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Topics for the Accounting Information Systems Course: A Dual Perspective Approach from Educators and Employers

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Topics for the Accounting Information Systems Course: A Dual Perspective Approach from Educators and Employers



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ABSTRACT

Researchers have studied which topics to address in the Accounting Information Systems (AIS) curriculum since the 1980s. Although previous studies have identified several core topics, they have noted that the rapid pace of technology calls for continued research. This study extends prior research by surveying and comparing the views of employers and AIS educators. Even though educators consistently rated the AIS topics higher in our survey than employers did, we find a general agreement between the two groups as to the relative importance of the topics. Educators and employers concur on core AIS topics, including spreadsheet skills, internal controls, and transaction processing/cycles and general ledger reporting. This is consistent with past research. On the other hand, the following areas have gained prominence among educators and employers: Sarbanes Oxley, encryption, SQL, ERP systems, Internet communication systems, and e-commerce. The findings of this study will assist AIS faculty in determining which content will be the most relevant to accounting majors.

Keywords

Accounting Information Systems (AIS), Accounting Information Systems Education, Curriculum, Educators, Academics, Employers, Practitioners, Technology Coursework, Topical Coverage

INTRODUCTION

Except for the Accounting Information Systems (AIS) course, the required courses for an undergraduate accounting major are typically predictable and consistent in most college curriculums. In contrast, the AIS course varies in both the topics and the emphasis on topics. Badua, Sharifi, and Watkins (2011) found a historical lack of consensus in oversight bodies seeking to influence the AIS curriculum (AAA Mock Committee Report, 1987; AICPA Core Competencies, 1999; AICPA Top Technologies, 2010). They state this "indicates that a considerable state of flux exists concerning suggested topical coverage in AIS courses over the years" (Badua, Sharifi, & Watkins, 2011, 91).

This flux is due at least in part to rapid changes that occur in technology and its use by professionals. Albrecht and Sack (2000) noted that advances in technology have reduced the cost of gathering data and reporting information. In the past decade, "big data" has become a popular term as business decisions have become more data-driven. AACSB Accounting Standard A5, issued in 2018, states, in part, that accounting students should have experience in "development of skills and knowledge related to data creation, data sharing, data analytics, data mining, data reporting, and storage . . ." (AACSB International, 2018b, p. 27).

The proliferation of topics makes it difficult to determine which items should be emphasized in the first – and in many cases the only – undergraduate AIS course. The current thought processes of educators¹ and employers² are valuable for determining the future content of required AIS courses. We deemed this review necessary to assess the relevance of the AIS curriculum at our institution. Our objective was to explore which AIS topics are the most important to graduates so we could tailor our AIS courses to emphasize the topics most relevant to our students. The challenge of knowing which topics to address in the AIS course has grown as the number of topics in the subject has increased. Badua, Sharifi, and Watkins (2011) conducted a review of syllabi for AIS courses between 1997 and 2007. They found that while the average number of topics in a course remained constant, the diversity of topics increased.

Our paper contributes to the existing research on AIS course topical coverage by comparing survey results from educators and employers. The findings of our study confirm previous research that identifies core topics that should be addressed in the AIS course. We also identify additional topics that are of moderate importance – topics AIS educators may want to consider addressing in their curriculum. The results of our study can inform curriculum reform decisions beyond our institution.

The next section provides a review of research on the AIS curriculum. Then we discuss the survey instrument and respondents, an analysis of the results, and finally a summary and conclusions.

LITERATURE REVIEW

In 2012, the Pathways Commission published *Charting a National Strategy for the Next Generation of Accountants*. In Action Item 4.1.6, they note:

"Technology is used to gather, transform, and analyze data into meaningful information for decision making. . . . Yet these changes (in technology) are usually not reflected in a robust timely fashion in academic accounting programs nor student's internship experiences. This curricular deficit creates a significant risk for accounting

program graduates, who, upon employment in a global environment, are expected to effectively and efficiently utilize and understand technologies and their capabilities, impacts, risks, and opportunities to add value to their organizations." (The Pathways Commission, 2012, p. 72)

In 2015, the Pathways Commission noted data collected from practitioner and academic focus groups "indicated (1) a strong consensus for some technologies (e.g., accounting students need to be highly competent with spreadsheets) and (2) significant discrepancies for other technologies" (The Pathways Commission, 2012, p. 10). Boulianne found that despite the importance of technology to accountants, "IT has lost ground, notably due to the larger coverage of Finance and Strategy/Governance" (2016, p. 314).

In many accounting programs, the AIS class is the technology course. Research regarding AIS topical coverage has been ongoing since the 1980s. Table 1 presents a summary of the topics most frequently mentioned as important in previous research.

In one of the earliest studies of AIS, Davis and Leitch (1988) found spreadsheets to be the highest-rated topic by recent accounting graduates. Spreadsheets continue to be rated the most important technology skill for accountants (Harper & Dunn, 2018; Tam, 2013). As indicated in Table 1, transaction cycles/processing, internal control, and databases are the other topics most often mentioned as important to accountants.

