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A Business Analytics Maturity Perspective on the Gap between Business Schools and Presumed Industry Needs

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Abstract:

Business analytics is a fast-growing job market for business school graduates. Hence, researchers have made many calls to enhance business analytics training in business schools to meet the growing market demand for analytics-savvy employees. A growing set of business analytics courses have begun to address these calls. In this paper, we examine the maturity of business analytics offerings in business schools in the United States by analyzing current business analytics-related course offerings of the top 104 business schools (363 courses) and 20 unranked business schools (51 courses) in the United States. We analyze these data by examining the types of courses offered and rank the schools based on their maturity levels in terms of business analytics offerings. Our findings indicate that, to the extent that these schools reflect what is happening across the nation, business schools still have a long way to go before they reach higher levels of business analytics maturity and that they are not yet in an ideal position to serve the presumed industry needs. We offer actionable recommendations.

Keywords: Business Analytics, Education, Maturity Levels.

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"*Despite recent growth, the programs and curricula in data analytics are far from meeting the increasing demand, and demands, of business.*"

—Dan LeClair (2016), Executive Vice President and Chief Operating Officer, AACSB International

1 Introduction

The volume, variety, velocity and veracity of data have been growing in many contemporary organizations (Dearstyne, 2012; Ignatius, 2012). Such organizations transitioned over the last decade from talking about gigabytes of data to talking about petabytes and beyond; from weekly data loads to the data warehouse and near real-time data transfers; from fixed past-looking reporting to ad-hoc predictive modeling; from relying mostly on internal operational data for decisions to relying on multiple sources including external ones; and from dealing with structured data stored in traditional entity-relationship models to unstructured data stored in flatter data structures and in distributed storage architectures. When companies start analyzing such data and build cultures and infrastructure of harnessing value from these data (i.e., engaging in business analytics (BA)), they can make faster and better decisions and, ultimately, become more competitive (McAfee & Brynjolfsson, 2012). In this study, we use the term business analytics to describe the use of data ("big" or "small") and data storage, retrieval, and analysis tools for gaining efficient and effective insights for decision making. We use this term over other similar terms (e.g., business intelligence, data science) for two key reasons. First, it seems to be more popular than the others, at least in business school settings. This choice is convenient, though, and we could have used other broad terms, such as business intelligence, interchangeably. Second, this term is broad and reflects the business orientation of our focus as opposed to terms such as data science, which imply a narrower focus (e.g., often excluding the strategic impact of BA on firms) and which are more popular in non-business schools (e.g., math, computer science). We also prefer this term over the term "big data" since not all data are "big" but still require storage, retrieval, and analyses capabilities for organizations to benefit from data-driven insights, and what is "big" versus "small" is subjective..

Given these potential benefits, many organizations have invested in the technologies and skills required for facilitating this transformation. Investment in BA seems to be a top priority in many organizations (Gartner, 2013), which the BA business's revenue growth reflects. For example, BA software revenues increased from US$17.5 billion in 2005 (IDC, 2010) to almost US$35 billion in 2012, and research firms expect this pattern to remain over the next several years (IDC, 2013). For such investments in BA software, hardware, and processes to succeed, one should supplement them by transforming the workforce. The workforce in such organizations (not just information technology and dedicated analytics personnel) should be able to deal with the new BA tools, techniques, and processes at its disposal. Otherwise, the investment in BA-centric technologies and processes will not translate into the desired business results (Tambe, 2014). Indeed, while many firms report on investments in BA, few report on any gains due to these investments (eMarketer, 2015) possibly because BA professionals with deep understanding of business processes and metrics and BA-savvy employees are hard to find and have become a sought-after product of business schools (Davenport, 2013a, 2013b; Davenport & Patil, 2012).

However, providing the industry with the qualities it desires seems to be challenging or at least lagging because the BA savviness of the current workforce is not always satisfactory (Ward, Marsolo, & Froehle, 2014). The demand for employees in the analytics discipline surpasses the supply in all business sectors (Solomon, 2014). Only 26 percent of companies feel that their analytics needs are met (Smith, 2016). These are the sorts of employees that should have business, information systems, and analytics skills (Watson, 2014). These needs behoove business schools to develop appropriate business analytics courses and programs for all majors.

