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The Transition from MIS Departments to Analytics Departments

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The Transition from MIS Departments to Analytics Departments

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ABSTRACT

This paper takes a look backward while simultaneously looking to the future for MIS departments that are making the transition to Analytics departments. MIS has a long past of providing a base of skills supporting organizations. We examine this history as well as how the blending of MIS with business translator and modeling skills has led to the development of analytics programs and concentrations. While the transition to analytics has taken place in many MIS departments at least partially, the question is how long analytics will remain a focus and when will the next major shift occur.

Keywords: Academic degree, IS environment, IS education, Computing education, Business analytics, IS education research

1. INTRODUCTION

In this paper of celebrating the 30th anniversary of the *Journal of Information Systems Education*, we use this opportunity to reflect on the last decade of the field and project on the next decade of the field through the eyes of department chairs. The first author of this paper recently celebrated the end of his 12th year as an "IS" department chair and turned over his current role to the second author who now looks out over the future of an "Analytics" department. As department chairs, we have not only the viewpoints as scholars and educators, but also as those who interact with employers, donors, accreditors, higher-level administrators, and many other stakeholders who play a role in the success (or lack thereof) of a department.

In the past decades, we have seen the field change direction and focus many times. At the original ICIS conference, Peter Keen (1980) famously suggested that maybe IS wasn't really a discipline at all but was rather a part of another discipline. Furthermore, he posited that to be a traditional discipline, it must incorporate more than "fads" and "reactions to new hardware." We have seen the demands of the field change many times from client-server architecture to outsourcing to business process reengineering to electronic commerce to data warehousing, and most recently, to business analytics. Table 1 outlines the overarching themes of the shifts in information systems over the past 60 years. Similarly, the curricula, faculty skills, and employers that we deal with have made many changes to try to keep up.

In the business school, the IS discipline has long had issues gaining parity with other more traditional disciplines like accounting, management, marketing, and finance (Banville and Landry 1989; Mason, McKenney, and Copeland, 1997). While these areas have also had changes with technology, the primary questions and the primary theories that define these as disciplines haven't really changed. The Big (now Four) accounting firms still recruit budding CPAs from accounting departments, Wall Street investment banks still recruit from finance departments, and Madison Avenue firms still recruit marketing graduates to work on their campaigns. Yet the IS graduates' job titles, recruiters, and career perspectives have changed. Petter et al.'s (2018) essay "Desperately Seeking the Information in Information Systems Research" further investigates the changing nature of the research questions,

Note: The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the United States Air Force Academy, Air Force, Department of Defense, or U.S. Government.

providing a history of many similar papers in the quest to develop continuity and differentiation in IS research.

First Era **60s to Mid-70s**	Decision Support (DS) Decision Support Systems (DSS) Human Computer Interaction (HCI)
Second Era **Mid-70s to Mid-80s**	Executive Information Systems (EIS) with limited Dashboards Online Analytical Processing (OLAP)
Third Era **Mid-80s to Mid/Late-90s**	Data Warehousing / Business Intelligence Umbrella Terms Data Cleansing, Business Process Reengineering, Decentralized Data Governance), Applications (Dashboards/Scorecards, OLAP) Internetworking
Fourth Era **Late-90s to Today**	Internet Age Electronic Commerce Ubiquitous Computing/Social Media Unstructured Data Cloud Computing/Software as a Service (SaaS)

Adapted from Table 1 Hirschheim and Klein (2012) and comments from Watson (2011) and Holsapple, Lee-Post, and Pakath (2014)

Table 1. Information Systems Eras

While more contemporary fields like supply chain management have popped up since the turn of the century, and are located in different areas like Operations Research / Operations Management / Logistics (traveling salesperson problem) or even marketing (Place from the "4 Ps"), these are generally seen as the emergence of a new discipline with a standard dependent variable and a question to be answered.