Some research has indicated there are disparities in the perceived importance of different technologies between academics and practitioners and between different types of practitioners. As mentioned above, the Pathways Commission (2015, p. 10) noted that data collected from practitioner and academic focus groups "indicated (1) a strong consensus for some technologies (e.g., accounting students need to be highly competent with spreadsheets) and (2) significant discrepancies for other technologies" (e.g., XBRL). In a study of 440 professional accountants, Welch, Madison, and Welch (2010) found CPA firms rated computer auditing highly while accountants in industry and government rated database software and IT operations higher. Winstead and Wenger (2015) surveyed practitioners (primarily CPAs) and academics about the desired proficiency of undergraduate accounting graduates in nine areas of AIS. In all areas of organization systems proficiencies, and in two of three areas of reporting and data sharing proficiencies, the academics favored higher levels of proficiency than practitioners. Newer topics (e.g., XBRL, data-sharing technologies, and basics of e-commerce) produced the most disagreement between the groups. Research also shows that the relative importance of different competencies for new graduates depends on several factors, including the size, industry, and nation of the employer (Winstead & Wenger, 2015; Hastings & Solomon, 2005). Various authors (Badua, Sharifi, & Watkins, 2011; Davis & Leitch, 1988) note that as new technologies emerge, AIS educators face an increased diversity of topics. Our research builds on this previous work by identifying, comparing, and contrasting the AIS topics that educators and employers currently identify as important for accounting graduates.

	1	1					1		1	1	T	
	Davis & Leitch (1988)	Groomer & Murthy (1996)	Theuri & Gunn (1998)	Richtermeyer & Kovar (2001)	Bain, Blankley, & Smith (2002)	Fordham (2005)	Badua (2008)	Dillon & Kruck (2008)	Welch, Madison, & Welch (2010)	Tam (2013)	Kearns (2014)	Harper & Dunn (2018)
Internal Control	Х	Х	Х	Х	X	Х	Х					
Transaction Cycles/Processing	Х	Х	X X		X	X	X	X				
Spreadsheets	Х				Х	Х		Х	Х	Х	Х	Х
Databases			Х	Х	Х	Х	Х		Х	Х		Х
Systems Documentation					Х	X	X					
Internet and E-commerce					X		X	X		X		
Information Security				X					X			X
Ethics					X		X			X	X	
Topics noted were included in the top five to ten for each paper. Because of differences in terminology, some topics do not match exactly.												

 Table 1: Topics Considered Important in Previous Studies

Topics noted were included in the top five to ten for each paper. Because of differences in terminology, some topics do not match exactly. Similar topics were included under more general headings (e.g., Systems Documentation includes flowcharts, DFDs, BPDs, etc.). Also, studies varied by methodology, topics, and whether a distinction was made between topical knowledge and technologies.

METHOD

ľ	Table 2: Populations Surveyed							
Panel A – Breakdown of Educators by Type of Institution								
	Type of Institution							
	4-year undergraduate							

Sample

	Educators	
4-year undergraduate	8	
Upper level students (juniors, seniors, masters)	3	
4-year undergraduate and accounting master's or MBA	34	
Institution offering Ph.D.'s	8	
Miscellaneous	1	
Total	54	

Number of

The educator survey was submitted to 124 attendees of the 2015 AIS Conference (response rate = 43%)

Number of Employees											
Industry	Less than 50	51 to 100	101 to 500	501 to 1,000	1,000 to 5,000	Over 5,000	Totals				
Financial and legal	2	0	4	0	10	1	17				
Local/Regional CPA firm	2	6	1	7	0	0	16				
National CPA firm	0	0	0	0	0	2	2				
Non-governmental Not for profit	2	0	0	0	2	0	4				
Governmental Entity	1	0	0	1	0	0	2				
Computers and technology	0	1	0	0	0	0	1				
Manufacturing	0	0	0	1	0	0	1				
Miscellaneous	2	0	2	1	0	1	6				
Totals	9	7	7	10	12	4	49				

our institution during the 2015-2016 and 2016-2017 academic years (response rate = 85%).

We surveyed two types of respondents: AIS educators and employers of accounting graduates. Educator respondents are from attendees of the AIS Educators Conference. The AIS Educators Conference is attended primarily by individuals currently teaching AIS. They are

generally involved in research in the field, which indicates they have current knowledge of upand-coming topics. Badua et al. (2011) and Richtermeyer and Kovar (2001) have also used this population when investigating AIS. Employer respondents are from firms who recruit accounting students at our institution. Although specific to our institution, Table 2 shows they represent a diverse group with regard to industry. The sample includes 18 public accounting firms, two large national/international firms, and 16 local/regional firms. It also includes several asset management firms, banks, federal and state departments (e.g., taxation and finance, health and human services, etc.), national/local manufacturing firms, and service companies. Slightly over thirty percent of the firms have more than 1,000 employees, twenty percent have between 500 and 1,000 employees, and the remainder is evenly divided between those with 100 to 500 employees, 50 to 100 employees, and less than 50 employees.

Research Instruments

We developed two versions of the survey. The first part of the employer survey consisted of questions related to employer characteristics. The corresponding part of the educator survey consisted of questions related to the institution where the participant taught and whether the participant had taught an AIS course in the last three years.

The second part was identical for both groups. It consisted of listing potential AIS topics and asking participants to rate the topics for what proficiency an undergraduate accounting major should have at graduation (see Table 3 in the Analysis section). The list is a compilation from previous research on AIS. The number of items was limited so that survey participants could complete the survey in approximately ten minutes since some research indicates shorter surveys have higher response rates (Burchell & Marsh, 1992; Clarkberg & Einarson, 2008). Respondents were to rate each topic on a Likert scale or answer as no opinion. The scale is the same as one used by Tam (2013): 1. No Opinion, 2. Not Relevant, 3. Awareness Only, 4. Some Understanding, 5. Good Understanding, 6. Full Understanding, and 7. Ability to Apply/Use.

