Integrating technology and data analytic skills into the accounting curriculum: Accounting department leaders' experiences and insights

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ABSTRACT

Recently, accounting professionals have highlighted the need for accounting students to have technology and data analytic skills to be successful in the accounting profession. To meet this demand, AACSB elected to mandate that all accounting departments with supplemental accreditation integrate a minimum level of technology and data analytic skills into their curricula through Standard A7 (now Standard A5). We report survey results of AACSB accredited accounting department leaders concerning their experiences in integrating technology into the curriculum, including their perspectives on implementation status and challenges, as well as their current program offerings. We find that Standard A7 was impactful in eliciting change, but that the method of integration, as well as the available courses, varies across programs. Our findings and discussion should be of interest to the leaders of accounting and business programs accredited by the AACSB or planning to gain accreditation, other accounting programs seeking to integrate technology, the AACSB and other accrediting bodies, as well as other stakeholders (e.g., AAA, AICPA).

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1. Introduction

Big data is widely viewed as the next frontier for innovation, competition, and productivity in business with 87 percent of Chief Financial Officers and financial professionals agreeing that Big Data will change business over the next ten years (McKinsey Global Institute, 2011; CGMA, 2013). Accounting is a profession in which data, information processing, analysis, and reporting are critical components and accountants have a significant role to play in Big Data and data analytics (Liu & Vasarhelyi, 2014; Alles, 2015). While accountants use of technology and data analytics is increasing, some maintain that their knowledge and understanding still lag behind the broader business community (e.g., Wang & Cuthbertson, 2015; Cohn, 2017). As such, enhancing the technology and data analytic skills of accounting majors is a key point of discussion for public accounting firms (e.g., PwC, 2015a; KPMG, 2017), the accounting profession at large (e.g., Fadairo, Williams, & Maggio, 2015; Tang, Norman, & Vendrzyk, 2017), the American Accounting Association (AAA), academics (Ballou, Heitger,

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& Stoel, 2018; Dzuranin, Jones, & Olvera, 2018), as well as accreditors such as the American Association to Advance Collegiate Schools of Business (AACSB, 2013).[1]

The impetus for accounting majors to learn technology and data analytics (Behn et al., 2012; AACSB, 2014; PwC, 2015a; Ballou et al., 2018), combined with continued calls for integration of these skills into accounting curricula (Lawson et al., 2014; Griffin & Wright, 2015; Sledgianowski, Gomaa, & Tan, 2017), require that we understand the experiences and challenges accounting departments face and the status of technology and data analytics integration. While there is some evidence of how individual accounting faculty are implementing data analytics into the classroom (Dzuranin et al., 2018), there is little insight as to how accounting departments as a whole are integrating technology and data analytics into the curriculum. Thus, the purpose of this paper is to survey AACSB accredited accounting department leaders (i.e., department chairs or heads) who can provide insights on their *department-wide* strategies for integrating technology, including their perspectives on implementation status, integration methods and challenges, and their current program offerings.[2]

Our study capitalizes on an AACSB standard change that mandates that accounting programs with AACSB supplemental accreditation implement technology and data analytic skills into their curricula.[3] Specifically, in recognition of the significant change in workforce skills and the continued calls by the profession that accounting faculty teach these skills to accounting majors, AACSB's 2013 accounting accreditation standards included Standard A7, *Information Technology Skills and Knowledge for Accounting Graduates* (AACSB, 2013). Standard A7 states:

> Consistent with mission, expected outcomes, and supporting strategies, accounting degree programs include learning experiences that develop skills and knowledge related to the integration of information technology in accounting and business. Included in these learning experiences is the development of skills and knowledge related to data creation, data sharing, data analytics, data mining, data reporting, and storage within and across organizations.[4]

Because this standard change made AACSB accredited accounting departments the first to be *required* to integrate technology into their curriculum, and since these departments are regularly peer-reviewed by AACSB and often viewed as leaders in both research and teaching (Trapnell, 2007; Brink & Smith, 2012), they are an important and valued population to gain insights from.

Our study addresses a gap in the literature by providing insights from accounting department leaders that are the first to be mandated to implement technology and data analytics skills into the accounting curriculum. Our results indicate that accounting departments are pursuing compliance with Standard A7 in a wide variety of ways, and we present detailed information regarding the various methods, the challenges faced, and the current status of program offerings with technology and data analytic components. Interestingly, it does not appear that integration methods, challenges, needed resources or program offerings are associated with specific university or department factors (e.g., public/private university, institutional focus, number of accounting students), suggesting insights and results of our study may broadly apply.

The primary contribution of our study is that the results can help guide not only those AACSB accredited programs that have been slower to implement changes, but also a broader set of programs and schools. For instance, the results of our study can provide helpful guidance to accounting departments seeking AACSB accreditation, as well as the 856 AACSB accredited business schools worldwide who are soon going to be required to comply with Standard 9: Curriculum Content (the updated complementary Business Accreditation) (AACSB, 2018a).[5] In addition, those accredited by other bodies (e.g., ACBSP, IACCBE) or other non-accredited universities may benefit from our findings as the need and requirement for curriculum change spreads. Finally, AACSB and other key stakeholders such as the AAA, AICPA, Institute of Internal Auditors, Institute of Management Accounts, Association of Government Accountants, and the business community at large may benefit from the findings of this study as they determine how to provide external guidance and resources that can help accounting departments strengthen technology and data analytics instruction in accounting curricula.

The paper proceeds by presenting prior literature and our research questions. We then describe the survey and present the results. The paper concludes with a discussion of results, recommendations for future research, and limitations of the study.

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[1] For parsimony, throughout the paper we often use "technology skills" when referring to "technology and data analytic skills".

[2] The titles of accounting department leaders vary across universities. In the interest of clarity, we refer to the leader of the department as the department chair or leader throughout the paper. Some accounting programs have department chairs that are responsible for multiple programs (i.e., accounting and information systems), we refer to them in accordance with the purpose of this study as accounting departments.

[3] As of the 2018 Accounting Standards, separate accreditation is now referred to as "supplemental accreditation" to acknowledge that the redundancy between business and accounting standards was removed, and to emphasize that accounting standards are incremental to business accreditation.

[4] This standard was updated in 2018 to Standard A5, *Information Technology Skills, Agility and Knowledge for Accounting Graduates and Faculty* (AACSB, 2018b, 27). Standard A5 retains the original objectives identified in Standard A7, but now includes faculty in the requirement. Standard A5 states: "Consistent with mission, expected outcomes, and supporting strategies, accounting degree programs include learning experiences that develop skills and knowledge related to the integration of information technology in accounting and business. This includes the ability of both faculty and students to adapt to emerging technologies as well as the mastery of current technology." The present study was conducted prior to the acceptance of the new standards. Therefore, we refer to Standard A7 throughout the paper.

[5] Standard 9 requires AACSB accredited business schools to include "current emerging business statistical techniques, data management, data analytics and information technology in the curriculum" (AACSB, 2018a, 37).

2. Literature review and research questions

2.1. Background on Standard A7 and research questions

AACSB introduced Standard A7 in April 2013. Although this standard became effective July 1, 2013, AACSB allowed a three-year implementation period that ended June 30, 2016. The focus of the standard is on "the development of skills and knowledge related to data creation, data sharing, data analytics, data mining, data reporting, and storage with and across organizations" and the motivation for this new standard is due to "the changing dynamics related to data analytics and related information technology expectations for accounting graduates" (AACSB, 2014, 2). While AACSB provided guidance in a White Paper (AACSB, 2014), Standard A7 (and the current Standard A5) allows accounting departments significant flexibility in how they choose to implement technology into the curriculum. As the implementation phase is over and compliance is now required, we have an opportunity to understand and learn from the AACSB supplemental-accredited accounting programs. The purpose of this study is to understand the integration of technology and data analytics into the accounting curriculum, the impact of the standard and its challenges, and the status of course offerings that incorporate technology and data analytic skills. To address these issues, we propose the following research questions:

RQ1: What is the impact of Standard A7 and the status of implementation and compliance?
RQ2: What guidance is used to integrate technology into the curriculum?
RQ3: What approaches are used to integrate technology into the curriculum?
RQ4: What are the challenges faced and what resources are needed?
RQ5: What courses currently incorporate technology skills and which technology software/programs are used?