2. IS THERE A DISTINCT NOTION OF TRADITIONAL MIS?

Topi (2019) gives the field an eloquent survey on the current state of IS Education as well as opining on its future. He ties the field's educational values to the future of work. Many of his thoughts are similar to what we observe as outgoing and incoming IS department heads. Where we expand is in the job of the IS department administrator – what do we do now to accommodate these changes, and what do we do differently than we have done before as the future holds many changes?

As we measure the field by what we teach in the classroom, what we teach has continued to evolve as the field has changed. Some of this is due to the normal changes expected by evolutions in technology that would happen in all fields (e.g., the emergence of accounting information systems or digital marketing), but other changes seem to be shifting what we think is important. Perhaps uniquely in the business school, except in the case of accounting where curricula are more or less mandated in the U.S. by state accounting licensing boards as students wish to sit for the CPA designation, management information systems (MIS) and also information technology (IT) has developed curriculum models. The development of those models has depended on input from many bodies, such as the Association for Computing Machinery (ACM), the Association for Information Technology Professionals (AITP), and the Association for Information Systems (AIS). Models have been developed for both the undergraduate and graduate curricula and updated approximately once per decade, as shown in Table 2.

3. WHY IS MIS CHANGING?

MIS has long occupied a spot between computer scientists and business professionals. Some in MIS may call the profession as that of business translators, while others might be offended by that statement as it would indicate that MIS professionals are less technically capable than they might be. We posit that many of these changing factors are due to the changing nature of the technology, and as it moves to being more user-friendly/accessible, then the curriculum moves towards the next more complicated item. For example, MIS senior scholar Hugh Watson (2011, p. 6) states it is the new nature of data that changes the role of the MIS professional:

> We are in the era of big data. In addition to the usual structured data from operational systems, organizations are capturing and storing less-structured data from their Web sites, call centers, e-mail, documents, social media, and elsewhere. There are more data sources, and the data is arriving at a higher velocity. This vast amount of data contains a wealth of potentially useful information but creates challenges for capturing, storing, and analyzing it. If BI directors fail to plan for and integrate big data into their BI strategy, governance, architecture, technologies, processes, and activities, they risk facing a vacuum filled by the business units, resulting in a new generation of analytic silos.

Similarly, Davenport and Harris (2017) continue along those lines by indicating the changes in analytics that are driven by technology, including pervasive data, autonomous analytics and decision making, democratization of analytics software, mining of unstructured data, and increased prediction and prescription.

While the data that our professionals are managing and analyzing are changing, so are the desires of employers; as educators, we have to interpret their desires. The job descriptions that are written often seem to be for so-called unicorns, with many requirements perhaps being more like wish lists. Watson (2012) calls for programs to have advisory boards made up of key alumni and employers, and to have them visit campus and make sure they participate in discussions involving changing directions of the curriculum and ways to improve student experiences through speakers, panels, and mentoring, as well as to learn the reality of situations for themselves.

Year	Curriculum	Level	Bodies
2002	IS2002: Curriculum Guidelines for Undergraduate Degree Programs in Information Systems Gorgone et al. (2002)	Undergraduate	ACM, AIS, AITP
2006	MSIS2006: Model Curriculum and Guidelines for Graduate Degree Programs in Information Systems Gorgone et al. (2006)	Masters	ACM, AIS
2008	IT2008: Computing Curricula Information Technology Volume Lunt et al. (2008)	Undergraduate	ACM, IEEE
2010	IS2010 Curriculum Update: Curriculum Guidelines for Undergraduate Degree Programs in Information Systems Topi et al. (2010)	Undergraduate	ACM, AIS
2016	MSIS2016: Global Competency Model for Graduate Degree Programs in Information Systems Topi et al. (2017)	Masters	ACM, AIS
2017	IT2017: Curriculum Guidelines for Baccalaureate Degree Programs in Information Technology Sabin et al. (2017)	Undergraduate	ACM, IEEE