One can presume that the lucrative job market that the abovementioned shortage has created also appeals to prospective students. Consequently, the demand for at least some BA courses and programs has increased beyond capacity. To illustrate, in 2015, the Master of Science in Analytics at North Carolina State University received close to 800 applications for about 100 openings. Similarly, Northwestern University's Master of Science in Analytics received 600 applications for 30 openings (Thibodeau, 2014). The analytics skills gap, though, is not just in terms of BA professionals (e.g., data-warehousing experts, business and data analysts) but also in terms of business school graduates across disciplines and majors (e.g., marketing, human resources, finance, accounting). Businesses often expect such graduates to use BA tools and apply a BA mindset in various situations (Bhimani & Willcocks, 2014; James, Maringer, Palade, & Serguieva, 2015; Loebbecke & Picot, 2015; Ulrich & Dulebohn, 2015). Despite this recent

growth, the programs and curricula in data analytics are far from meeting the increasing demands of business (LeClair, 2016). Therefore, a gap between business school BA training and industry needs may threaten potential gains due to business analytics investments, and current BA training paradigms may not adequately prepare business students for contemporary work environments.

Business schools are one entity with the opportunity to provide the training that contemporary workforces require and close the abovementioned business analytics skills gap. To illustrate some aspects of the needed transformation, a business student majoring in information systems ten years ago needed to have background in traditional data storage and management. In contrast, contemporary graduates in this business school who BA-intensive organizations would hire would need to be familiar with data warehousing, reporting tools, real-time data transformation and loading, and perhaps even technical issues such as distributed data storage architectures (e.g., Hadoop and MapReduce). Similarly, business graduates working in BA-centric organizations, even though they may not major in information systems, statistics, or operations management, would still need to be familiar with the BA tools at their disposal and be able to engage in reporting, visualization, and analytics. They may also need, in some cases, to participate in analyzing and designing BA solutions for their departments (e.g., marketing, HR, finance, etc.). In fact, Solomon (2014) found that 28 percent of employees used predictive tools and predicted that this figure will rise to 42 percent in the next few years; in addition, Solomon found that 84 percent of employees would like their workplace to integrate analytics into their daily work.

Indeed, business schools were not left oblivious to these trends, and the number and depth of business analytics courses, concentrations and degree programs and the availability of BA teaching materials have substantially increased over the last several years (Wixom et al., 2014). Preparing students for a typical business analytics role includes foci on four major content domains: data analysis, databases, data warehousing, and business analytics (Gupta, Goul, & Dinter, 2015; Mitri & Palocsay, 2015; Schiller et al., 2015; Wixom et al., 2014; Wixom et al., 2011) . Business schools offer an increasing number of courses in all of these domains (Gupta et al., 2015; Mitri & Palocsay, 2015; Wixom et al., 2014). However, we do not know if they offer a sufficiently large cluster of courses such that their graduates have sufficient knowledge in all four content domains. The extent to which these business schools cover the abovementioned content domains defines their level of BA maturity and, in essence, determines how well they can prepare well-rounded students for the lucrative BA job market.

In this study, we operationalize and measure the BA maturity levels among leading and unranked business schools and make and explore insightful inferences regarding the extant status quo of BA education in business schools. In particular, we address the following questions:

Q1: After several years of considering and introducing business school courses in analytics, how far have we reached in catering to the presumed market needs as reflected in the four abovementioned content domains?

Q2: Do graduate programs do a better job than undergraduate programs in catering to the broad set of knowledge needs?

Q3: Is the extent to which schools address the content domains associated with their ranking, and are there differences between ranked and unranked business schools?

Q4: Ultimately, are business schools in a good position to cater to all relevant knowledge domains and even close the BA skills gap described above?

Answering such questions has important implications because it can help business schools to reflect on their BA offerings and guide them toward producing more well-rounded BA graduates and even better cater to market needs.