2.2. RQ1: Impact of Standard A7 and the status of implementation and compliance

Pincus, Stout, Sorensen, Stocks, and Lawson (2017) identify a number of technology forces that are changing the accounting profession but note that teaching and curriculum development has not experienced a commensurate level of progress. One of the goals of the AACSB is to "accelerate innovation" (AACSB, 2019), but updating the accreditation standards still take time. For example, the most recent AACSB accounting accreditation standards were updated in April 2018, a five year process from the previous update in April 2013.[6] This lengthy process is likely due to the need for the AACSB to revise and approve the standards, allow accounting departments sufficient time to implement changes, and then assess compliance with the standards before considering new revisions. Therefore, accounting departments may not always wait for standards to change to make curriculum updates. For instance, many accounting departments form relationships with business professionals to keep abreast of changes in the business environment, and make curriculum updates to respond to these changes. The need for accountants to develop stronger technology and data analytic skills was clear well before the AACSB standards were updated (e.g., Chang & Hwang, 2003; Curtis, Jenkins, Bedard, & Deis, 2009). Therefore, how impactful accounting department leaders felt Standard A7 was to inducing changes (vs. some other mechanism) to the accounting curriculum is not clear.

Department leaders' perspectives on the impact is one way to consider the influence of Standard A7, the other is leaders' perspectives on the status of implementation and compliance. AACSB accreditation can be essential to a business school's credibility, a determining factor in the school's overall ability to be competitive, affect job opportunities for students, and influence faculty recruitment (Trapnell, 2007; Thomas, Billsberry, Ambrosini, & Barton, 2013; Miles, Franklin, Grimmer, & Heriot, 2015). As such, adherence to *changes* in accreditation requirements to maintain accreditation status, and thus credibility and competitiveness, is important to business schools and accounting departments that have supplemental accreditation. However, even though it is in the best interest of accounting departments to comply with the AACSB standards, not all schools may have the immediate bandwidth (in terms of faculty and funds) to comply with such changes (Heriot, Franklin, & Austin, 2009). In addition, depending on the timing of the department's next AACSB accreditation peer review, some departments may have had an additional few years before being formally assessed (i.e., peer reviews occur every five years). Therefore, accounting departments may have started implementation at varying times depending on both the availability of resources and when they expect their next AACSB peer review. Furthermore, because accounting departments did not have a technology requirement prior to Standard A7, integration of technology and data analytics into accounting courses before the standard likely varied from one university to another. As a result, departments are likely at different stages in the implementation and compliance process. This discussion leads to research question one: *What is the impact of Standard A7 and the status of implementation and compliance?*

2.3. RQ2: Guidance used to integrate technology into the accounting curriculum

A key issue in integrating technology and data analytics into the curriculum is ensuring that changes meet or exceed the intent of Standard A7 and the needs of the organizations who will employ accounting majors. To achieve this, accounting departments can rely on guidance from standard-setters, academic peers, presentations at conferences, AACSB-specific sem-

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[6] Prior to the 2013 revisions, the last AACSB accounting standards' updates were in 1991 and 2003 (Miles et al., 2015).

inars, business community resources, and/or academic community resources. The most direct guidance from AACSB includes the standard (AACSB, 2013, 2018b), a White Paper on the standard (AACSB, 2014), and seminar presentations. The objectives of these forms of guidance are to clarify the implementation of Standard A7 and to encourage additional discussion on the substance and content of information technology skills and knowledge obtained through accounting curricula.

However, AACSB does not intend to be prescriptive in how the standard is implemented. Rather, the intent is to allow accounting departments to determine how best to meet the standard given their mission statements, resources, and student populations. For example, the White Paper (AACSB, 2014) indicates that accounting departments might incorporate technology across the curricula, but could also integrate the new requirements through modules or several different courses. AACSB also encourages a multidisciplinary approach and indicates courses could fall under other disciplines (e.g., information systems, mathematics).

Other sources of guidance external to AACSB include discussions with peers and attending conferences (e.g., Accounting Programs Leadership Group). In addition, professional bodies, especially the Big4 firms, are working to identify the skills they would like future accounting graduates to have (e.g., PwC, 2015a; PwC, 2015b) and are creating instructional resources that develop those technology and data analytics skills (e.g., Deloitte Foundation's Trueblood Cases and Ernst & Young's Academic Resource Center).

Both the AAA and individual academics have also developed guidance and instructional resources. The Pathways Commission (2015) sponsored by the AAA encourages the development of curriculum models, shareable resources, and accounting faculty to meet the needs of the business environment. Several years ago, the AAA also introduced the Accounting IS Big Data conference to provide an opportunity for members of the accounting profession and academia to discuss technological changes affecting the profession, as well as provide workshops for instructors in how they can incorporate technology and data analytics into the classroom. Starting in 2018, the AAA has offered the Intensive Data and Analytics Summer Workshop annually to help faculty develop the skills necessary to teach technology skills to their students.

In addition, academics have published guidance and instructional cases in academic journals. For example, several published articles provide guidance on managing and implementing curriculum changes and the integration of technology and data analytics (e.g., Lawson et al., 2014; Lawson, Pincus, Sorenson, Stocks, & Stout, 2017). Sledgianowski et al. (2017) synthesize available technology-oriented instructional resources by course to assist in meeting the goals outlined by Standard A7. Due to the general guidance from AACSB, and the number of other available guidance, we pose research question two for consideration: *What guidance is used to integrate technology into the curriculum?*

2.4. RQ3: Accounting department integration methods

AACSB's White Paper (2014) suggests that meeting the objectives of Standard A7 can take a variety of paths and that a multidisciplinary approach might involve other departments, faculty, and courses. In addition, deciding what skills to incorporate and how is complicated by the fact that academic literature addressing the uses of technology and data analytics in accounting and the needed skills is limited (Dzuranin et al., 2018; Cao, Chuchyla, & Stewart, 2015; Vasarhelyi, Kogan, & Tuttle, 2015). Dzuranin et al. (2018) suggest three possible approaches, a focused approach (i.e., one focused course), integrated approach (i.e., incorporated throughout a number of classes) or a hybrid approach (i.e., both a focused course and some integration into other courses).[7] Dzuranin et al. (2018) indicate that faculty support a hybrid approach in general, but approaches to integration are likely to vary depending on the availability of appropriately skilled faculty, financial support, and technology resources. For example, accounting departments with limited resources may be more likely to implement changes through one course (i.e., a focused approach) and rely more heavily on other departments that have technology skills (e.g., information systems). Alternatively, accounting departments with more extensive resources may be more likely to integrate technology skills throughout the curriculum (e.g., an integrated approach). The implementation approach may also depend on whether the accounting department is joined with other departments (e.g., information systems), which could make a multidisciplinary approach easier and/or more cost-effective. Based on this discussion, we expect implementation to differ across the accounting departments that have AACSB supplemental accreditation. We explore this notion with research question three: *What approaches are used to integrate technology into the curriculum?*

2.5. RQ4: Challenges to integrating technology and needed resources

Funding might present a challenge to integrating technology into the accounting curriculum. At the operational level, the cost to achieve and maintain AACSB accreditation is substantial (Heriot et al., 2009). New standards typically increase this cost and limited flexibility in short-term budgets exacerbate the problem (Pincus et al., 2017). Another obstacle may be the lack of detailed guidance, making it difficult for accounting departments to obtain funding for critical resources (e.g., computer labs, new faculty) and/or garner support from the accounting faculty and other business school faculty. In addition, implementing technology and data analytics into accounting curricula has a personal cost to faculty (e.g., time to learn and time to incorporate changes into courses) that some faculty may view as unrewarded (David, Maccracken, & Reckers,

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[7] At the time of this survey, a single course to meet Standard A7 was acceptable. However, under Standard A5, the basis for judgment for departments under review must include "a list of current and emerging technologies used in each accounting course," suggesting integration into multiple courses is now expected.

2003). Watty, McKay, and Ngo (2016) find faculty resistance is a major challenge for implementing technology into accounting curricula. Faculty support for changes may be especially problematic if senior faculty are near retirement and unwilling to learn new types of technology or software. However, it is not simply an issue of resistance of current faculty to learn, but also of hiring new accounting faculty who have the expertise to teach technology skills (Hastings, Reckers, & Solomon, 2003).

Change often incurs challenges, but which challenges are most impactful in the integration of technology and data analytics into the accounting curriculum is unclear. The resources accounting departments need to implement changes is also uncertain. To explore these issues in more detail, we propose research question four: *What are the challenges faced and what resources are needed?*

2.6. RQ5: Current status of technology in the curriculum

The Pathways Commission finds that there has been little change in the *content* of accounting curricula, especially in regards to technology adaptation (Behn et al., 2012). This sentiment is echoed by Boyce, Greer, Blair, and Davids (2012) who argue that business schools' adaptation to a technology-driven business environment has been piecemeal and lacks necessary systematic changes. While both the Pathways Commission (2015) and PwC (2015a) have provided some insight into the technology skills needed by accounting graduates, there is little insight into how departments are incorporating technology into the curriculum. For instance, accounting information systems (AIS) is commonly viewed as a course where teaching of technology skills can be easily incorporated (Dzuranin et al., 2018), but a number of other accounting courses (e.g., audit and assurance) are also possibilities. In addition, the shortage of accounting faculty with the skills necessary to teach technology and data analytics (e.g., Krahel & Vasarhelyi, 2014) could limit course offerings, or could result in faculty in other departments or adjunct faculty teaching technology-oriented courses.