Table 2. IS-Related Curriculum Models

4. THE RISE OF COMPETITIVE FIELDS – ANALYTICS

As mentioned earlier, MIS programs and graduates can often be seen to be chasing the next fad, or field. As of now, business analytics is the latest choice, which in MIS programs evolved out of earlier efforts in Business Intelligence (BI) and Data Warehousing, or perhaps just borrowed from Operations Research (OR), Operations Management, Decision Sciences, Statistics, or other fields. Earlier this decade, Chiang, Goes, and Stohr (2012) spoke of BI and analytics education and program development having three areas: analytical skills, IT knowledge and skills, and business knowledge and communication skills – areas traditionally referred to in MIS programs and the requisite model curricula. Wixom et al. (2010) talk of BI in other classes or perhaps within a single class, and in (2011) call for entire curricula in the field. Wixom et al. (2014) observe entire curricula in BI but still with employer dissatisfaction with the practical experience provided.

Following Wixom's work, several scholars, including Holsapple, Lee-Post, and Pakath (2014) and Gorman and Klimberg (2014), studied the emergence (shown in Figure 1) and benchmarking of analytics programs. The latter demonstrated it as an evolution not of MIS, but of scientific and quantitative management principles. In their benchmarking, they also create a framework for analytics professionals shown in Figure 2. It is short of a model curriculum in analytics, but it is not a far stretch to get to one from there. They lay out the three main pillars of the field as quantitative methods, statistics, and information systems/business intelligence.

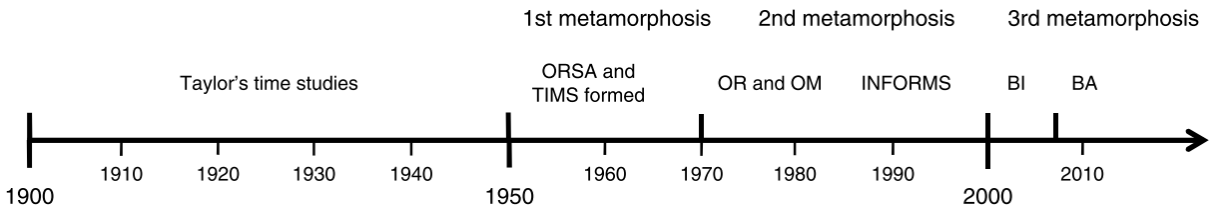

Figure 1: The timetable showing the evolution of business analytics begins with Fredrick Taylor's scientific approach to business problems, and carries through the birth and convalescence of operations research, statistics, and management information systems.

Figure 1. Evolution of Business Analytics by Gorman and Klimberg (2014)