2 The Study

To examine the issues we mention in Section 1, we collected and analyzed data on BA related courses offered by the top 104 business schools in the United States (US) as per the US News and World Report (US News, 2014) and 20 randomly selected unranked business schools (and presumably with less favorable reputations compared with the ranked ones). We asked two independent coders to locate such

courses on the universities' websites and also used external reports to locate such courses[1]. We next asked these coders to classify the courses into predefined categories (the content domains we mention in Section 1) based on the description or syllabi provided on the websites. Both coders were graduate research assistants who have taken BA courses and who have knowledge of BA offerings and the BA job market. We trained them to look for data science- and business analytics-relevant courses on university websites (given that many terms may relate to business analytics, we wanted our search to be broad rather than narrow) and tested their ability to do so in several dry-runs on schools not included in this study. The coders proved to be proficient and consistent in their ability to find, understand, and classify BA-related courses.

The coders classified the courses based on their level (undergraduate and graduate, including PhD level) and overarching BA knowledge domain (database, data analysis, business analytics, data warehousing). The coders used the following subjects/topics to classify the courses:

Database: courses that primarily covered database concepts, design, management, and/or implementation.

Data analysis: courses that primarily covered applied statistics, decision sciences, data mining, machine learning, predictive analytics, or domain-specific models and techniques such as marketing analytics.

Business analytics: courses that primarily overviewed or introduced business analytics. Such courses often covered topics such as foundations of business intelligence, data visualization, big data, and their roles in business strategy and in improving business performance. Also, we included courses that included topics from multiple other categories (data analysis, database, and data warehousing in this category. We reasoned that, if a course did not focus on a topic, it was an overview course that only touched on each topic but did not provide in depth knowledge of each topic. This list also included advanced introductions to business analytics and capstone or a final project courses.

Data warehousing: courses that primarily covered data warehousing concepts, design, management, and/or implementation.

The coders also categorized the courses depending on whether they focused entirely on BA (we called this category "directly BA") or merely supported BA skills (we called this category "foundation BA"). The directly BA group included relatively new or redesigned courses and primarily covered key elements of analytics. The foundation BA group included courses that existed before the rise of business analytics but provided students with data management and quantitative skills needed for more advanced BA-specific courses. An example of a directly BA course is "data mining for managers", which focuses solely on BA and is a key theme in BA training (Watson, 2014). An example of foundation BA course is a database course. We need to distinguish these two course types because it can shed light on the extent of effort that schools put into shifting to contemporary and comprehensive BA training rather than focusing on or re-packaging existing knowledge domains (e.g., database and business statistics) that relate to and serve as a basis for BA.

Next, two information systems professors reviewed the lists and websites and the classifications that the coders produced. They reconciled the minor differences among the independent raters. This process resulted in 363 valid course records, which we then analyzed.

Individuals in both academic and industry settings use the two common and related terms data science and business analytics. As such, we accounted for both terms in our search. With that said, business schools do not commonly offer data science-type courses and programs. While business analytics (BA) and data science (DS) programs typically cover common subjects, they generally differ in their approach and depth of coverage. The BA and DS programs, in essence, have matured into two distinct entities. Business schools almost always offer business analytics (and related programs, such as marketing analytics and business intelligence), and these courses typically focus on the business aspects of analytical solutions. Of the 23 schools with top-ranked master's programs in analytics covered in a recent article, nine were business schools (Masters in Data Science, n.d.). These 23 programs used names such as business analytics (5), marketing analytics (2), business intelligence (1), and analytics (1). The other 14 schools listed in this article offer data science programs, which schools commonly offer in collaborations with multiple departments from engineering, science, mathematics, and business colleges.

[1] Data Informed's map of university programs in big data analytics (http://data-informed.com/bigdata_university_map/) and new data science higher education program in 2014 (http://www.mastersindatascience.org/).

Data science programs tend to have a narrower focus compared with business analytics programs and cover more in-depth technical subjects, such as statistics, algorithms, programming, and big data technologies. Business analytics students also get some exposure to most of these topics in courses offered in the business analytics program but generally learn about techniques and methods to use these technologies in solving business problems rather than learning technologies and algorithms per se. Business analytics programs and courses generally broadly cover business issues and business analytics applications in organizations and cover only the needed technical details of analytics.