Furthermore, while the Pathways Commission's Report (2015) indicates a strong consensus for the need to teach some technologies (i.e., spreadsheets), the report indicates significant divergence on which other technologies should be taught. PwC (2015a) calls for an overhaul of the accounting curricula to include more programming courses (e.g., Python), multivariate and inferential statistics (e.g., using R), and data visualization tools (e.g., Tableau). However, Earley (2015) suggests some caution to accounting departments conducting a complete overhaul given that it is still unclear how much accounting professionals may have to conduct the underlying programming and statistics versus needing to know how to interpret and convey the results. Collectively, the guidance from practice on which technologies may be most useful is inconsistent and is rapidly changing as new software is developed. Given the lack of consensus from practice, accounting departments may often make their own choices about which technologies (e.g., Tableau, IDEA, and Excel) to use and teach.

Our final research question is comprised of two questions: First, it seeks information regarding the courses involving development of technology and data analytics skills, as well as information regarding who might be teaching the course. Second, the question asks what specific technology software and programs are currently incorporated into the curriculum. Formally stated, research question five asks: *What courses currently incorporate technology skills and which technology software/ programs are used?*

3. Research method

3.1. Participants and administration

To examine our research questions, we created a survey to administer to department chairs at AACSB schools that have supplemental accounting accreditation.[8] We intentionally chose this population because AACSB accounting departments were the first to have a formal mandate to integrate technology into their curriculum, are peer-reviewed by AACSB every five years, and are often viewed as leaders in research and teaching (Trapnell, 2007; Brink & Smith, 2012). Therefore, our participants should be attentive to the demands of Standard A7 and offer important information that may be shared to guide other accounting programs in their implementation of technology and data analytics skills into their curricula. Department chairs are also likely to have a more comprehensive view of changes across the department and the business school, due to their administrative role, than accounting faculty within the department who may only be aware of their own courses and how they teach them.

We collected data from our participants using an online survey through Qualtrics in February and March of 2017. The survey sample was determined using AACSB's website that listed 188 business schools (177 national and 11 international) with supplemental accreditation for their accounting programs as of December 31, 2016 (AACSB, 2017). From this list, we used the 2015–2016 Hasselback *Accounting Faculty Directory* (Hasselback, 2016) augmented with information from university web pages to locate the name and email address of each department chair. We obtained department chairs' email addresses for 186 of the 188 separately accredited accounting departments.

In late February, we sent an initial recruitment email to our potential respondents followed by reminder emails over the course of the following five weeks. Each email asked the recipient to participate in an online survey regarding a research study about how AACSB accredited accounting departments are implementing technology into their accounting programs. A highlighted link to the survey was included in each email. Of the 186 qualified respondents, 83 started the survey (44.6

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[8] The authors obtained Institutional Review Board approval to conduct this study.

Table 1
Respondent demographics.

	Number	Percent
Type of university		
Public	58	85.3%
Private	10	14.7%
Institution focus		
Research	23	33.8%
Teaching	2	2.9%
Balanced	43	63.3%
Department type		
Accounting only	60	88.2%
Blended department	8	11.8%
(with information systems, finance, and/or law)		
Faculty composition		
Full-time accounting faculty		
<10	8	11.8%
10–20	43	63.2%
<20	17	25.0%
Adjunct (Part-time) accounting faculty		
5–10	41	60.3%
>10	27	39.7%
Student composition		
Undergraduate accounting students		
50–100	5	7.40%
100–200	10	14.70%
>200	53	77.90%
Graduate accounting students		
No graduate program	4	5.90%
<25	7	10.30%
25–50	15	22.10%
51–100	22	32.40%
>100	20	29.40%

Note: 68 of 69 respondents completed the demographic questions.

percent). We deleted 14 respondents from our study because their responses were incomplete. As a result, 69 useable surveys are included in our analysis to examine our research questions, representing a 36.7 percent response rate.[9]

Table 1 displays demographic information related to the institutions and the compositions of the faculty and accounting students. The respondents seem sufficiently diverse to represent accounting departments that have supplemental accreditation by AACSB and to provide information on the implementation of technology and data analytics into accounting curricula. In addition, since a large majority of our respondents are from schools with a balanced institutional focus and a mid-size faculty and student composition that is representative of many accounting programs (not just those with AACSB separate accreditation), our results are likely to be applicable to a wide set of accounting programs.

3.2. Survey instrument

The primary focus of the survey was to elicit responses on the status and progress made by accounting departments to integrate technology and data analytics into both undergraduate and graduate accounting curricula. The questions were developed through both personal insights of one of the author's experiences as an AACSB peer reviewer, as well as insights one of the authors gained during attendance of the annual Accounting Programs Leadership Group conference hosted by the AAA and discussions with a number of department leaders at this meeting. We also performed an extensive search of the literature related to accreditation and the accounting curriculum to determine opportunities to further inform the literature in these areas.

To construct our specific survey questions, we referred to a number of studies examining curriculum-related topics (e.g., Brink & Smith, 2012; Miles et al., 2015) and used best practices for survey design (Rea & Parker, 2014). Specifically, the survey design employed several question and response formats including Likert scales, yes/no options, and multiple-choice options, either restricted to one response or selecting all that apply. We also used open-ended questions to augment multiple-selection answers and to offer respondents the opportunity to provide a more comprehensive response regarding their department's implementation choices and needs. By using multiple question formats, the survey design encouraged respondents to read each question and allowed the respondents to answer our questions while giving them opportunities

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[9] A widely cited source on survey research indicates that surveys with over 30 percent are rare, and 5 to 10 percent are common (Alreck & Settle, 2004). In addition, a more general survey of deans/heads of member schools on the AACSB 2013 accreditation standards had a 23 percent response rate (Miles et al., 2015). Collectively, this suggests our response rate exceeds the acceptable range for purposes of the present study.

Table 2
Research questions, survey questions and results' references.

Research question	Associated survey questions	Response options	Results' references
RQ1: What is the impact of Standard A7 and the status of implementation and compliance?	a. How much has Standard A7 impacted your department's decision to make changes to the accounting curriculum?	5-point scale from 1 ("Not at all") to 5 ("Very much")	Fig. 1 Panel A
	b. How far along is your department in complying with Standard A7?	5-point scale from 1 ("Not started") to 5 ("Fully implemented")	Fig. 1 Panel B
	c. How would you rate your department's current compliance with Standard A7?	7-point scale from 1 ("Well below minimum standard") to 7 ("Well above the minimum standard")	Fig. 2 Panel A
	d. How challenging do you feel it will be to maintain compliance with Standard A7 long-term?	5-point scale from 1 ("Not challenging at all") to 5 ("Extremely challenging")	Fig. 2 Panel B
	e. What do you perceive as the biggest challenge long-term to maintaining compliance?	Open text response	In text
RQ2: What guidance is used to integrate technology into the curriculum?	a. How satisfied are you with the Standard A7 implementation guidance provided by AACSB?	7-point scale from 1 ("Extremely dissatisfied") to 5 ("Extremely satisfied")	Table 3 Panel A
	b. What resources have you used in deciding how to best implement changes? Please order these from most used to least used.	Rank order resources used from most used (1) to least used (7). Options include: AACSB resources (e.g., AACSB White Paper), discussions with other universities (i.e., chairs/directors), conference meetings and proceedings (e.g., Accounting Programs Leadership Group), resources provided by the AAA (e.g., teaching cases), resources provided by other professional bodies (e.g., AICPA), business community professionals (e.g., resources provided by public accounting firms), or other with an open text box	Table 3 Panel B
RQ3: What approaches are used to integrate technology into the curriculum?	a. Is your department working with other departments in implementing changes (e.g., information systems, management)? If yes: Which departments (select all that apply)?	Yes or No If yes, options include: information systems, management, finance, mathematics, or other with an open text box	Table 4 Panel A
	b. How is your department implementing (or planning to implement) Standard A7? If participant selected "through one course" or "through a few courses", we asked which courses were (would be) affected and at what level?	Options include: through one course, through a few courses, through a majority of courses or other with an open text box Open text box for listing of the courses	Table 4 Panel B & Panel C
	c. At what level are the courses offered?	Options include: undergraduate, graduate or both	Table 4 Panel D
	d. Please provide any additional information that would be helpful in understanding the implementation process at your University that may not be obvious through the survey responses you have already provided.	Open text box	Table 5
RQ4: What are the challenges faced and what resources are needed?	a. Identify how challenging each item (e.g., appropriate faculty, necessary funding) is in implementing changes to comply with Standard A7?	5-point scale from 1 ("Not challenging at all") to 5 ("Extremely challenging")	Table 6 Panel A
	b. What resources do you need that are currently not available at your University?	Options include: selecting that they have all they need or all that apply including: funding support, technology-oriented faculty, computer lab(s), support from other department faculty, access to programs/software, technology support department/team, or other with an open text box	Table 6 Panel B
RQ5: What courses currently incorporate technology skills and which technology software/programs are used?	a. Do you have a required undergraduate Accounting Information Systems course?	Yes or No	Table 7 Panel A
	b. Do you have any other courses for undergraduate Accounting majors (required or elective) that incorporate teaching technology skills (e.g., data analytics)? If yes: Please list the course(s).	Yes or No If yes, open text box	Table 7 Panel B
	c. Do you have any graduate accounting courses that incorporate teaching technology skills (e.g., data analytics)?	Yes or No If yes, open text box	Table 7 Panel B

