31			16	16
Project Management	32				
AIS Auditing/Generalized Audit Software	33	5		10	7
Local Area Network	34	2		6	11
Emerging Technologies ¹	35	13			
Software Purchases	36				
Data Flow Diagrams ¹	37	19			
Information Life Cycle ¹	38				
Document Flowcharts ¹	39				
Systems Implementation and Testing	40				
HTML ³	41	14	29		
System Flowcharts ¹	42				
Managing Vendors & Service Providers ³	43				
Data Mining ²	44				
System Design and Maintenance	45				
	46	15 & 22	23 & 26		

Notes:

This study* with no division for firm size since previous studies did not rank based on firm size

Industry/government (IG)**

¹Badua, Sharifi, & Watkins (2011)- textbook topics

²Coyne, Coyne, & Walker (2016)- current and proposed course topics

³added by authors to provide an up-to-date list

Appendix B – Rankings of IT Skills (continued)

	This Study*	Dillon & Kruck (2008)	Chen et al. (2009)	Welch et al. (2010)	Welch et al. (2010)
IT Skills		Rank Order (RO)	RO	RO (CPA)	RO (IG)**
ERP	47	6	18		
Database Management Systems (SQL/NoSQL/Access)	48	18			
Databases (relational, etc.)	49	7	8	8	4
Value Added Networks ³	50				
XBRL ¹	51				
Block Chain Accounting ³	52				
Governing/managing IT Investment/Spending ³	53				
Open Source Software ³	54				
E-R Diagrams ¹	55				
Data Warehouses	56	16			
Database Implementation ¹	57				
REA Diagrams ²	58				
CASE Tools	59	24			
Program Design	60	21			
Database Design ¹	61				
Programming Languages	62	25	20	18	19
Database Normalization		17			
Data Structures		20			
Process Modeling		23			
Data Modeling		12			
IT Gathering Techniques		10			
Business Graphics Software			2	15	17
Presentation Software			4		
Audit Software			5		
Tax Preparation Software			6		
Small Business Systems			7		
Computerized Accounting packages			9		
IT Assurance			10		
Communication Software			11		
Operating/Managing Own System			12		
Decision Support Software			15		
Statistical Analysis and Forecasting Packages			16		
Utility Programs			17		
Web Design Software			19	18	20
IS Objectives Evaluation			21		
System Evaluation			22	13	14
IT Administrative Issues			24		
IT Operations			25	13	10
End-User Management			27		
Windows Software				3	3
Presentation Software				5	4
Technology Terminology				7	6
Data Analysis				11	9
Telecommunication Software				12	13
Technology Management				14	12
Client/Server Management				15	17
Collaboration Software				12	15

Notes:

This study* with no division for firm size since previous studies did not rank based on firm size

Industry/government (IG)**

¹Badua, Sharifi, & Watkins (2011)- textbook topics

²Coyne, Coyne, & Walker (2016)- current and proposed course topics

³added by authors to provide an up-to-date list

¹ The studies presented in this literature review are the ones that were available when the IT skills for the questionnaire were determined.

² The three ranking studies presented in Appendix B represent the most current studies that ranked at least 24 distinct IT skills at the time this study's questionnaire was developed.

³ Skills are from previous ranking studies and textbook topics, and some are new due to changes in technology or not being included in previous ranking studies.

⁴ Members have the opportunity to participate voluntarily in posts on the Open Forum.

⁵ They provided the most responses to the 62 IT skills questions.

⁶ Although the questionnaire included a Don't Know option (a valid response), those responses are not included in the statistical analysis or the effective response rate.

⁷ This is likely due to lack of familiarity with these IT skills.

⁸ Only 14 of the respondents answered all 62 IT skills questions; nonresponses are likely due to lack of familiarity with the skill.

⁹ While some might suggest age is a factor with respect to IT skills, that may not be the case if the individual has kept up with changes in technology through additional training. Since the questionnaire did not collect data regarding additional technology training, this issue cannot be addressed.

¹⁰ Additionally, firm size affects some IT skills' importance, as this study indicates. Since previous studies did not address firm size, the rank order for this study's results in Appendix B are without division for firm size to provide comparability with the previous studies.