Of the top-nine business analytics-type programs, none required any course outside the business school. However, of the other 14 data science-type programs, four had one or more (either required or elective) business analytics-type courses; the majority relied on computer science, math, and engineering courses. We included all business analytics courses offered in the business schools we surveyed regardless of whether business analytics or data science programs offered them. In essence, we included a business analytics program course if a business school offered it. We specifically considered all business analytics and data science type undergraduate and graduate (including PhD-level courses) offered in the business school. We did not consider the programs to which these courses belonged.

We analyzed our data in three key ways. First, we processed course frequencies to understand how the different categories of directly BA and foundation BA courses were distributed across graduate and undergraduate programs. We performed this step to detect possible differences in undergraduate and graduate training offerings in the area of business analytics. Second, we aggregated data by school/university and developed two potential BA maturity scales along which we ranked each school. We performed this step to assess the extant level of BA maturity in business schools. We then correlated these ranks with the school's national ranking (for ranked business schools) to detect possible associations. Third, in the two previously described analyses, we compared ranked (representing presumably top schools in the nation) and unranked business schools (representing schools with presumed lower reputation compared with the ranked ones) in terms of their BA offerings to further shed light on associations between BA maturity and offerings and each school's relative standing.

3 Analysis and Results: Business Analytics-related Courses

Tables 1 and 2 outline the distribution of courses along the examined categorical dimensions for the top-ranked and unranked business schools. To account for the differences in the population/sample size, we divided the frequencies by the respective sample sizes. We report these numbers in parentheses, and they reflect the average number of courses per school in each category.

Table 1. BA-related Courses (Averages in Parentheses) by Category in the Top 104 Business Schools (n = 104)

		Program level				Total
		Undergraduate		Graduate		
		Foundation BA	Directly BA	Foundation BA	Directly BA	
BA course type	**Business analytics**		27 (0.26)		44 (0.42)	**71 (0.68)**
	Data analysis	20 (0.19)	40 (0.38)	30 (0.29)	80 (0.77)	**170 (1.63)**
	Database	42 (0.40)		70 (0.67)		**112 (1.08)**
	Data warehousing		5 (0.05)		5 (0.05)	**10 (0.10)**
Total		**62 (0.60)**	**72 (0.69)**	**100 (0.96)**	**129 (1.24)**	**363 (3.49)**

Table 2. BA-related Courses (averages in parentheses) by Category in Unranked Business Schools (n = 20)

	Program level					Total
		Undergraduate		Graduate		
		Foundation BA	Directly BA	Foundation BA	Directly BA	
BA course type	**Business analytics**		8 (0.40)		1 (0.05)	**9 (0.45)**
	Data analysis	15 (0.75)	5 (0.25)	2 (0.10)	2 (0.10)	**24 (1.20)**
	Database	15 (0.75)		3 (0.15)		**18 (0.90)**
	Data warehousing					**0 (0.00)**
Total		**30 (1.50)**	**13 (0.65)**	**5 (0.25)**	**3 (0.15)**	**3 (0.15)**

We can make several observations based on this analysis. First, the top business schools offered significantly more BA-related courses compared with the unranked schools—a difference that seems to be much more pronounced at the graduate level. The average number of BA related courses was 3.49 for the top business schools and 2.55 for the unranked schools. Graduate programs at the top business schools had, on average, 2.2 BA-related courses, whereas graduate programs at the unranked schools had, on average, 0.4 such courses.

Second, the top business schools offered the majority of the BA-related courses at the graduate level, but we found an opposite result for the unranked schools. For example, unranked business schools offered on average 2.15 undergraduate BA related courses; however, the top ranked schools offered, on average, 1.29 such courses. Thus, it seems that undergraduate students, though presumably an important part of the future workforce that contemporary organizations require, do not receive as much BA training as their graduate student counterparts do in top schools, which adds to the gap between industry demands and university supply that we mention in Section 1.