Table 2 (*continued*)

Research question	Associated survey questions	Response options	Results' references
	If yes: Please list the course(s). d. What specific technologies are used and taught by the instructors (select all that apply)?	Options include: electronic spreadsheets, business intelligence and analytics technologies, database management software, enterprise resource planning software, audit software, XBRL, programming and query language, and other with an open text box	Fig. 3

to describe their specific circumstances in more detail. We did not provide any incentive for participants to respond and the survey instrument did not allow them to go backwards.

For all of our research questions, we asked several inter-related questions to our participants. Table 2 provides an overview of our five research questions, the associated survey questions, the response options, and the results' references for each question.

4. Survey findings

4.1. The impact of Standard A7 and the status of implementation and compliance

The first set of questions relate to the impact of Standard A7, the current status of accounting department's implementation of technology into the curriculum, and the department chair's perspective on their compliance with the standard. We asked department chairs whether Standard A7 had an impact on their accounting department's decision to make changes to the accounting curriculum. Responses indicate that 49.2 percent of departments thought that Standard A7 considerably impacted their decision (i.e., selected "quite a bit" or "very much") to make changes, and an additional 33.3 percent were somewhat impacted (RQ1a; Fig. 1 Panel A). Only 17.3 percent of our sample viewed the standard as having little or no impact. This result indicates that the new standard was instrumental in encouraging a large portion of accredited accounting departments to consider the importance of technology skills for accounting majors and to make appropriate changes. Responses to an open-ended question indicate that those who felt the standard had a lesser impact were already making changes in response to accounting and business organizations' demands for these skills before Standard A7 was formalized. For instance, one participant said, "Our programs have always been very technology focused and we have always worked with the business community on what skills our students need. A7 therefore had NO impact on our curriculum".

We also asked the department chairs to indicate at what stage of compliance they perceive the department to be in (RQ1b; Fig. 1 Panel B). According to our respondents, 23.2 percent of the departments believe they have fully implemented changes and another 46.4 percent have mostly implemented changes. However, almost one-third of the sample indicate they have only partially implemented changes or are still in the planning stage.[10] This result provides some support to Pincus et al. (2017)'s contention that curriculum development has not experienced a level of progress that is commensurate with the technology advances in the business world. We conduct additional exploratory analysis to examine differences in compliance, integration approach, and challenges based on implementation stages in the supplemental analysis section.

We also asked whether department chairs felt they were in compliance with Standard A7 (RQ1c; Fig. 2 Panel A). From the department chair's perspective, 69.6 percent (16-well above, 14-moderately above, and 18-somewhat above) believe they are implementing changes that would be considered "above the minimum" required by the standard. In fact, 23.2 percent believe they are well above the minimum. On the other hand, 20.3 percent feel they are just meeting the minimum standard, and another 10.1 percent indicate that they are not compliant (i.e., below the minimum standard).[11] Collectively, these perceptions suggest that department chairs may feel as though they can pass an AACSB peer review with the changes they have currently implemented to date (i.e., they have met the bar of the minimum that the standard requires), but that in their view they have not fully implemented changes to meet the *intent* of Standard A7.

Finally, we asked how challenging the department chairs feel it will be to maintain compliance with Standard A7 (RQ1d; Fig. 2 Panel B) and what they view as the greatest long-term challenge to maintain compliance (RQ1e; not tabled). The second question was an open text response that we coded into categories based on the most common responses.[12] The results

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[10] We find a marginally significant negative correlation (-0.285; p<0.10 two-tailed) between responses regarding the impact of Standard A7 (Fig. 1 Panel A) and implementation progress (Fig. 1 Panel B). This result suggests that those who felt most impacted by Standard A7 are also the furthest from full implementation.

[11] While compliance with Standard A7 was required as of July 2016, AACSB accredited accounting programs are only peer reviewed every five years, and thus could still be below the minimum standard when our study was conducted without a formal compliance assessment.

[12] The coding was performed by having one author review the responses to the open text question and develop a list of the high-level categories identified as challenges. These included documentation, maintaining faculty competence, staying current with technology changes, funding resources, and other. A second author then independently coded the responses into these categories and assessed whether any other categories were present. None were identified. The first author then reviewed the codes to verify accuracy and consistency of the codes, and discrepancies were discussed and reconciled between the two authors.
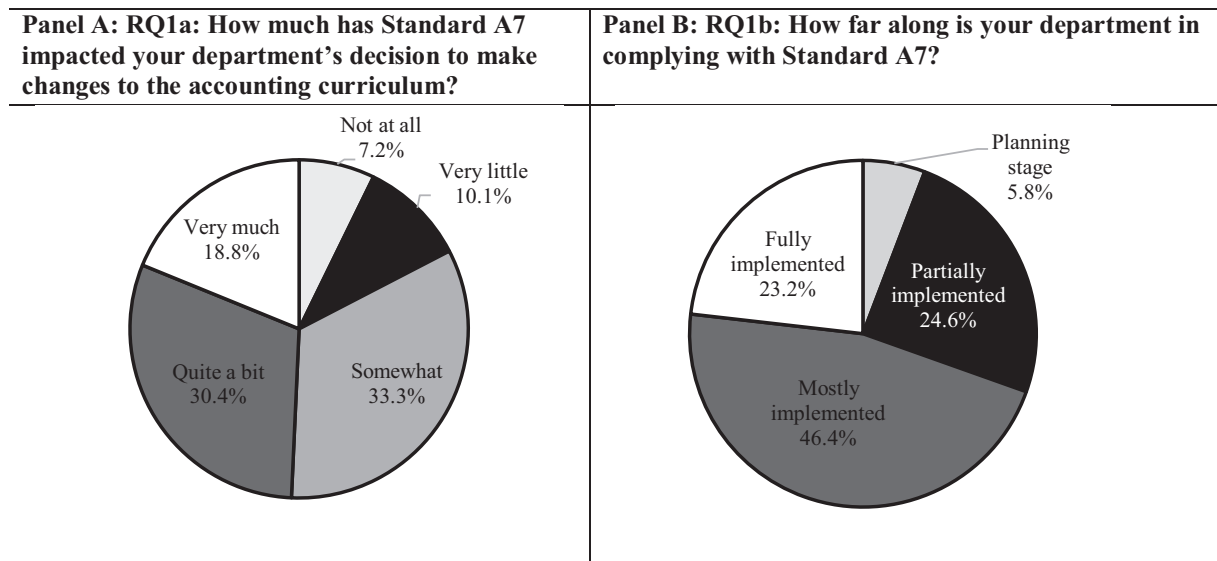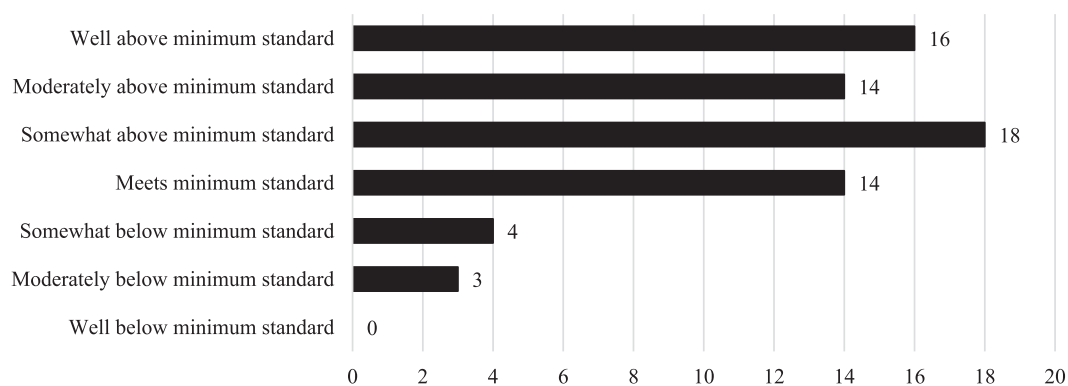
Fig. 1. Standard A7 impact and status of implementation. **Note:** Pie graphs in Panels A and B are based on answers provided by 69 respondents.
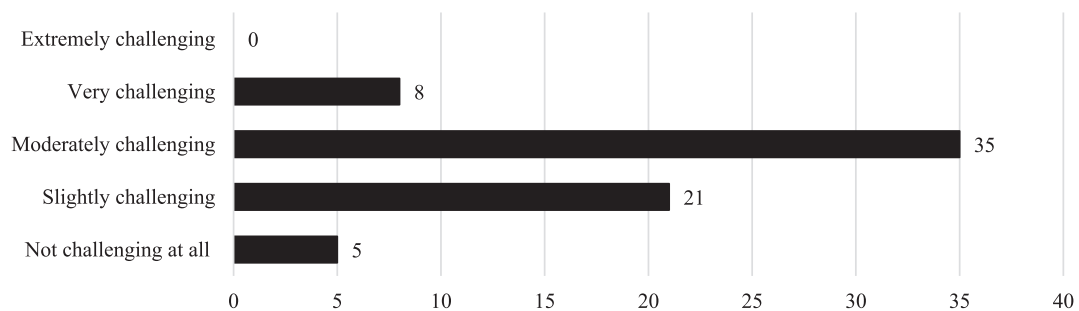