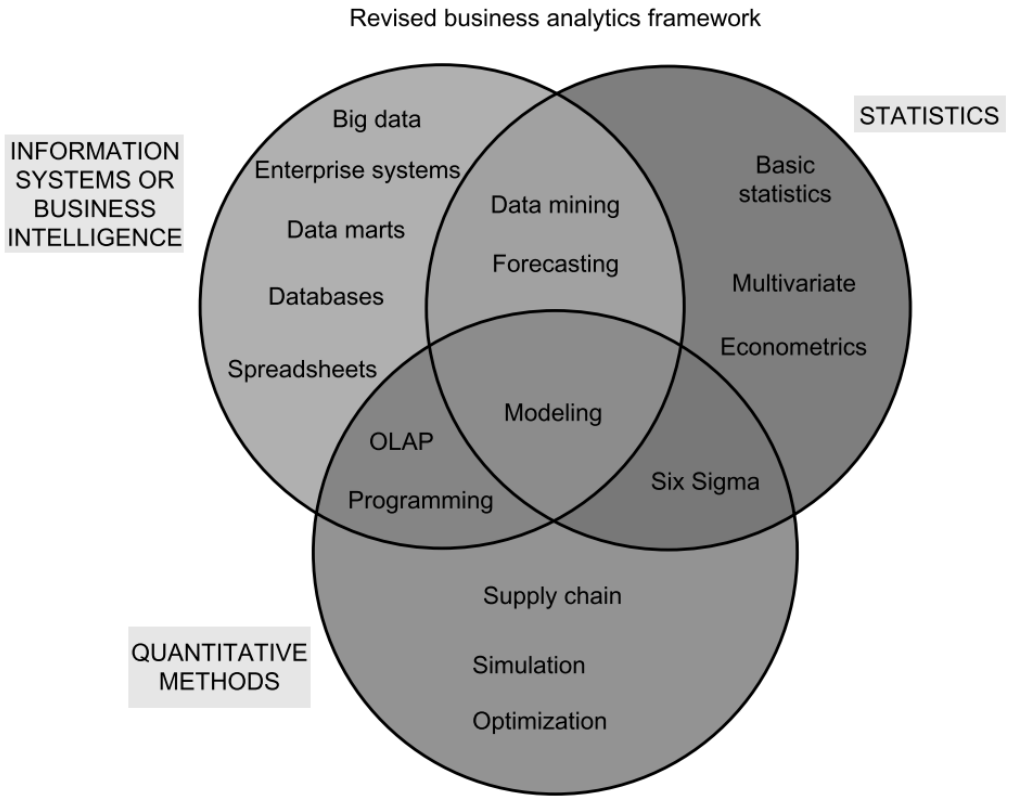

Figure 2. Business Analytics Framework by Gorman and Klimberg (2014)

Watson (2011, p. 5) also looks at the development of the field. While he notes BI and analytics also developing out of decision support systems, he wonders about the changing nature of the field and how it might really be different.

> Why all the name changes? It isn't that the previous names were bad; more likely, vendors, consultants, writers, and others who offer decision support products and services saw the opportunity to have people and companies take a fresh look at their offerings by promoting them as new and different.

Klimberg and McCullough (2013, p. 59) ask a similar question:

> How is academia responding to this new and developing field? As a result of this spike in interest, many academic institutions simply change the names of their courses and programs to now include the words business analytics or business intelligence in their names.

Gorman and Klimberg (2014) note that MIS, OR, computer science, engineering, and statistics all offer their own perspectives on the field of business analytics. They look at the curricula of several programs and note the amount of content that is statistics, OR, IS, and general business. In general, programs combine statistics 49%, OR 26%, IS 21%, and general business knowledge 4% (weighted percentages). But of course each program has differing weights based on their view of the field, as they compare programs from Tennessee (43%, 19%, 19%, 19%) with Cincinnati (50%, 41%, 9%, 0%) and NYU (44%, 44%, 0%, 11%) in the same content areas mentioned in summary above. There are not (yet) curriculum models like there are for IS and IT that are blessed by large organizations, but several papers propose such models. For example, Holsapple, Lee-Post, and Pakath (2014) define business analytics into one of six classes: a movement, a collection of practices and technologies, a transformational process, a capability set, an activity type set, or a decisional paradigm. Wilder and Ozgur (2015) go even further to propose a Bachelor's-level curriculum for undergraduate business analytics majors. In their paper, they also define three different skillsets for data analyst jobs as shown in Figure 3.

5. THE RISE OF SPECIALTY FIELDS – CYBERSECURITY

As many IS departments have embraced analytics, others have instead (or additionally) focused on cybersecurity. As far back as 1998, the U.S. National Security Agency (NSA) developed a program to denote academic departments as NSA Centers of Academic Excellence in Cybersecurity. George Mason University, James Madison University, Purdue University, Idaho State University, Iowa State University, the University of California at Davis, and the University of Idaho were the original schools given this designation two decades ago. While the designation is given to institutions and not colleges nor departments, business school MIS departments saw this as a way to get involved in the cybersecurity areas. As of this writing, 165 institutions in the United States hold this