Third, it seems that the examined universities (both top ranked and unranked) focus mostly on foundation database and data analysis courses and less on BA-specific courses such as data warehousing and general business analytics courses (e.g., overview courses dedicated to business analytics and big data). BA-specific courses represent only 22 percent and 18 percent of the total BA courses in the top-ranked and unranked schools, respectively. Hence, the schools emphasize traditional database and analysis topics instead of more advanced and BA-specific courses, such as data warehousing and general analytics courses. As such, we can see that this emphasis may constitute why there is a potential gap between industry needs and business school BA training and, consequently, why there is a short supply of data warehousing professionals (Everett, 2011). We can only speculate that this focus on traditional courses that relate to analytics but are not BA-specific arise from the lag in academia to teach the skills that industry requires; it may take time to recruit and train faculty to teach these relatively new concepts.

Fourth, while the top-ranked schools had an almost equal division between directly BA courses (72) and foundation BA courses (62) at the undergraduate level, they had proportionally more directly BA courses at the graduate level (129 vs. 100). Again, this finding shows that undergraduate students may not be exposed to the same BA issues and to the same extent as their graduate counterparts do in the top schools, which may point to an important gap in undergraduate business school training in the US.

Fifth, the unranked schools had more foundation BA courses at both the undergraduate and graduate levels (but especially at the undergraduate level). This finding implies that unranked schools offer mostly traditional foundation BA courses and focus less on innovative, cutting-edge BA-specific solutions. In contrast, top-ranked schools in the US have more balanced offerings. It seems that the top-ranked schools have made some progress in offering BA-related courses, especially at the graduate level, but unranked schools still have progress to make because they lag significantly in offering directly BA courses at both the ungraduated and graduate levels.

4 Analysis and Results: University-level Business Analytics Maturity

After analyzing the BA-related course pool on a course basis, we aggregated data for each business school and classified each school's level of BA maturity based on the frameworks we describe below. BA implementation and operation include three main components: data capture and management, analytics and business intelligence, and performance management (Watson, 2014; Wixom et al., 2014). As such, one can assume that ideal BA education should cover these components in dedicated courses. One can also assume that well-rounded students who will receive BA training should be exposed to all of these topics. Hence, the BA maturity level of schools reflects the extent to which their relevant dedicated courses cover these BA facets. These three areas of BA practice correspond to four types of BA courses discussed in the previous sections. We explain the relationships below.

The first BA element, data capture and management, covers collecting structured and non-structured data from various internal and external data sources. It also covers loading these data into relational and non-relational data stores. Many information systems departments in business schools offer a required course that covers foundations of relational databases. Some schools have also started offering data warehousing courses that also cover contemporary techniques to capture and manage big data (including non-relational components and distributed data storage), which includes topics such as column-oriented databases, NoSQL, Hadoop, MapReduce, and, occasionally, extract-transform-load (ETL) processes. Database and data warehousing courses normally cover this BA practice area.

The second BA element, analytics and business intelligence, covers the basics of business intelligence, the components and approaches of business analytics solutions, and the statistical and computational techniques used in business analytics. Generally, schools offer this element in three categories of courses: data analysis, foundations of business intelligence/analytics, and advanced analytics. Many business schools require a core course on introducing data analysis or business statistics, which typically covers topics in descriptive (including some elements of data visualization), predictive, and prescriptive statistics. Business schools that offer specialized programs (e.g., BS, MS or MBA in business analytics) typically deliver foundations of business intelligence/analytics and advanced analytics courses. The foundation of business intelligence/analytics module overviews the key technologies, motivations, strategies, and ideas related to BA/BI. Courses that pertain to this module typically cover issues such as why companies should invest in BA; uses of BA such as summarizing and presenting data via meaningful charts, reports, scorecards and dashboards; decision making using information such as summaries and decision support systems outputs; and the technologies needed for implementing BA solutions. They also sometimes cover case studies describing successful and failed BA-implementation projects, user acceptance of BA solutions, and the strategic effects of BA on firms and industries. Several business schools present these topics in a shallower manner in an introduction to information systems course. Advanced analytics courses typically cover the statistical models required for making various types of complex predictions, inferences, and analyses. Courses in this domain build on basic statistics courses (and, hence, we use the term "advanced" here), which most business schools have offered (e.g., introduction to business statistics), and cover more BA-relevant analytical techniques. Analytics and business intelligence courses typically focus on data- and text-mining techniques, on analytics forecasting, and on predictive and prescriptive analytics. They teach students how to identify meaningful patterns or relationships in data, predict future events, and assess the attractiveness of various options (e.g., which market segment will more likely to prefer our product over existing products? Which firm is more likely to default on its loan given its financial ratios?). The business analytics and data analysis course categories we discuss in Section 3 cover this BA practice domain.