Administration of Survey

We e-mailed a link to the survey to 124 attendees of the 2015 AIS Educator Conference in July 2015. We sent out email reminders at one-week intervals for four weeks. We received fifty-four usable responses for a response rate of 43%. The vast majority (85%) of the respondents had one undergraduate AIS course in their curriculum, followed by 11% with two courses, and the remaining 4% with more than two AIS courses. Over 90% of the respondents have taught AIS in the past five years. Moreover, the profile of the respondents closely resembled the general attendee profile of the AIS Educator Conference. Panel A of Table 2 shows the type of institutions where participants currently teach.

We also e-mailed a link to the survey to 57 employers who recruited accounting students from our institution during the two academic years (2015-2016 and 2016-2017) following the AIS Educator Conference. We sent email reminders at one-week intervals for two weeks and then made follow-up phone calls asking employers to participate. We received 49 usable responses for a response rate of 85%. Panel B of Table 2 shows the breakdown of employers by industry. Two industries (CPA firm and financial and legal) account for 67% of responses.

RESULTS

Analysis

The summary statistics in Table 3 are based on the responses on the Likert scale defined above. The table provides a breakdown of the employer and educator responses, as well as a breakdown of employers by public accounting, financial/legal firms, and other.

The "no opinion" category was included as a choice in the survey so that respondents who were unfamiliar with a topic would not merely guess at its relevance. The number of responses (n) varies by question since we omitted the "no opinion" responses from the analysis. We include a brief analysis of the no opinion category at the end of the results.

Evaluation of Topics

The data from the employer and educator columns in Table 3 was used to construct a contingency table (Table 4) that summarizes the relationship between the educator and employer responses. We divided the items, based on their median, into three categories: *greater importance* (7. full understanding or 6. ability to apply/use), *moderate importance* (5. good or 4. some understanding), and *less importance* (3. awareness only or 2. not relevant).

Slightly over half the topics fell in the same category for both the employers and educator respondents. Many of these topics are in the *moderate importance* category for both groups. Employers classified slightly more than 25 percent of the topics as being *less important* while educators rated them as having *moderate importance*. Almost half of those topics are related to databases and database design (ER diagrams or UML class models, REA ontology, QBE, SQL, and relational database implementation). The only database-related topic that employers rated as having *moderate importance* was basic database concepts.

The only item that had medians in the category *greater importance* for both the educator and the employer respondents was basic spreadsheet skills. Advanced spreadsheet skills were also considered important by both groups (falling in the *moderate importance* category). While not necessarily taught routinely in AIS classes, as mentioned in the literature review, research has consistently shown spreadsheet knowledge is considered important for success to an entrylevel accountant.

Educators categorized three other items as having *greater importance*: transaction cycles, internal controls, and COSO. Employers classified those items as *moderate importance*. Internal controls and COSO relate to the topic of internal controls, which research has consistently mentioned as an important topic in the AIS curriculum (see Literature Review). Both groups categorized the related topics of IT controls and IT audit as having *moderate importance*.

Table 3: Summary Statistics and Rankings of AIS Topics by Educators and Employers (Sorted by Employer Mean Response)