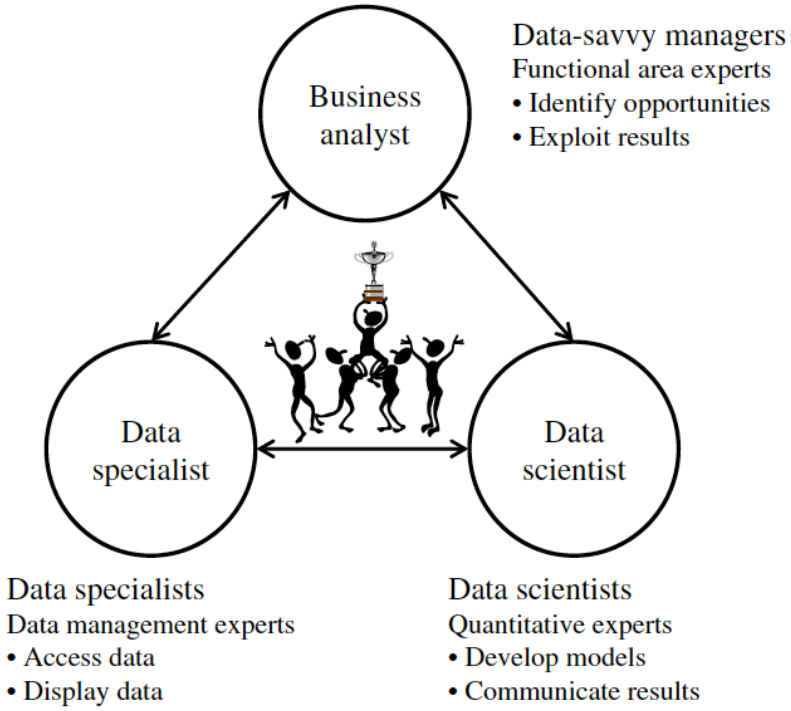

Figure 3. Definitions of Data Skills by Wilder and Ozgur (2015)

designation, including our own university (though the programs are housed in Computer Science here). In many leading universities, MIS programs host these efforts.

6. THE COMBINATIONS OF EFFORTS - SCHOOLS OF INFORMATICS

Other campuses have created real or virtual colleges designed to host information science efforts from across their campuses. Perhaps the longest lasting one and most well-known is at Indiana University with its School of Informatics, Computing, and Engineering. It offers undergraduate degrees in computer science, informatics (21 cognates ranging from biology, medicine, geography, arts, security, business, etc.), intelligence systems engineering, and statistics and graduate degrees ranging from data science, bioinformatics, and secure computing. Other similar efforts exist at Georgia Southern University and Illinois State University. The decoupling of MIS from the business school creates challenges for the administrators in retaining the identity of MIS as well as building a new identity.

7. PREPARING THE STUDENTS FOR THE JOB MARKET

In the midst of these changes, we need to prepare students for the jobs of today and tomorrow.

We know that, in recent years, the terms that have appeared in job searches have evolved. A search of terms for IS academic jobs from the ISWorld listserv highlights the shifting from "Electronic Commerce" in 1999, "Data Warehousing" and "Business Intelligence" in 2002, "Virtual Worlds" in 2008, "Business Analytics" in 2014, and most recently "Data Science" and "Machine Learning." General Assembly and Burning Glass Technologies (2015) reported a focus on what they termed "hybrid tech jobs" which are jobs such as digital marketing, data analytics, and product managers that combine traditional programming and analysis and design skills with "offline skills" of analysis, design, and marketing. Watson (2011, p. 36) suggests that a diverse set of skills is required for those who perform analytics, or at least one person on each team should possess "the ability to work with large data sets as well as an understanding of analysis methods, domain knowledge, and communications skills." Since it may be difficult to find these in a single candidate, Watson (2011) also recommends that organizations have internal training programs specifically to grow analytics skills. Watson (2013) states: "The era of Big Data and analytics is here… we need to give [our business students] a thorough understanding of the power of data – and how to use that power to drive their organizations forward."