The third BA element, performance management, broadly covers performance measurement, mentoring, and decision making for improving business performance. Courses covering this topic often employ a more managerial perspective and focus on finding the key performance indicators an organization should focus on; how to define, measure, record and store these performance indicators; and how to retrieve, analyze, and make business decisions based on these analyses. Several business schools offer such courses and, in many cases, use case studies to illustrate the full decision making cycle involved in performance management. The majority, however, discuss such issues in other courses. Hence, the general business analytics type of courses we discuss in Section 3 cover this BA practice domain.

We acknowledge that other courses can cover the abovementioned BA components to some extent (e.g., an introduction to information systems course can offer a module on business analytics). However, this approach largely facilitates basic familiarity and certainly does not provide the same level of perpetration

in each one of the BA facets as a dedicated and focused set of BA courses does. Hence, our maturity model focuses on full courses in the abovementioned BA knowledge and practice domains rather than on modules in courses.

One can classify the courses covering the abovementioned BA-specific components into three overarching and distinguishable categories: general/overview BA courses (we called them general business analytics (GBA)), courses that focus on data management specifically for business analytics (excluding typical foundation database and similar courses) (we called them data warehousing (DW)), and courses that focus on analytical and statistical models (excluding basic data-analysis courses such as elementary statistics) (we called them data analysis (DA)). Because performance-management courses can pertain to any of these categories (e.g., they could be general or focus on analytical models), we included them in the proper abovementioned categories based on their specific content.

Using this schema, we recorded the number of direct BA courses business schools offer in each one of the three direct BA course groups: general business analytics (e.g., an intro/overview course), data management for BA (e.g., a data warehousing course), and data analysis (e.g., a data-mining course). We expected that BA-mature schools would offer courses that cover all three categories with sufficient depth (of at least one full course). A well-rounded graduate who is ready to take a BA-related job should be familiar with all of the BA elements and ready to use them in work settings. Even though different jobs require different foci on the abovementioned BA elements (e.g., a financial analyst and BA project manager would need different skillsets), if graduates want to easily transition between BA-related jobs or extend their marketability to a broader set of potential BA-related positions, they should have practical knowledge regarding all BA-related area, as opposed to being familiar with just one or a small subset of BA areas. This wide-net approach is also useful because, based on our anecdotal interactions over the last several years with hundreds of students, we have realized that most students do not know in advance what area of analytics they want to work or specialize in or whether they will even need analytics in their line of work. Such needs emerge later in their education cycle when they obtain internships or search for jobs.

Applying the above logic, we constructed two BA-maturity scales and ranked each school on these scales based on its BA-specific offerings. In the first BA-maturity framework, we assumed that all three BA course areas are equal in importance and, consequently, evenly contribute to a school's BA maturity. In this framework, we gave schools with no direct BA courses (though other courses in such schools may mention BA) a maturity score of 0. We gave schools that did not offer a direct BA course in any two of the three groups a maturity score of 1. We gave schools that offered at least one direct BA course in at least two groups a maturity score of 2. Lastly, we gave schools that offered at least one BA course in each of the three groups the highest maturity score of 3. In essence, this BA maturity framework captures the number of BA areas a school covers with dedicated BA courses.

In the second BA maturity framework, we assumed that a general business analytics (GBA) course was more important than a DA or DW course based on the assumption that GBA courses (i.e., BA overview courses) seem to include and cover more and broader BA topics than DW or DA courses do). Using this logic, we gave schools with no BA-specific courses a maturity score of 0. We gave schools that did not offer a BA overview course but offered either a BA-specific data-management or data-analysis course a maturity score of 1. We gave schools that offered at least one BA-specific data-management and one data-analysis course but did not offer a BA overview course with a maturity score of 2. We gave schools that offered an overview BA course but not DW and DA courses a maturity score of 3. We gave schools that offered an overview BA course with at least one course from the other two domains (BA-specific data-management or data-analysis courses) a maturity score of 4. Lastly, we gave those schools that offered at least one course in each of the above categories and gave students the opportunity to study all the components of BA through dedicated courses a maturity score of 5.