							Breakdown by Employer Type													
	Educator (total n=54)			Employer (total n=49)			0	CPA firm (total n=18)			Financial and Legal (total n=17)				Other Employer (total n=14)					
	n	Mediar	n Mean	StdDev	n l	Media	n Mean	StdDev	n M	/ledian	Mean	StdDev	n	Median	Mean	StdDev	n ľ	Median	Mean	StdDev
Spreadsheets, basic functions	54	7	6.7	0.7	47	6	6.0	1.0	18	6.5	6.2	0.9	16	6	5.8	1.2	13	6	6.0	1.1
Spreadsheet, Advanced	54	5	5.6	1.3	46	5	4.9	1.3	17	5	5.1	1.1	16	5	4.5	1.6	13	5	5.2	1.2
General Ledger Reporting	53	5	5.7	1.1	45	5	4.8	1.5	17	5	4.9	1.1	15	5	4.4	1.7	13	5	5.2	1.5
Internal Controls	54	7	6.3	0.9	42	5	4.6	1.3	17	5	4.8	1.1	13	4	3.8	1.2	12	5	5.2	1.5
Traditional Transaction cycles and processing	54	6	6.0	0.9	43	5	4.4	1.5	17	4	4.2	1.4	14	4.5	4.0	1.7	12	5	5.1	1.3
Computer Fraud and Abuse	53	5	5.2	0.9	43	4	4.4	1.3	17	4	3.9	0.9	14	5	4.8	1.3	12	5	4.7	1.5
Flowcharts	54	5	5.4	1.3	44	4	4.3	1.4	17	4	3.9	1.1	15	5	4.5	1.5	12	4.5	4.7	1.5
Systems Documentation in general	52	5	5.1	1.3	43	4	4.3	1.4	17	4	4.0	1.1	15	4	4.3	1.3	11	5	4.7	1.7
Business Process Diagrams	54	5	4.8	1.3	44	4	4.3	1.4	16	4	3.8	1.0	16	5	4.5	1.5	12	4.5	4.7	1.5
Basic Database concepts	54	5	5.3	1.3	45	4	4.2	1.4	17	3	3.4	1.1	16	5	4.6	1.4	12	5	4.8	1.4
Data Flow Diagrams	54	4.5	4.5	1.5	43	4	4.2	1.4	16	4	3.7	1.0	15	5	4.4	1.5	12	4	4.6	1.5
Business process analysis and modeling	54	5	5.3	1.2	43	4	4.2	1.3	15	3	3.5	1.0	15	5	4.3	1.2	13	5	4.8	1.6
IT controls	53	5	5.3	1.0	44	4	4.2	1.3	17	4	4.2	1.0	14	4	4.1	1.4	13	4	4.2	1.5
Systems Security	51	5	5.0	1.0	44	4	4.1	1.2	17	4	3.7	0.8	15	5	4.5	1.2	12	4.5	4.3	1.5
IT audit	49	5	4.7	1.1	43	4	4.0	1.2	17	4	4.1	0.7	13	4	3.8	1.3	13	4	4.1	1.5
Sarbanes Oxley	54	5	5.2	0.9	43	4	3.9	1.3	16	3.5	3.7	1.1	15	4	3.9	1.2	12	5	4.3	1.6
Internet (TCP-IP, client-server systems)	51	3	3.5	1.2	43	4	3.9	1.5	15	4	3.6	1.2	15	3	3.8	1.7	13	4	4.4	1.6
Privacy Regulation and controls	51	4	4.4	1.1	44	4	3.9	1.3	16	3.5	3.3	0.8	15	4	4.2	1.4	13	4	4.2	1.5
Commercial Accounting/ERP software	51	5	5.0	1.4	40	4	3.8	1.3	17	4	3.7	1.0	11	4	3.5	1.4	12	4	4.3	1.4
Operating systems	52	4	4.3	1.0	44	4	3.8	1.4	17	4	3.5	0.9	15	4	3.8	1.5	12	4	4.3	1.7
Encryption	51	4	3.9	1.0	43	4	3.7	1.3	17	4	3.3	0.8	14	4	4.0	1.5	12	4	4.1	1.6
COSO	54	6	5.6	1.2	35	4	3.7	1.4	15	4	4.1	1.2	8	2	2.5	0.8	12	5	4.1	1.6
Digital Signatures	51	4	3.8	0.9	43	4	3.7	1.4	17	3	3.3	0.8	14	4	3.9	1.7	12	4	4.0	1.7
Systems Development Life Cycle	51	4	4.3	1.3	36	4	3.6	1.0	12	3	3.3	0.9	13	4	3.5	1.0	11	4	4.1	1.2
ERP systems	52	5	5.0	1.1	32	3	3.6	1.5	13	3	3.3	1.3	8	2	2.5	0.8	11	5	4.6	1.6
E-commerce	51	4	4.0	1.0	39	4	3.5	1.1	15	3	3.3	1.0	12	3	3.1	1.0	12	4.5	4.3	1.1
Value Chain	52	5	4.6	1.2	30	3.5	3.5	1.3	8	2.5	2.9	1.1	10	3.5	3.4	1.2	12	4	4.0	1.5
COBIT	50	4	4.4	1.0	29	3	3.4	1.4	9	4	3.4	1.2	8	2	2.5	0.8	12	4.5	3.9	1.6
Basic computer programming	50	3	3.3	1.2	44	3	3.4	1.4	16	2.5	2.9	1.0	15	3	3.3	1.2	13	4	4.0	1.7
Relational Database implementation	52	5	4.8	1.3	39	3	3.3	1.4	14	2	2.7	1.0	13	4	3.7	1.5	12	3	3.6	1.6
Query By Example (QBE)	49	4	4.4	1.6	39	3	3.3	1.4	14	2	2.5	0.9	13	4	3.6	1.4	12	4.5	3.8	1.5
Structured Query Language (SQL)	53	4	4.0	1.3	38	3	3.3	1.4	14	2	2.5	0.9	12	3.5	3.5	1.5	12	4.5	3.9	1.4
EDI	50	4	3.8	1.0	33	3	3.2	1.2	12	2.5	2.8	0.9	9	2	2.8	1.1	12	4	3.8	1.4
eXtensible Business Reporting Language (XBRL)	50	4	3.9	1.3	32	3	3.0	1.1	12	2	2.4	0.7	9	3	3.0	1.1	11	4	3.6	1.2
eXtensible Markup Language (XML)	49	3	3.4	1.1	34	2.5	3.0	1.3	12	2	2.4	0.7	10	3	3.1	1.2	12	3.5	3.5	1.6
REA ontology	52	4	3.9	1.4	22	2	3.0	1.3	4	2	2.0	0.0	7	3	2.9	0.9	11	3	3.4	1.5
E-R Diagrams or UML class models	52	4	4.3	1.3	34	2	2.7	1.1	14	2	2.4	0.8	8	2	2.6	0.9	12	2.5	3.2	1.5

1. No Opinion 2. Not Relevant 3. Awareness Only 4. Some Understanding 5. Good Understanding 6. Full Understanding 7. Ability to Apply/Use

The summary statistics displayed above exclude the "No Opinion" responses.

The responses are sorted from the largest to the smallest mean by the Employer group.

AIS Educator Journal – Volume 14 (2019)

Page 42

AIS Topics: Educators and Employers

		Lesser Importance	Moderate Importance	Greater Importance	
Employers (n=49)	Lesser Importance	 Basic computer programming XML 	 COBIT EDI E-R diagrams or UML class models ERP systems Query By Example (QBE) REA ontology Relational database implementation Structured Query Language (SQL) Value chain XBRL 		
	Moderate Importance	• Internet (TCP-IP, client-server systems)	 Advanced spreadsheets Basic database concepts Business process analysis and modeling Business process diagrams Computer fraud and abuse Data flow diagrams Digital Signatures E-commerce Encryption Experience with commercial accounting/ERP software Flowcharts General Ledger Reporting IT audit IT controls Operating systems Privacy regulation and controls Sarbanes Oxley Systems development life cycle Systems documentation in general Systems security 	 COSO Internal controls Transaction cycles 	
	Greater Importance			• Basic spreadsheets	
		Lesser Importance = 2. Not Moderate Importance= 4. So Greater Importance = 6. Ful The medians of responses us "No Opinion" responses are	Relevant and 3. Awareness Only ome Understanding and 5. Good Understanding l Understanding and 7. Ability to Apply/Use sed in the construction of this table are in Table 3. excluded.	<u>.</u>	

 Table 4: Contingency Table of Educator and Employer Responses Categorized by Median of Responses

 Educators (n=54)

Another block of topics categorized as having *moderate importance* by both groups is related to e-commerce (these topics include digital signatures, encryption, and privacy regulation and controls). Employers rated the topic of e-commerce itself as being of *lesser importance*. Employers also had XBRL as of *lesser importance*. Educators rated XBRL as having *moderate importance*. Richtermeyer and Kovar (2001) reported that a majority of AIS faculty either covered or intended to cover these topics.