8. INTERACTING WITH THE EMPLOYERS - ADVISORY BOARDS

To increase connectedness with the field of practice, many business school departments have created and use advisory boards following the suggestion of Watson (2012). These boards are usually made up of professionals in the field that offer advice into curricular matters and assist with student placement at graduation. While perhaps once deemed only at a dean's or chancellor's level as a way of rewarding large donors and key alumni, going forward they are now a key tool used by the department head to interact with the community. At our university, we rely on 15-20 professionals at the VP level or

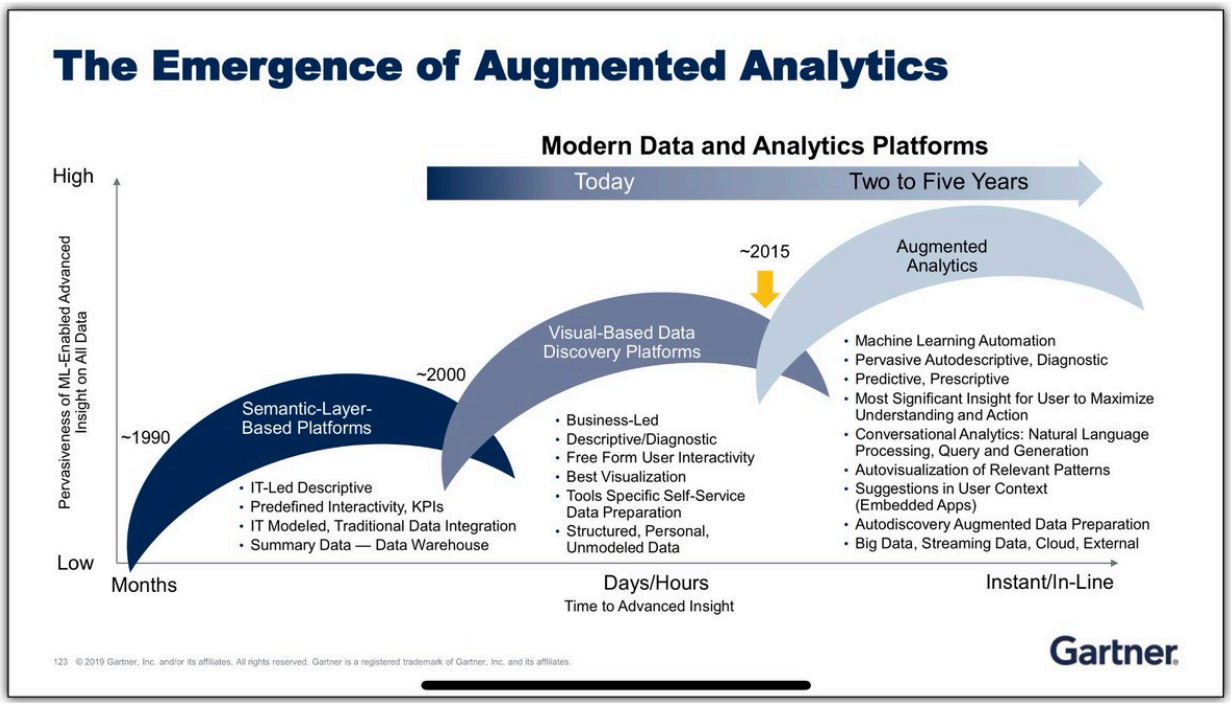

Figure 4. The Emergence of Augmented Analytics by Sallam (2019)

above as members of our advisory board, and they personally (or their company) make a donation to support the efforts of the department as part of their Commitment To Serve.

9. INNOVATION AND PEDAGOGICAL ISSUES

An example of changes that have already taken place in the teaching of analytics is the expansion of the categories of analytics from descriptive, predictive, and prescriptive to include the 4th category of autonomous analytics (Davenport and Harris, 2017). This newest category includes machine learning (ML), artificial intelligence (AI), and deep learning (DL) models where the final two categories are categorized by reduced involvement by human analysts. This brings a new phase of curriculum development for business analytics departments because while many ML algorithms have traditionally been covered in predictive modeling, we now must determine how much AI/DL to include in our programs.

As we adapt to the changes in curriculum, we also have to retrain our faculty to adapt their teaching methods to align with the students' desires for more hybrid and online courses. There has been tremendous growth in the online MS analytics programs space, including MS Business Analytics, MS Data Science, and MS IS programs with specializations in areas such as cybersecurity, data analytics, and systems integration.