Tables 3 and 4 use the above two BA-maturity frameworks and outline the distribution of levels of BA-maturity by level of studies in ranked and unranked schools. Note that, even though the assumptions behind each maturity scale are slightly different, the ratings they produced were consistent ($r = 0.88$, $p < 0.001$ and $r = 0.89$, $p < 0.001$ for undergraduate and graduate programs, respectively). These maturity scores also highly correlated with the total number of BA-specific courses each university offered ($r = 0.69$ to 0.89 depending on the maturity scale used and the level of studies, $p < 0.001$). Hence, we deemed these BA maturity rankings to be consistent and reliable. Ultimately, they pointed to similar conclusions.

Table 3. BA-maturity Levels by Level of Studies and Ranked vs. Unranked Schools Using the First BA Maturity Framework*

BA maturity level	Top-ranked schools				Unranked schools			
	Undergrad	%	Graduate	%	Undergrad	%	Graduate	%
0	57	55%	40	38%	10	50%	17	85%
1	38	37%	46	44%	9	45%	3	15%
2	9	9%	17	16%	1	5%	0	0%
3	0	0%	1	1%	0	0%	0	0%
Total	**104**		**104**		**20**		**20**	
Weighted average	**0.54**		**0.80**		**0.55**		**0.15**	

*** Level 3:** at least one course in each of the three areas.
Level 2: at least one course in two out of the three areas.
Level 1: at least one course in one out of the three areas.
Level 0: no BA-specific courses.

Table 4. BA-maturity Levels by Level of Studies and Ranked vs. Unranked Schools Using the Second BA Maturity Framework*

BA maturity level	Top-ranked schools				Unranked schools			
	Undergrad	%	Graduate	%	Undergrad	%	Graduate	%
0	56	53.85%	40	38.46%	10	50.00%	17	85.00%
1	28	26.92%	32	30.77%	4	20.00%	2	10.00%
2	2	1.92%	1	0.96%	0	0.00%	0	0.00%
3	11	10.58%	14	13.46%	5	25.00%	1	5.00%
4	7	6.73%	16	15.38%	1	5.00%	0	0.00%
5	0	0.00%	1	0.96%	0	0.00%	0	0.00%
Total	**104**		**104**		**20**		**20**	
Weighted average	**0.89**		**1.39**		**1.15**		**0.25**	

* **Level 5:** at least one each of GBA, DW, and DA
Level 4: at least one GBA; at least one DW or DA
Level 3: one GBA (no DW and no DA)
Level 2: at least one DW and one DA (no GBA)
Level 1: at least one DW or DA (no GBA)
Level 0: no BA-specific courses

As we can see, the vast majority of the examined business schools (top ranked and unranked) reached low levels of BA maturity and few reached full maturity. In other words, the existing course offerings at most top ranked and unranked schools, as represented on their websites, fail to cover all major components of business analytics education both in their undergraduate and graduate degree programs. Only a handful of schools offered a breadth of courses that covered the data management, analysis, and general business-analytics skills needed to become a well-rounded business analytics professional, and the rest provided partial or lack of coverage of key BA topics in dedicated BA courses.

The maturity of graduate programs in the top schools (averages of 0.80 and 1.39) is clearly higher than that of programs in unranked schools (averages of 0.15 and 0.29). We found a similar result for the undergraduate programs (averages of 0.54 and 0.55 in the top-ranked schools and averages of 0.55 and 1.15 in the unranked schools). Variance analyses indicated that all of these differences were statistically significant ($p < 0.01$) and consistent across the two proposed BA maturity frameworks. Hence, we can conclude that graduate programs at top-ranked business schools are more BA-mature than others; yet, they are still relatively far from high levels of BA maturity. We found an opposite pattern for the undergraduate programs. The BA maturity of undergraduate programs in the top-ranked schools was slightly lower than this observed in unranked schools. This effect, however, was not statistically significant,

which suggests that ranked and unranked schools do not substantially differ in the BA maturity of their undergraduate programs.