The results presented in Table 4 use the combined responses from all employer types as defined in Panel B of Table 2. To identify potential industry-specific differences, we repeated the analysis of Table 4 by each one of the following employer categories:

- CPA firms. This category consists of both local/regional and national CPA firms (total n=18).
- Financial and legal firms (total n=16).
- Other firms (total n=17). We constructed this category by combining the responses of the other types of employers displayed in Panel B of Table 2.

Table 5 displays the response categories for which the importance category of the designated employer category differed from those of the combined employer group.

Both the CPA and the other firms categories scored COBIT higher (as of *moderate importance*) than the combined group, while financial and legal firms and other firms scored query by example higher (as of *moderate importance*) than the combined group. Also, the other firms category scored structured query language and basic computer programming higher (as of *moderate importance*) than the combined group while CPA firms scored basic database concepts lower (as of *low importance*) than the combined group.

CPA Firms	Financial and Legal Firms	Other Firms
 <u>Least to Moderate Importance</u> COBIT <u>Moderate to Least Importance</u> Basic database concepts Business process analysis and modeling Digital Signatures Privacy Regulation and controls Sarbanes Oxley System Development Life 	 <u>Least to Moderate Importance</u> Query by Example (QBE) <u>Moderate to Least Importance</u> Internet (TCP-IP, client-server systems) COSO 	 <u>Least to Moderate Importance</u> Basic computer programming COBIT EDI ERP systems Query By Example (QBE) Structured Query Language (SQL) Value chain XBRL
This table shows the response c	ategories for which the median r	ating of the designated employer

Table 5: Changes in Responses in Comparison with Combined Employer Responses

This table shows the response categories for which the median rating of the designated employer subgroup differed from that of the combined employer group displayed in Table 4. The Other Firms category includes non-profits, computers and technology, manufacturing, and miscellaneous.

To permit an item-by-item comparison of the educator and employer groups, we constructed the scatter plot displayed in Figure 1 Panel A. In this figure, each plotted point corresponds to the mean response for an AIS topic. The diagonal reference line (i.e., identity line) represents perfect matching in the mean responses between the groups. In the figure, nearly all of the points are above the diagonal reference line, suggesting that educators consistently rated the topics higher than employers did. In their study, Bain, Blankley, and Smith (2002) reported a similar pattern. The plotted points reveal a positive correlation, which suggests that there is general agreement between the two groups as to the relative importance of the topics. (The Spearman's rank correlation of means is 0.78 with p-value <0.001. In the Bain, Blankley, and Smith (2002) study, the reported correlation value was 0.51.)



Table 6 displays a summary of the educator and employer responses by each topic. We used the Mann-Whitney U test to statistically compare the distribution of responses of the educator and the employer groups to each one of the 37 topics. This is a nonparametric

counterpart of the well-known t-test used to compare population means. The Mann-Whitney U test is appropriate for the current application given the ordinal (Likert scale) nature of the responses. The test identified statistically significant differences (at the 0.05 significance level) between the two groups for 30 (out of 37) topics. Comparison of sample means using the two-sample t-test led to nearly identical results. The seven topics for which there is no statistically significant difference (i.e., the p-value of the test is greater than 0.05) in the responses of educator and employer groups are shaded in Table 6.

We compared the rank of each topic for the educator and employer groups in Table 6. There are two differences we believe are worth mentioning. Internal control was one of the highest-ranked topics for both groups (2 for educators and 4 for employers). However, the rank for COSO shows a marked disparity between the groups (6 for educators and 22 for employers). The COSO internal control framework is accepted as the authority on internal controls, so it was not readily clear to us why the employer rank for COSO was significantly lower than their rank for internal control as a topic. We were able to gain a better understanding of this apparent discrepancy as described below.

We carried out a comparison between the financial and legal firms and CPA firms, even though the reliability of such an analysis is limited by the modest sample sizes. Figure 1 Panel B displays the scatter plot of mean responses to survey topics by these two employment sectors. All in all, there is a high degree of agreement between the groups with a Spearman's rank correlation value of 0.62. It is worthwhile to mention that in a topic-by-topic comparison, the only one that showed a significant difference between the two groups was COSO (p-value < 0.01). The rank for COSO was 7 for CPA firms while it was ranked 37 (last) for financial and legal companies. This suggests that there is a close agreement between educators and respondents from CPA firms about the importance of this topic in an AIS course.

The second significant difference noted in Table 6 relates to system documentation. For employers, systems documentation in general, business process diagrams, flowcharts, and data flow diagrams had similar ranks (7, 8, 9, and 11, respectively). Educators had the same rank as employers for flowcharts, but the ranks for systems documentation in general, business process diagrams, and data flow diagrams were lower (13, 17, and 22, respectively). This is a shift from Bain et al. (2002), where the rank for systems documentation was higher for faculty than professionals (3 vs. 22). It seems that employers are placing more emphasis on documentation than they had before Sarbanes Oxley.