Fig. 2. Status of compliance. **Note:** Bar graphs in Panels A and B are based on answers provided by 69 respondents.

show that 62.3 percent (43/69) perceive a notable challenge (i.e., selected "moderately" or "very" challenging) and an additional 30.4 percent (21/69) recognize at least some challenge to maintain compliance with the standard. Of those who answered (n = 49), the biggest perceived challenges relate to maintaining faculty competence in teaching technology skills (n = 26),

staying current with the changing technology software and skills businesses want of accounting graduates (n = 15), and having the funds and appropriate resources to maintain compliance (n = 9). From these responses, department chairs clearly believe they will experience continuing challenges to maintain compliance with Standard A7. In addition, regardless of the need to maintain compliance with supplemental AACSB accreditation, all accounting departments may face ongoing challenges as the use of technology continues to make rapid advancements. This is an important consideration for strategic planning for both the department and the business school.

4.2. Guidance used to integrate technology into the curriculum

The next set of questions relate to department chairs' perspectives on the AACSB guidance on Standard A7 implementation and the guidance they used (are using) to integrate technology into the accounting curriculum. We asked department chairs to rate their satisfaction with AACSB's guidance on implementation of Standard A7 (RQ2a; Table 3 Panel A). 52.2 percent of respondents were satisfied to varying degrees with the guidance (36/69), 31.9 percent (22/69) were indifferent, and only 15.9 percent (11/69) were dissatisfied to some degree.

We also asked respondents to rank the resources they used in deciding how to best implement changes from most used (one) to least used (seven) (RQ2b; Table 3 Panel B). The most used resources include AACSB resources (mean = 2.67), conference meetings and proceedings (mean = 3.02), and discussions with other universities (mean = 3.03). The least used resources include resources provided by business community professionals (mean = 3.41), AAA resources (mean = 4.38), and other professional bodies (mean = 4.75). The majority of department chairs seem satisfied with the AACSB resources, which may be due to the flexibility of implementation allowed. These results also indicate that some sources are used more often by department leaders when deciding how to implement change, while perhaps the other sources (i.e., AAA and other professional bodies) are more beneficial for implementation in specific courses or may need to better advertise or explain how their resources can be used by department leaders to make department-wide curriculum decisions.

4.3. Accounting departments integration methods

The next set of questions refer to the third research question, which asked accounting chairs specifics about how the department integrated (will integrate) technology and data analytic skills into the accounting curriculum. First, we asked if the accounting department is working with other departments in implementing changes (RQ2a; Table 4 Panel A). Most of the respondents indicated (66.7 percent) they were working with other departments. Of those (n = 46), 91.3 percent said they are working with their information systems department, 13.0 percent management department, 4.4 percent finance department, and 13.0 percent other departments (e.g., economics).[13]

The second question inquired how the department is integrating (will integrate) technology into the curriculum (RQ3b; Table 4 Panel B). The majority of accounting departments (81.2 percent) are integrating technology into a few courses, suggesting an integrated or hybrid approach is common. However, some are working to incorporate technology through the majority (14.5 percent) or all (1.4 percent) courses and a couple (2.9 percent) plan to focus on one course. In a follow-up question, for those who answered either "through one course" or "through a few courses" we asked which courses specifically were (would be) affected (RQ3c; Table 3 Panel C). We coded the responses into course types.[14] The two respondents who said "one course" both said implementation is occurring through the AIS course. Of the respondents who said "a few courses" (n = 56), the most common courses include Information Systems (69.6 percent), Audit/Fraud (48.2 percent), and Data Analytics (35.7 percent). Collectively, these results are complementary to Dzuranin et al. (2018), and indicate that many departments are using an integrated approach, with some departments using a hybrid approach in which a specific data analytics course is also offered. Finally, we asked at what level the courses are (will be) offered. The responses indicated that 22.1 percent are undergraduate only, 77.9 percent selected both undergraduate and graduate, and none indicated graduate only (RQ3d; Table 4 Panel D).

Finally, we asked our participants to provide any additional information that may be helpful to understand the implementation process at their university (RQ3e; Table 5). Collectively, both our survey results and participants' comments highlight the variety of approaches accounting programs are choosing to integrate technology into the curriculum.

4.4. Challenges with integration and needed resources for implementation

Our fourth set of questions deal with the challenges accounting departments have and continue to work through in integrating technology skills into the curriculum and what resources they still need. We asked respondents to identify how challenging each of nine items (e.g., appropriate faculty, necessary funding) were in implementing changes to the curriculum (RQ4a; Table 6 Panel A). The items viewed as most challenging (i.e., those in which >25 percent selected "very challenging" or "extremely challenging") include appropriate faculty (31.3 percent), necessary funding (28.8 percent),

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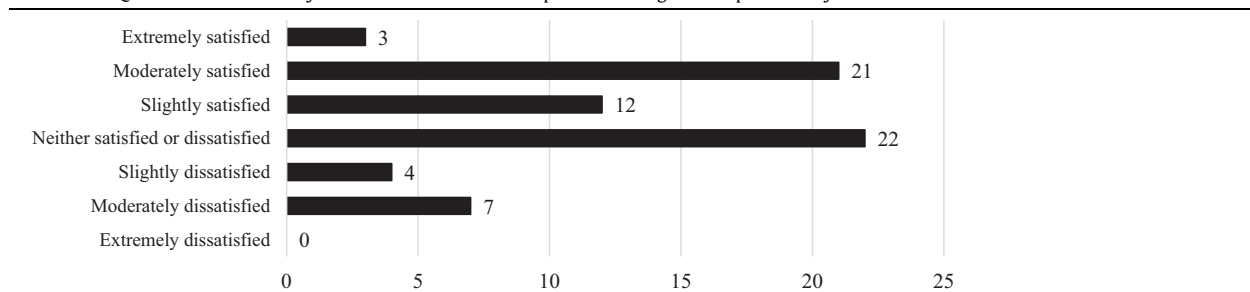[13] No respondents indicated that they were working with their mathematics department.

[14] Because of the diversity in courses, we grouped the individual courses mentioned into categories to understand which courses include technology skills. For example, courses in the "Audit/Fraud" category include external auditing (including both basic and advanced courses), internal auditing, forensic accounting, and fraud.

Table 3
Satisfaction with AACSB guidance and other guidance use.
Panel A: RQ2a: How satisfied are you with the Standard A7 implementation guidance provided by AACSB?