Along with pedagogical changes, we have to adapt to the changing software landscape. Our own program has evolved from exclusively using programs such as Tableau, JMP, SPSS Modeler, and SAS to include additional options such as PowerBI and open source software such as R and Python. This expansion to open source software brings about additional issues of lack of faculty training as well as the unintended effect of using a wide variety of packages in Python and R to accomplish the same tasks and therefore causing additional confusion for students. Therefore, some consistent faculty training and adopting of preferred practices for commonly used tasks (such as reading in data, performing a regression, or creating a scatterplot, for example) is strongly recommended. Watson (2013) promotes the use of vendor resources as well as online resources for faculty and student support. For example, Teradata University, Tableau, and Data Camp are great resources for faculty and students to get free access to software training.

A final determination that must be made is to find the correct balance of exposure or mastery of tools and exposure or mastery of concepts. We must determine how much theory is needed for a business analyst versus a data scientist.

10. CONCLUSIONS AND A VIEW OF THE FUTURE

The Gartner Group issued a report (2019) which projects the three- to five-year future of data and analytics technologies. They forecast augmented analytics, continuous intelligence, and explainable artificial intelligence as the top trends that have significant disruptive potential. An associated diagram (see Figure 4) was shown at the 2019 Gartner Data & Analytics Summit (Sallam, 2019). As these technologies move towards areas of newer mathematics and computer science trends, it is possible that the business purpose could get lost in the realm of computational reasoning. We can see this focus on the automation of the results with software, such as IBM Watson, that looks at your data and tries to guess the questions you want to answer and SPSS Modeler's "Automated Model Nuggets." This trend will increase the need for a "business analytics" degree to provide that "business translator" perspective.

We foresee that as higher education administrators and company executives begin to use the new buzzwords artificial intelligence and machine learning, our jobs as professors will expand to provide insight into the terminology and clarification around what these technologies are and can (and cannot) accomplish. We must continue to promote the advantages of having a degree that not only focuses on modeling, but also on the business landscape, the data management side (including cleaning, governance, storage, querying, etc.), and the "so what" at the end that provides students the framework to tell the data story.

As interesting and volatile as the previous 12 years have been, the next 12 years will be even more telling. While MIS has continued to have an existence within larger Schools of Informatics at some universities, whether or not this will continue to occur within the rapidly increasing interdisciplinary schools of data science is unclear. Schools such as the Universities of California, Virginia, Michigan, and Oregon have all recently announced large interdisciplinary efforts in analytics or data science, attempting to bring under one fold the many places where analytics education will occur across the university campus. While the goals are laudable, it is up for debate whether the current disciplinary traditions will exist or are folded into another area. Similarly, will MIS departments that are increasingly housing analytics be able to exist on their own, or exist within business schools, or will they be wrapped into entirely new disciplines, colleges, or departments?

While the need for it will continue, we furthermore question whether the term "business analytics" will even exist outside of academic contexts twelve years from now. Around the turn of the 21st century when electronic commerce was immensely popular, many well-known universities started Bachelor's or Master's degree programs in electronic commerce. An Internet search in July 2019 found that degrees in electronic commerce, outside of a handful of for-profit universities, were largely non-existent. There were a few concentrations in other degree programs, but electronic commerce degrees are largely history. Outside of certain academic journals and buzzwords, the term has largely faded away as "electronic commerce" is now just "commerce." It is possible, perhaps even likely, that "business analytics" will just become "business."

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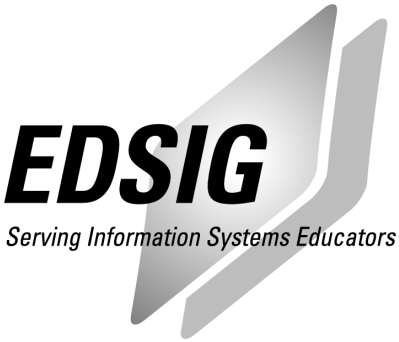

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