No Opinion Responses

As mentioned above, we included the "no opinion" category in the survey so that respondents who were unfamiliar with a topic would not guess at its relevance. Moreover, the rate of "no opinion" responses is a useful gage to assess the familiarity of different groups with AIS topics. Table 6 displays the percentage of "no opinion" responses by question. We noted a relatively higher occurrence of "no opinion" responses for the employer group. For educators, the "no opinion" response rate for all questions was less than 10%.

In contrast, for the employer group, 10 (out of 37) questions had more than 25% "no opinion" response rate. The questions with high "no opinion" responses were also those that generally ranked lower by the employers. As would be expected, there was a tendency to say "no opinion" among people who do not supervise entry-level accountants (median "no opinion" response rate of 21%) vs. those that do (median "no opinion" response rate of 8%).

		Educator (n=54)				Employer (n=49)					
	n	% No Opinion	Mean	Rank	n	% No Opinion	Mean	Rank	p-value		
Spreadsheets, Basic Functions	54	0	6.7	1	47	4.1	6	1	0.0001		
Spreadsheet, Advanced	54	0	5.6	5	46	6.1	4.9	2	0.019		
General Ledger Reporting	53	1.9	5.7	4	45	8.2	4.8	3	0.0069		
Internal Controls	54	0	6.3	2	42	14.3	4.6	4	<.0001		
Traditional Transaction Cycles	54	0	6	3	43	12.2	4.4	5	<.0001		
Computer Fraud and Abuse	53	1.9	5.2	11	43	12.2	4.4	6	0.0016		
Flowcharts	54	0	5.4	7	44	10.2	4.3	7	<.0001		
Systems Documentation in General	52	3.7	5.1	13	43	12.2	4.3	8	0.0024		
Business Process Diagrams	54	0	4.8	17	44	10.2	4.3	9	0.0502		
Basic Database Concepts	54	0	5.3	9	45	8.2	4.2	10	0.0002		
Data Flow Diagrams	54	0	4.5	21	43	12.2	4.2	11	0.3381		
Business Process Analysis and Modeling	54	0	5.3	10	43	12.2	4.2	12	<.0001		
IT Controls	53	1.9	5.3	8	44	10.2	4.2	13	<.0001		
Systems Security	51	5.6	5	16	44	10.2	4.1	14	0.0004		
IT Audit	49	9.3	4.7	19	43	12.2	4	15	0.0038		
Sarbanes Oxley	54	0	5.2	12	43	12.2	3.9	16	<.0001		
Internet (TCP-IP, client-server systems)	51	5.6	3.5	35	43	12.2	3.9	17	0.2264		
Privacy Regulation and Controls	51	5.6	4.4	23	44	10.2	3.9	18	0.0191		
Commercial Accounting/ERP Software	51	5.6	5	14	40	18.4	3.8	19	0.0005		
Operating Systems	52	3.7	4.3	25	44	10.2	3.8	20	0.0173		
Encryption	51	5.6	3.9	31	43	12.2	3.7	21	0.2603		
COSO	54	0	5.6	6	35	28.6	3.7	22	<.0001		
Digital Signatures	51	5.6	3.8	34	43	12.2	3.7	23	0.3931		
Systems Development Life Cycle	51	5.6	4.3	27	36	26.5	3.6	24	0.0163		
ERP Systems	52	3.7	5	15	32	34.7	3.6	25	<.0001		
E-commerce	51	5.6	4	29	39	20.4	3.5	26	0.0766		
Value Chain	52	3.7	4.6	20	30	38.8	3.5	27	0.0003		
COBIT	50	7.4	4.4	22	29	40.8	3.4	28	0.002		
Basic Computer Programming	50	7.4	3.3	37	44	10.2	3.4	29	0.9185		
Relational Database Implementation	52	3.7	4.8	18	39	20.4	3.3	30	<.0001		
Query By Example (QBE)	49	9.3	4.4	24	39	20.4	3.3	31	0.0013		
Structured Query Language (SQL)	53	1.9	4	28	38	22.4	3.3	32	0.0091		
EDI	50	7.4	3.8	33	33	32.7	3.2	33	0.0074		
eXtensible Business Reporting Language	50	7.4	3.9	32	32	34.7	3	34	0.0026		
eXtensible Markup Language (XML)	49	9.3	3.4	36	34	30.6	3	35	0.0347		
REA Ontology	52	3.7	3.9	30	22	55.1	3	36	0.0049		
E-R Diagrams or UML Class Models	52	3.7	4.3	26	34	30.6	2.7	37	<.0001		

Table 6: Educator and Employer Mean Responses and Ranking by AIS Topic

• The sample means displayed above exclude the "No Opinion" responses.

• The responses are sorted from the largest to the smallest ranking of topic means by the Employer group.

• Shaded rows indicate no statistically significant difference between the distribution of the responses of the educators and employers.

AIS Educator Journal – Volume 14 (2019)

Page 48

AIS Topics: Educators and Employers

DISCUSSION AND CONCLUSIONS

Discussion

We found that employers and educators rated almost two-thirds of the AIS topics in the same category (Table 4). The educators and employers rated internal control, transaction processing systems and cycles, systems documentation, computer fraud, and database management as moderately important or most important. Employers had more topics rated as *lesser importance*, while educators rated most of those topics as having *moderate importance*.

A direct one-on-one comparison of our research to prior studies presents nontrivial challenges due to the differences in topics explored, importance ratings employed, and subject populations of the studies involved. However, our findings on core topics closely agree with the conclusions of other authors. These core topics include spreadsheet skills, internal controls, transaction processing/cycles, and general ledger reporting. The significance of these topics has remained relatively constant over time. Covering these topics in the basic AIS course would leave time for a few additional topics of particular interest to an instructor or that are requested by advisory committees or local employers. Having a standard core of AIS topics across schools would prevent confusion as to what new graduates learn in the basic undergraduate AIS course.