	Count
Extremely satisfied	3
Moderately satisfied	21
Slightly satisfied	12
Neither satisfied or dissatisfied	22
Slightly dissatisfied	4
Moderately dissatisfied	7
Extremely dissatisfied	0

Panel B: RQ2b: What resources have you used in deciding how to best implement changes? Order from most to least used

	Ranked 1 (Most used)	Ranked 2	Ranked 3	Ranked 4	Ranked 5	Ranked 6	Ranked 7 (Least used)
AACSB resources	28	9	8	4	5	10	0
Conference meetings and proceedings	11	16	15	10	8	3	1
Discussions with other universities	9	15	20	11	3	6	0
Business community professionals	11	14	10	9	8	11	1
AAA resources	3	3	4	22	22	9	1
Other professional bodies resources	0	7	6	8	18	25	0

Note: 69 respondents completed the question identified in Panel A. 64 respondents completed the rank ordering question identified in Panel B. Responses are sorted by mean rankings. "Other" is not included in Panel B because it was ranked 7th and left blank for 61 of the 64 respondents who completed the question.

appropriate guidance (28.4 percent), and clarity of business expectations (26.8 percent). Many also perceive finding appropriate educational resources as a moderate challenge (64.2 percent). On a positive note, the majority of respondents indicated that support of the business school and of the accounting faculty is of little or no challenge (67.2 percent and 79.1 percent, respectively), a result contrary to Watty et al.'s (2016) assertion that faculty resistance is a major impediment to change.

Department chairs identified what resources they need that are currently unavailable at their school. Respondents could select that they have all they need or select all that apply from a number of choices (e.g., funding support, technology-oriented faculty) (RQ4b; Table 6 Panel B). Of the 66 who responded, 25 (37.9 percent) indicated they have all they need. For the remaining 41 respondents, the top three most needed resources included funding support (63.4 percent), technology-oriented faculty (48.8 percent), and computer labs (29.3 percent). Results of both questions clearly indicate that department chairs' biggest hurdles to effective integration of technology are funding and appropriate faculty.

4.5. Current status of technology in the curriculum

Our final set of questions focus on which courses include technology and data analytics skills, which faculty teach these courses/technologies, and which technologies faculty use in their courses. First, we asked whether the accounting department has a required undergraduate AIS course (RQ5a; Table 7 Panel A), and found that 11.6 percent currently do not. Given the repeated calls from the profession regarding the need for technology and data analytics skills of accounting majors, we did not expect to find any AACSB accredited accounting programs that did not have a required AIS course. It is possible that those departments rely upon a computer science or information systems department to offer a comparable course for their accounting majors. For the 88.4 percent who do have a required undergraduate AIS course, we followed up by asking who teaches that course. Most (80.3 percent) indicate that at least one PhD faculty teaches the course. However, respondents also indicated that professional (29.5 percent) and adjunct faculty (13.1 percent) teach undergraduate AIS.

We also asked department chairs if they offer additional courses that have a technology or data analytics component at the undergraduate and/or graduate level (RQ5b and RQ5c; Table 7 Panel B). At the undergraduate (graduate) level, 76.8 (83.3) percent of respondents indicated that they offer at least one other course. The mean number of additional courses offered is 1.92 (SD 0.90; not tabled) at the undergraduate level and 1.76 (SD 0.86; not tabled) at the graduate level; the means are not statistically different. The most common course types are data analytic courses or courses where data analytics are a component (41.5 and 56.4 percent offer at least one, respectively), additional information systems related courses (32.1 and 43.6 percent offer at least one, respectively), and audit/fraud courses (30.2 and 34.5 percent offer at least one, respectively). Also, 50.9 (80.0) percent identified additional courses taught by the accounting department and 62.3 (30.9) percent identified additional courses taught by other departments. In addition, PhD faculty commonly teach at least some of the additional courses at the undergraduate and graduate levels (100.0 percent and 89.1 percent, respectively). However, compared to the undergraduate AIS course, a greater percent of professional faculty teaches at least one of the additional courses (37.7 percent and 34.5 percent, respectively).
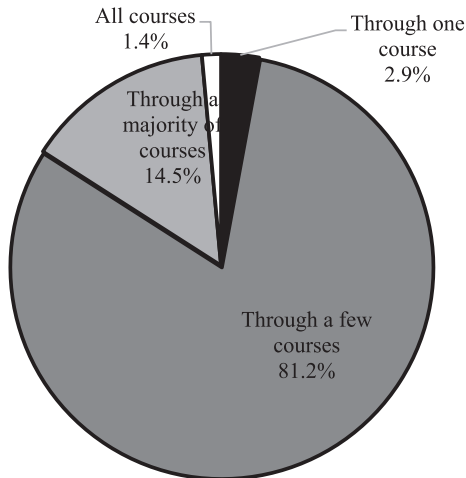
Table 4

Accounting departments integration methods.

Panel A: RQ3a: Is your department working with other departments in implementing changes?

	No	Yes	Information systems	Management	Finance	Other
Number	23	46	42	6	2	6
Percent	33.3%	66.7%	91.3%	13.0%	4.4%	13.0%

Panel B: RQ3b: How is your department integrating (planning to integrate) technology skills?

Panel C: RQ3c: Course types where integration has occurred (or is planned)

	Number	Percent
Information systems	39	69.6%
Audit/fraud	27	48.2%
Data analytics	20	35.7%
Managerial accounting	13	23.2%
Financial accounting	8	14.3%
Tax	3	5.4%
Other	9	16.1%

Panel D: RQ3d: Level of course offering

	Number	Percent
Undergraduate only	15	22.1%
Graduate only	0	0.0%
Undergraduate and Graduate	53	77.9%

Note: Panel A and B include 69 respondents and Panel D 68 respondents. In Panel A, if respondents selected yes (n = 46), they could select all departments that applied. In Panel C, the question asked those respondents who selected "a few courses" (n = 56) to identify specific courses technology skills were (will be) integrated. A number of different courses are offered by universities; as such, this table reflects a consolidation of courses into course types.

Department chairs identified specific technologies that are taught in these courses (RQ5d; Fig. 3). The respondents could select all that apply from a list of nine items. The responses suggest that a number of these technologies are taught to some extent in various courses. Specifically, electronic spreadsheets, business intelligence and analytics technologies, accounting and tax research software, audit software, and database management software are all reportedly used by >70 percent of the accounting departments in our sample.

Collectively, these results may help accounting departments benchmark what they are doing against others. For example, accounting curricula that does not require an undergraduate AIS course is not the norm, and these departments may consider this change. In addition, for departments trying to determine which courses to develop or incorporate technology skills into, it seems data analytics, information systems, and audit/fraud courses are the most common. Therefore, departments could either follow the common path or could consider differentiating their curricula by incorporating technology skills into other course types. Finally, based on our results of the technologies used, those not incorporating electronic spreadsheets and business intelligence and analytics technologies are behind what appears to be fairly standard in most accounting programs.

4.6. Supplemental analysis

To examine whether there are any differences in Standard A7 impact and compliance level, integration approach, and challenges across differentiating dimensions of universities and accounting departments we performed ex-post exploratory

Table 5
RQ3e: Quotes from participants on implementation strategies.

Participant ID	University Description	Quote
ID-2	Public, Balanced Focus	"We aren't doing anything. AACSB is very liberal in what must be done to comply."
ID-7	Public, Research Focus	"We are pooling together faculty from core courses to develop a progressive introduction to the tools"
ID-9	Public, Balanced Focus	"The BIS faculty in our department are so much more qualified in tools than any accounting professor. I think the BIS connection is the way to go to get the best outcome for the students."
ID-10	Public, Teaching Focus	"Based upon discussions at meetings, I don't feel as though there is a clear compliance benchmark. But, I don't think this is a bad thing. I see the requirement as a "commitment in principle" to elevate the level of technology education in our programs. I think that we can demonstrate that. I am concerned that we will do more to appear to comply with the standard than we will to actually prepare students for what awaits them."
ID-14	Public, Balanced Focus	"Insufficient work has been done to implement Standard A7 into other accounting concentration courses (such as auditing and financial accounting). It is a first step to add more accounting information systems courses, but ideally technology should be built into more of the basic concentration courses."
ID-17	Public, Balanced Focus	"This is all new, so we are still trying to identify affected courses, amount [of] information to teach, how to teach data analytics, at what point in the program to expose students, and how to close the loop with a measurement tool."
ID-52	Private, Balanced Focus	"My department has worked with the information systems department for two years and the end result is that we will have to hire accounting faculty to teach even the basic course….the systems department views the masters in accounting as less relevant than the MBA - they will offer the MBA version of the basic course but not make modifications to make it relevant to accounting students."
ID-57	Public, Research Focus	"At this point, we are anticipating full implementation at the graduate level. At the undergraduate level, we will likely teach some skills within AIS and then re-enforce the skills across the curriculum."
ID-69	Public, Balanced Focus	"To help implement the standard, we formed an ad hoc committee consisting of faculty who teach accounting information systems and those who teach auditing."