Lastly, correlation analyses revealed that a school's ranking spot was negatively associated with the BA maturity of its graduate program (BA maturity score 1: $r = -0.24$, $p < 0.05$; BA maturity score 2: $r = -0.21$, $p<0.05$; high ranking spots represented by low numbers; hence, the negative correlation). That is, schools ranked higher on the US News report had higher BA maturity in their graduate programs compared with schools ranked lower. However, we observed no significant association between BA maturity levels and school rankings for ungraduated programs. This finding suggests that top-ranked business schools tend to incorporate more BA-specific courses into their graduate curricula than their lower-ranked counterparts do. All schools seem to be lagging in their BA-specific undergraduate course offerings.

As for why, one reason might be that top schools are visionaries and market leaders and, consequently, on average, might be able to see the markets' BA needs better than others do. Another plausible explanation is that they may also have better funding and resources than others and, consequently, on average, might be able to offer broader BA content than lower-ranked schools do. This finding may also be alarming because top business schools represent only a fraction of all business schools in the nation and, based on our findings, seem to be superior in terms of BA-specific course offerings to unranked schools.

5 Conclusion and Recommendations

To the extent that data available on the websites of leading and unranked business schools in the nation reflect a general trend, we found that business schools in the US largely did not reach acceptable levels of BA maturity. It appears that business schools, including the ones listed on the US News World Report, have a long way to go to reach higher levels of BA maturity both in graduate and undergraduate programs. Given the growing market demand for BA professionals and for managers and employees who are BA savvy, we recommend that business schools reflect on their curricula and programs, assess their levels of BA maturity using frameworks like the ones we used in this study, and strive to reach higher levels of BA maturity in the near future. They can do so by offering more/new BA-specific courses along the three course categories we propose in this paper (data warehousing and processing, quantitative business analytics, and general/overview BA courses).

Specifically, we recommend that business schools first assess their BA maturity level and consider whether it fits their desired goals (e.g., not all schools may want to produce BA-savvy graduates; it may depend on specific business needs and types of jobs in their geography and market). As a second step, if there is a gap between industry needs and their BA training in their local geography, they may use the frameworks we developed in this study to identify their deficits and come up with a plan to address them. For example, if a school's region has high demand for managers of BA projects and business analysts (these are top jobs in which we place their students) but the school offers only an overview/introduction to BA course, it may consider offering also courses in the business-analysis and data-management areas as a means to increase their students' marketability.

On average, the findings indicate that lower-ranked and unranked schools should widen their business analytics offerings and that all schools should improve these offerings for undergraduate students if they believe that BA is a lucrative market for their students. We recognize that doing so is easier said than done with limited resources. However, with a clear vision and a status-quo assessment using our proposed BA maturity frameworks, schools can at least seek to hire professors who can teach BA courses, which seemed to be the trend in the last cycle of MIS faculty hiring: many job postings in 2015-16 have focused on business analytics. Alternatively, schools can retrain some of their faculty such that they can teach the need BA courses. For example, SAS offers summer training workshops for faculty that schools can use to increase their capacity to deliver BA courses. Many certificate programs that faculty can participate in for increasing their BA teaching abilities also exist (Solomon, 2014).

Lastly, we acknowledge this study's limitations and associated possible future research directions. First, we provide a snapshot of current offerings. It would be interesting to observe changes in BA maturity over time. Second, we focus on classifying business schools courses along the dimensions of course categories and level of training. Since some programs allow business students to take courses from other departments (e.g., computer science) our assessment of maturity was internal only (i.e., inside the business school). Future research may consider extending our maturity framework and consider courses and capabilities external to the business school. Similarly, the dimensions of classification we employed,

while important, are not the only possible classification dimensions. Future research may further classify courses based on the programs to which they pertain (e.g., MBA vs MS in IS or business analytics vs. data science). Finally, it would be interesting to consider the impact of BA maturity on student marketability, job prospects, and pay. To address such issues, researchers should employ longitudinal designs and possibly compare BA-mature and with BA-immature schools in terms of their students' success after controlling for possible effects of other factors (e.g., school ranking).

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