Educators and employers in our study rated topics that were predicted by Bain et al. (2002) to exhibit rising prominence as having *moderate importance*. These include SQL, ERP systems, Internet communication systems, and e-commerce. Certain other areas, such as Sarbanes Oxley and encryption that have gained prominence over the last few years and were rated as having *moderate importance* in our study, were not considered in most previous studies.

Employers rated several topics related to databases in the *lesser importance* category. This is surprising given anecdotal evidence from graduates of our accounting program and previous research (Fordham, 2005, p. 117) that found both "advanced understanding of relational database design" and "working knowledge of database query design. . ." were important AIS skills. Looking at the subdivision by employer type (Table 4), both financial/legal and other firms scored QBE higher than the combined group, as having *moderate importance* and other firms also scored SQL and basic computer programing as having *moderate importance*. In contrast, CPA firms rated basic database concepts as having *lesser importance* than the combined group rated them. This agrees with prior research that found database skills were more important in industry and government (Welch, Madison, & Welch, 2010). It may be that CPA firms have the client supply most of the data for analysis, while in other firms, accountants are responsible for retrieving the data.

The single topic rated as having *greater importance* by both groups was basic spreadsheets. Advanced spreadsheets had the second highest mean in both groups (Table 3). Some business schools, including ours, teach/require basic spreadsheet proficiency as a component of the general business curriculum. Badua's (2008) analysis of AIS course syllabi did not find spreadsheets as one of the top ten topics covered.

There was less agreement between the educator and employer groups on the topics considered to be of *lesser importance*. The sentiment of irrelevance expressed by employers was far stronger than that expressed by educators. Some of the less important topics identified were XML, basic programming, and the Internet (TCP-IP, client-server systems).

Employers also had XBRL in the *lesser importance* category. Educators rated XBRL as having *moderate importance*. The employer rating was surprising, given the fact the SEC requires companies to submit financial statements in XBRL. It seems that accounting students

should have a basic understanding of XBRL and how it is used. That understanding would be facilitated if students understood XML (rated as of *lesser importance* by both groups of respondents) before being introduced to XBRL. However, this response is similar to the findings of Winstead and Wenger (2015), where CPAs favored a lower level of proficiency than academics for "data-sharing and XBRL." Looking at the breakdown by employer category, other firms was the only category that changed XBRL from lesser *to moderate importance*.

Changes at Our Institution

Our department first implemented a required AIS course for undergraduate students entering the school in 2009. This change was a result of a recent program review and the implementation of the 150-hour requirement for CPAs in New York. Before that time, an elective AIS course was offered only once per academic year due to lack of student demand/interest. The new course was offered for the first time in the Spring 2011 semester. Since that time we have used a variety of different textbooks and approaches to teaching the course. Also, although our Accounting Program is not separately accredited, we were aware of Accounting Standard A7 issued in 2013 and reiterated in 2018 as Standard A5. The standard states, in part, that accounting students should have experience in "development of skills and knowledge related to data creation, data sharing, data analytics, data mining, data reporting, and storage . . ." (AACSB International, 2018b, 27). To ensure the required AIS course is current and to determine what content is most appropriate for the elective AIS course, our department decided to survey AIS educators, and firms that recruit our students. The results of those surveys, reported in this paper, have helped us to tailor our AIS courses to provide the highest level of relevance to our students.

We have made modest changes to the required AIS course. We have increased the coverage of internal controls and COSO and made the AIS course a prerequisite to the auditing course. The prerequisite has presented some problems due to the number of required accounting courses. We have continued with it at present but may have to change it to a co-requisite in the future.

Rather than flowcharts, we now use business process diagrams (BPDs) to illustrate system documentation. In our survey, flowcharts and BPDs had the same mean response from employers. However, the mean for BPDs had no significant difference with the mean of educators (see Table 6). This is noteworthy since, in general, employers rated topics lower than educators. Several students have commented that they have found this relevant when interviewing for jobs. Each semester students are required to complete a project requiring them to analyze data in a database to investigate a business problem and communicate their findings. In the most recent semester, students were required to complete a BPD of the system, to document their understanding, before completing the other parts of the project.

Both educators and employers have consistently ranked basic and advanced spreadsheet skills as important for accounting students. Our surveys reinforced these findings. As mentioned above and as implied by AACSB, we believe that the topic of basic spreadsheet skills belongs in a course required for all business majors. Therefore, we only introduce a limited number of spreadsheet functions (e.g., what-if analysis and data validation) that have specific applications in the text.

We have revamped the elective AIS course in our department based, in part, on the results of our research. The class is now taught in a computer classroom with students spending significant time in each class learning different types of software. We have added a several-week

module on advanced spreadsheet functions. Both employers and educators ranked advanced spreadsheets highly (second for employers and fifth for educators). Anecdotal evidence from students indicates they have found this knowledge immediately useful in their internships and employment. In our survey, employers were asked: "Please list any specific Commercial Accounting software students should have experience with." Quickbooks was the most frequent software mentioned. In response, we have added a Quickbooks module. We also added modules on NetSuite (a cloud-based ERP system) and Tableau (for data visualization). Students have reacted favorably to the changes. Enrollment in the elective doubled in the second offering of the revamped course.

At the graduate level, our M.S. in Accounting program has added a concentration and a certificate in data analytics to address growing interest in this area. The four new courses that comprise this concentration area are: Business Intelligence and Information Systems, Quantitative Methods for Data-Driven Decision Making, Data Visualization and Predictive Analytics, and Decision Modeling and Analytics.