Note: This table presents respondents' quotes on their perspectives on the implementation of technology and data analytic skills.

Table 6
Challenges with integration and needed resources.
Panel A: RQ4a: Identify how challenging each item is in implementing changes
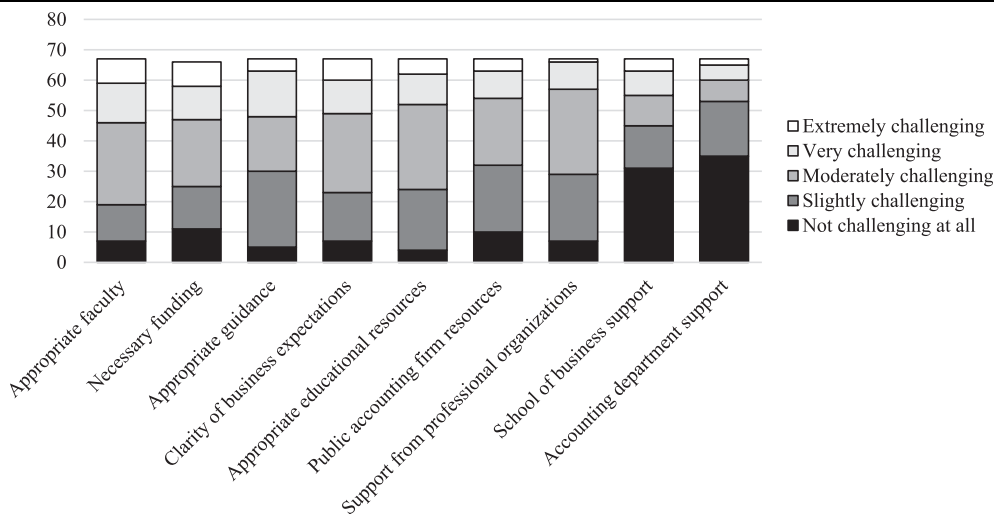
Panel B: RQ4b: What resources do you need that are currently unavailable at your school?

	Number	Percent
I have all that I need	25	37.9%
Require some resources:	41	62.1%
Funding support	26	63.4%
Technology-oriented accounting faculty	20	48.8%
Computer lab(s)	12	29.3%
Support from other department faculty	11	26.8%
Access to programs/software	6	14.6%
Technology support department/team	4	9.8%
Other	3	7.3%

Note: Panel A includes 67 respondents. Panel B includes 66 respondents. For those requiring some resources, the percentage is calculated as the number of responses for each item divided by those requiring some resources (n = 41).

Table 7
Available course types and who teaches them.

Panel A: RQ5a: Do you have a required undergraduate AIS course?	Number	Percent
No required AIS course	8	11.6%
Required AIS course, taught by:	61	88.4%
PhD faculty	49	80.3%
Professional/clinical faculty	18	29.5%
Adjunct faculty	8	13.1%

Panel B: RQ5b and 5c: Do you have any other courses for accounting majors that incorporate teaching technology skills?	Undergraduate (n=69)		Graduate (n=66)	
	Number	Percent	Number	Percent
No additional courses offered	16	23.2%	11	16.7%
Additional courses offered	53	76.8%	55	83.3%
Course types:				
Data analytics	22	41.5%	31	56.4%
Information systems	17	32.1%	24	43.6%
Audit/fraud	16	30.2%	19	34.5%
Spreadsheet	8	15.1%	0	0.0%
Managerial accounting	7	13.2%	0	0.0%
Data management	4	7.5%	0	0.0%
Statistical analysis	4	7.5%	0	0.0%
Financial accounting	3	5.7%	0	0.0%
Other	10	18.9%	8	14.5%
Additional courses, offered by:				
Accounting department	27	50.9%	44	80.0%
Other department (e.g., information systems)	33	62.3%	17	30.9%
Additional courses, taught by:				
PhD faculty	53	100.0%	49	89.1%
Professional/clinical faculty	20	37.7%	19	34.5%
Adjunct faculty	7	13.2%	6	10.9%

Notes: Panel A includes 69 respondents. The percent calculations for faculty equal the number for each type of faculty divided by the number indicating they have a required AIS course (n = 61). Panel B includes 69 (66) respondents for the undergraduate (graduate) level, three respondents indicated they do not have a graduate accounting program. Respondents identified all additional courses available to accounting majors at both the undergraduate and graduate levels involving instruction of technology and data analytics. As there are a significant number of different courses offered at universities, this table reflects a consolidation of courses into course types. The percent calculations for department offerings and faculty are equal to the count in each category divided by the number indicating they have additional courses incorporating technology skills (undergraduate = 53; graduate = 55).
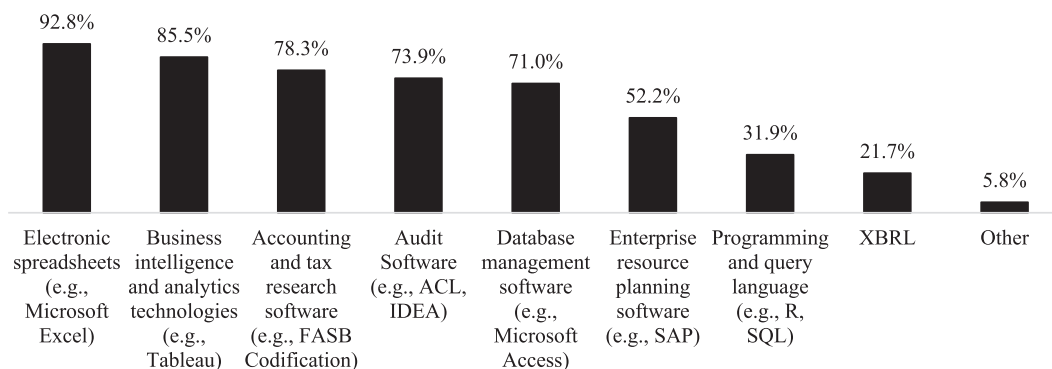

Fig. 3. RQ5d: Technology used and taught. **Notes:** The figure includes 69 respondents. The percent calculations are the number for each item divided by the total number of respondents.

analyses.[15] Specifically, we considered public vs. private universities, institutional focus (i.e., research vs. balanced), student composition and faculty composition. Overall, we find very few differences. We find that accounting chairs at private universities perceive long-term compliance as more challenging than those at public universities (means 3.20 vs. 2.57; t = 2.434, p = 0.018). We also find that accounting curricula at private universities is less likely to require an undergraduate AIS course

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[15] Because this analysis was exploratory, and in many cases conducted with small and uneven samples, there is an increased risk of finding spurious results. Therefore, we limit discussion of results to those in which we find significance at p<0.05, two-tailed.

than curricula at public universities (40.0% vs. 6.9% do not require AIS; Fishers Exact Test = 0.013). We find no differences across any of the differentiating dimensions (i.e., public/private, institution focus, student or faculty composition) for the impact of Standard A7, the level of compliance, the integration approaches used, the challenges faced or resources needed by accounting departments. Collectively, these results suggest that differentiating dimensions of universities and accounting departments do not explain why certain departments feel Standard A7 was more impactful, are at a lower level of compliance, or are using different implementation methods. In addition, regardless of university or department characteristics the challenges and needed resources appear to be similar.

We also examined whether accounting departments that indicated they had fully implemented changes to comply with Standard A7 differed in their compliance, satisfaction with AACSB guidance, integration approach, and challenges faced from departments at other levels of implementation. To perform these analyses, we ran ANOVAs to compare results across the three implementation levels (i.e., planning/partially implemented, mostly implemented, and fully implemented) and post-hoc Scheffe tests to examine differences between levels.

We find that departments at earlier stages perceive themselves at a lower level of compliance with Standard A7 (means = 3.86-planning/partially, 5.44-mostly, and 6.56-fully; F = 36.69, p = 0.00; Scheffe tests indicate all means are significantly different from each other at p < 0.01). Those in the earliest stages also perceive a greater challenge in maintaining compliance long term than those fully implemented (means = 3.00, 2.66, and 2.25, respectively; F = 4.66, p = 0.01; Sheffe tests indicate only means of planning/partially and fully are significantly different, p = 0.01). In addition, we find that those in earliest stages of implementation are less satisfied with the guidance from AACSB (means = 3.95, 4.66, and 5.56, respectively; F = 7.61, p = 0.00; Scheffe tests indicate fully is significantly different from planning/partially and mostly, p = 0.00 and p = 0.06, respectively). We find no significant differences in integration approaches. Finally, we find that those in earlier stages of implementation perceive having appropriate faculty (means = 3.67, 277, and 2.75, respectively; F = 5.18, p = 0.01; Sheffe tests indicate means of planning/partially are significantly different from mostly and fully, p = 0.02 and 0.04, respectively) and appropriate guidance as greater challenges than those who have fully implemented changes (means = 3.38, 2.70, and 2.31, respectively; F = 5.70, p = 0.01; Sheffe tests indicate means of planning/partially are significantly different from mostly and fully, p = 0.06 and 0.00, respectively). These results shed some light on the factors that may be most likely to hinder accounting department's implementation efforts (i.e., lower level of current compliance with Standard A7).