Implications and Suggestions

Based on survey results and the limited changes made at our institution, we have several suggestions. Both employers and educators rate Excel as having *greater importance*. As mentioned above, we have added an advanced spreadsheet component to our elective AIS course. Several students have commented they have found this useful in internships/jobs. In general, we believe the best way for students to acquire and build competency using spreadsheets is to incorporate an advanced spreadsheet assignment in every accounting course, negating the need to include it as a separate topic in AIS.

The AACSB advocates this approach in Accounting Standard A5. The standard states in part:

"Consistent with mission, accounting degree programs integrate current and emerging accounting and business practices in three primary components within the curricula. 1. Information systems and business processes including data creation, manipulation / management, security, and storage. 2. Data analytics including, for example, statistical techniques, clustering, data management, modeling, analysis, text analysis, predictive analytics, learning systems, or visualization. 3. Developing information technology agility among students and faculty, recognizing the need for continual learning of new skills needed by accounting professionals" (AACSB International, 2018b, 27).

The recent AACSB 2018 Business Standards update has added Technology Agility to Standard 9 – Curriculum Content (AACSB International, 2018a). This implies that technology should be integrated throughout the business curriculum, not just in accounting classes.

Badua et al. (2011) found that the number of topics covered in an AIS course has remained constant at about six. However, they note that the variety of different topics taught in AIS courses has increased over time. The results of the current research show that AIS educators and employers agree on a broad array of topics that is of *moderate importance* to accounting undergraduates. A single undergraduate AIS course does not have sufficient time to cover in any depth or even introduce all of the topics identified as being important. We agree with the suggestion of Badua et al. (2011) that a second AIS course may be warranted. This second

course would contain those "likely to change with technological innovation." We believe the second course could address topics rated as *moderate importance* not addressed in a basic AIS course and topics important to local employers.

We recognize this suggestion may be impractical at many institutions due to the number of required courses for accounting majors. Boulianne (2016) found a decrease in the number of required IT courses in accounting programs since the unification of the three Canadian professional accounting associations. With the advent of the 150-credit hour requirement for a CPA license, schools should critically assess whether there are courses that relate primarily to the CPA examination that could be moved to the graduate program allowing for additional flexibility in the undergraduate program. Another approach is to determine if there are IT topics/skills that are relevant for all business students to have. Examples of possible topics include privacy regulation and e-commerce. A required course could then be designed to address those topics as part of the curriculum for all business students. A business course focused on technology is in line with the recent update of AACSB Business Standards, which includes Technology Agility (AACSB International, 2018a).

Limitations of the Study

There are several limitations to the current study. Our first survey only included instructors attending the AIS Educator Conference. Similarly, we e-mailed employers' surveys to employers who recruit accounting students at our college. However, we believe that the industries that recruit our accounting students are similar to other schools located in a medium-sized metropolitan area (~1,000,000 population). The majority of respondents were from CPA, financial, and legal firms. The ordering of topics in the survey may have created a bias in responses. The topics were not randomized. Bryan and Smith (1997) found randomization did not eliminate bias. Another concern is sampling bias created due to nonresponse. For the employer group, the exceptionally high response rate (85%) to the survey alleviated our concerns in this regard. For the educator group, even though the response rate was lower (43%), the sample size (54) was satisfactory. Moreover, the profile of the respondents closely resembled the general attendee profile of the AIS Educator Conference.

As explained in Table 2, the sampling periods used for the educator and employer groups are slightly different. The sampling period for the employer group was extended by an additional year to achieve a more representative sample. We believe that that the added duration for the employer group is not sufficiently long to incorporate a marked change in the opinions of the educator and employer groups on AIS topics of interest.

It would be helpful to explore the perceptions of different types of employers in more detail. Our limited sample size prevented an in-depth analysis in this regard. We also did not collect detailed information on the survey participants. Collecting additional demographic information would be useful.

Summary and Future Directions

This study aimed to compare the perceptions of educators and employers regarding topics of importance in AIS education. To that end, we surveyed AIS educators and employers of recent accounting graduates. In line with past research, our findings reaffirmed the strong agreement between educators and employers on core AIS topics, including spreadsheet skills, internal controls, transaction processing/cycles, and general ledger reporting. On the other hand, Sarbanes Oxley, encryption, SQL, ERP systems, Internet communication systems, and ecommerce have gained prominence among educators and employers.

Our study highlights the need to investigate emerging questions on AIS curriculum. For 85% of the educators surveyed, their institution only offered one AIS course. The number of AIS topics continues to grow. It would be useful to study the need for a second AIS course from both the educator and employer points of view. Another topic for further research is the determination of the factors that underlie markedly different ratings of topic between the educator and employer groups (e.g., database concepts, XBRL). The depth and breadth of data analytics in the AIS curriculum warrants further study. Likewise, Blockchain technology and cryptocurrencies have recently gained prominence in business publications. They highlight the fact that it is important for research addressing topics in AIS to be performed periodically so that we can monitor trends and new topics.

This paper contributes to the literature by reporting on the perceptions of educators and employers of the topics that are important to accounting students. It provides data that will assist educators in evaluating what topics would be most relevant to their students. Curriculum research should be performed periodically because we, as accounting educators, must consider industry needs and the changes in technology as we update and improve our curriculums.

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¹ We use the term educator to represent teachers who are engaged in instruction of accounting students. Some of the research cited uses the term academics. The two terms refer to substantially equivalent populations.

² Our research surveyed employers of accounting graduates. Different research cited uses practitioners or employers. When citing the research, we used the same terms as the authors. Both terms refer to similar populations.