5. Conclusions

The purpose of this paper is to provide insights from leaders of AACSB supplemental-accredited accounting programs on integrating technology and data analytic skills into the curriculum to meet the data-driven needs of the accounting profession and to comply with Standard A7. We asked our respondents to answer a number of questions regarding the implementation and compliance progress made by their departments, the guidance and resources available to integrate technology and data analytic skills, the challenges in integrating technology, and which courses currently include instruction on technology and data analytics.

Overall, the results suggest that Standard A7 has had a significant impact on promoting change in the accounting curricula at AACSB accredited accounting programs. This result suggests that the comparable business accreditation standard (i.e., Standard 9) is also likely to have a positive influence on raising the importance of teaching technology and data analytics across AACSB accredited business schools. Almost 70 percent of our respondents report that they have already implemented changes and view their changes as above the expectations contained in Standard A7. However, given only 23 percent have fully implemented their changes, it is clear that the speed at which curriculum change is taking place is slow and is likely to continue to be problematic in the "age of acceleration" we currently live in (see Friedman, 2016, 187). Further, almost one-third of respondents believe they are below or just meeting the standard. This may reflect the challenges faced in keeping pace with ever-changing technology.

Our results indicate that the biggest challenges to implementation are shortages of appropriate faculty and funding. In addition, there appears to be significant concern regarding maintaining long-term compliance with Standard A7, which centers on hiring and keeping competent faculty who maintain competency with technology. While our sample only includes AACSB accredited accounting programs, we expect these concerns are likely common across both accredited and non-accredited programs. In particular, because the revised AACSB standard (i.e., Standard A5) suggests that accounting departments will not only be evaluated on developing technology skills of their students but also their faculty, departments are likely to face even greater pressure to both hire and continue to develop faculty. However, due to funding challenges across business schools, accounting department leaders may need to be creative in their approach to finding or developing qualified faculty to teach these critical technology skills to students. They may choose to emphasize the development of technology and data analytic skills of existing faculty as a more cost-effective alternative given hiring faculty with these skills seems to be a significant challenge. In this circumstance, they may be able to locate free or inexpensive training courses for their faculty at their universities, through vendors, online videos such as YouTube, LinkedIn training, Lynda.com, and others. However, business schools must also consider the reward structure/incentives for faculty to take such initiatives (especially those untenured) to encourage excellence in the classroom (Behn et al., 2012).

Approximately half of the department chairs in our study are satisfied with AACSB's guidance. Those who needed more guidance sought help from peers at other universities and conferences to assist them in their implementation decisions. The results also indicate that the research and resources provided by the AAA and other professional bodies (e.g., the AICPA, accounting firms) are not used very often. While a multitude of resources are available through these sources, it may be that these resources are more beneficial for implementation in specific courses or these groups need to clarify how their resources can be used by department leaders when making department-wide curriculum decisions.

We found significant variation in integration methods, which includes the breadth of involvement of other departments, the number of courses included, and the types of courses that are used. The open-ended responses from accounting departments' leadership indicates varying perspectives on interpretation and understanding of what the standard implies. Two quotes from respondents highlight this range of perspectives, where one department chair said, "We aren't doing anything. AACSB is very liberal in what must be done to comply." Another said, "Based upon discussions at meetings, I don't feel as though there is a clear compliance benchmark. But, I don't think this is a bad thing. I see the requirement as a commitment in principle to elevate the level of technology education in our programs. I think that we can demonstrate that." While we do not believe all universities should or could integrate technology and data analytic skills in the same way, the significant variation we find suggests that further dialogue is needed between accrediting bodies, academics, and business leaders to establish more tangible benchmarks for the level of technology skills students need for career success in order to establish what "compliance with Standard A7" entails to ensure this success.

In evaluating the status of courses available to accounting majors in which technology and data analytics are taught, we find the overwhelming majority of departments require AIS in the undergraduate curriculum, although 12 percent still do not. Our findings also reveal that a number of courses incorporate technology and data analytics, but the courses and the technologies vary widely. This suggests that gaps may exist in the level of technology and data analytics skills taught to accounting majors at some schools. However, the results indicate that there are some fairly common course types (e.g., audit/fraud) and technologies (e.g., spreadsheets) taught across accounting departments that can help department leaders benchmark their approach against others.

Finally, our exploratory supplemental analyses indicate that very few of our results are associated with specific university or accounting department factors. While some may assume that integration methods, challenges and needed resources might differ by the size and focus of a university or department our results do not suggest that this is the case. This is an interesting and important result, as it indicates that the common methods of integration could be broadly applied. In addition, because the same challenges and resource limitations exist across types both department leaders, as well as external sources (e.g., AACSB, AAA), may consider how these challenges and limitations can be alleviated across universities. For example, perhaps the AAA could consider developing online trainings or webinars from their Intensive Data and Analytics Summer Workshops that could be accessible by more instructors for a lower cost.

Our results should be informative to key stakeholders (e.g., the business community, AAA, AICPA, and CMA) who may further assist in providing guidance and resources to help accounting programs continue to make curriculum improvements that enhance the technology skills of accounting majors. The changes that have occurred because of Standard A7 indicate that AACSB has the ability to use accreditation standards to change curricula to meet the requests of accounting and business organizations. Our study adds to the ongoing dialogue urged by the AACSB regarding the needs of the business community (AACSB, 2014). Our findings offer useful insights for accounting departments that are unsure of how to implement changes and provides current information to those departments that question how their efforts compare to other accredited accounting programs. For example, we find that one differentiating factor in current course options among universities is offering a specific course on data analytics at the undergraduate level (42 percent report offering this course). For those accounting programs not separately accredited by the AACSB (i.e., those not accredited or accredited by other bodies), our findings offer information that may be used to enhance the technology and data analytic skills and abilities of their accounting majors as the need and/or requirement for these changes spread.

As a final note, AACSB may wish to use our survey results, combined with Peer Review Team visit reports, to prepare another white paper that would inform the continued efforts of accounting departments in the implementation of the standard. While the intent of the standard is not to be prescriptive, at a minimum, some level of technology skills should be required. AACSB could work with representatives from the accounting profession to determine a minimum level of skills that are required for accounting majors to possess as they enter the workforce.

Results from our study provide a number of avenues for future research. First, researchers could investigate how the variation in technology and data analytics skills for accounting majors impacts student enrollment in accounting programs, skill-sets students develop, recruitment of students at top employers, and early job performance. Another important avenue for research is to investigate approaches to developing technology skills of faculty, given the difficulty in hiring already-trained faculty in this area. A future study may also identify the content of specific courses to determine what technology skills students obtain. For example, to complement the present study, as well as Dzuranin et al. (2018), another useful perspective would be to investigate how accounting faculty have implemented technology skills and data analytics into their specific courses (e.g., auditing, managerial, tax), to provide a more in-depth understanding of the technologies and resources they are using and the time they are spending on teaching technology and data analytic skills. An additional avenue for future research could examine accounting departments that integrate data analytics and technology solely through accounting courses as compared to accounting departments that approach compliance by collaborating with departments across the

business school. Finally, future research on AACSB standard changes may consider examining how the time until the next review may influence departments' responses to changes.

Limitations of our study include those that are common to survey research and can limit the reliability of the data that is collected. For example, the results are specific to respondents who are accounting department chairs at AACSB accredited business schools and have supplemental accreditation. As a result, our findings may or may not generalize to non-accredited accounting departments. In addition, there is a general lack of control over who responds to a survey (Parker & Kohlmeyer, 2005). It is also possible that department chairs may exhibit some social desirability bias and respond more favorably about their implementation of technology or progress with Standard A7 compliance than may actually be the case. In addition, some department chairs may not be fully aware of what their accounting faculty are doing or what technology is currently included in accounting courses. More generally, survey research can capture attitudes and opinions at a point in time, which offers the ability to suggest associations or correlation, but cannot determine cause and effect relationships.

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