

AN EXPLANATORY STUDY ON THE BUSINESS ANALYTICS PROGRAM IN THE U.S. UNIVERSITIES

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ABSTRACT

For the past several years, business analytics program or courses in universities around the world have been widely designed and developed as various businesses and industries have exceedingly demanded business data analyst and data scientists, because diverse types of big data have been available for the deep analysis to make a better decision making. This study is to examine how U.S. universities have designed and implemented business analytics programs and courses in terms of the degree program at the undergraduate/graduate level, the number of courses, and/or certificate program. Ninety-four (94) U.S. universities in the AACSB-Accredited Universities and Schools (2017) list were investigated using their Web sites. Based on the Web search, sixty (60) universities have developed business analytics programs at the undergraduate or graduate level. Also, the study explored curriculum of the business analytics program, which will suggest curriculum development for schools that will design and develop the business analytics program in the future.

Keyword: Business Analytics Program, Curriculum, AACSB, Data Scientist, Certificate Program

INTRODUCTION

Since the early 1980s, personal computers have been invented so as to improve personal, group, and organizational productivity so that data sizes stored for organizations have been increased in the exponential rate along with the development of technologies including the Internet-based Web, e-mails, social network services, Twitter, Facebook, YouTube, Amazon.com, etc. Like physical universe, the digital universe is growing very rapidly. In the digital universe, Turner (2014) said the digital growth rate is 40% a year. The size of the digital universe in 2013 was 4.4 zettabyte (ZB), which means 4.4 trillion gigabytes, and its growth rate is expected to be doubled every two years and by 2020. Then, the size will be grown to 44 ZB, combined with new and copying contents. Davenport et al. (2012) said that very high demand of data scientists today from any organizations is very similar to that of Wall Street quantitative analysts in 1980s and 1990s. Google's Chief Economist Hal Varian (2009) on Statistics and Data said, "I keep saying the sexy job in the next ten years will be statisticians. People think I'm joking, but who would've guessed that computer engineers would've been the sexy job of the 1990s?"

With enormous sizes and assorted kinds of stored data in the digital universe and high demands for data scientists and business data analyst in the many industries, it is very much imperative for business schools to design and develop courses such as data mining, business intelligence, and business analytics/business data analytics. The courses usually teach up-to-date knowledge and technical skills to collect, sort, analyze, and optimize data to solve business and management problems in various domains. Actually, numerous colleges and universities have already developed and implemented business analytics programs at the undergraduate/graduate level and business analytics certification programs while other universities are planning to develop the programs mostly in the business schools.

Business analytics programs have focused on relationships among information technology (IT), business world, and social network services world to find some discernable patterns or connections so that the results can be applied to decision making processes for better services and policy making in the varied areas of consumer services, public policies, hospitals, early alert system for students at risk, general school systems, and elections. As information system (IS) major came out as a necessary academic discipline in 1980s to bridge between business and computer fields, business analytics programs in the 2010s connect among IT users, digital universe, consumers, and producers of

business world. The programs help prepare business students, particularly IS major students to know how to gather data, arrange in group, and analyze them for calculating, communicating, predicting, and visualizing the results. Business analytics programs in business schools, therefore, have been designed to emphasize data-driven decision making with unstructured or structured data rather than holistic-driven decision making process in an organization.

This study is to examine business analytics program in business schools in U.S. using AACSB-Accredited Universities and Schools listed in its website (2017). The research questions are as follows: How many universities offer business analytics degree programs at the undergraduate/graduate level, and how many courses are required for the program? How many universities offer business analytics certificate programs, and how many courses are required for the business analytics certification program? What skills are the major elements of the business analytics program? In addition, reviewing business analytics programs and courses in the universities on the AACSB-Accredited Universities and Schools (2017) list, the authors will suggest curriculum for business analytics programs to universities that will develop the program in the near future.

LITERATURE REVIEW

Massive Stored-Data, Big Data, and Business Analytics

Organizations have more data accumulated now than ever before. Business data analysts and data scientists collect data, sort, analyze, interpret, and use it to find ways to increase business efficiencies, reduce risk, and measure organizational performance. To see the industrial demand for business data analyst and its related fields, Best Jobs in America (CNN Money, 2017) are listed as follows: statistician, software developer, programmer analyst, user interface designer, database administrator, IT security director, analytics manager, IT business analyst, IT training specialist, e-learning specialist, information technology operations manager, Web master, information technology director, database analyst, information assurance analyst, and mobile apps developer. 16 out of 100 best jobs listed belong to IT or IT related positions, and analytics manager is ranked 41st.

Big data becomes a driving force for the business analytics. One of many areas is social network services, which have been accumulating massive digital data, which, for example, needs social network analysis. Bernard Marr (2014) explained five Vs involved in big data: volume, velocity, variety, veracity, and value. Beal (2017) illustrated that big data refers to a very large amount of data combined with structured and unstructured data, which regular relational databases and techniques can't process properly in time. That's why and how business analytics or business data analytics as a new wave become very popular and demanding program. Cooper (2012) described data analytics or business analytics as the process of developing actionable insights through the problem definition, the application of statistical models, and the analysis against existing and simulated future data.

Today's business world has been moving forward to make better decisions based on the data-driven decision-making rather than intuition or gut feelings-driven decision making. O'Reilly (2007) said we lived in new trends on IT, that is, data as the next Intel Inside. Even though decision makers can get by on their own intuition and real world business experiences, at the present time, the name of the game is data in the future. Ayres (2007) suggested that to work with super crunching numbers properly, three requirements were needed: large amounts data available, computer processing power, and accurate tracking systems available. In addition, Granger et al. (2007) emphasized that two most important parts in the IS curriculum design were marketing and curriculum, on which this research focused.

Levels and Development of Business Analytics Curriculum

To close the gap between the needs of the business industry and the academia, plentiful types of data analytics and business analytics courses, degree, and certificate programs for students have been developed. Evans (2016) defined in his book that business analytics refers to the use of data, IT, statistical analysis, quantitative methods, and mathematical or computer based models to help managers gain improved insights about their business operations and make better and fact-based decisions. Most business analytics courses are categorized into three levels: descriptive, predictive, and prescriptive analytics. Furthermore, Evans (2016) explained business analytics as an integration of three layers of subjects taught in the business school. First layer deals with statistics, modeling, and optimization model. Second layer involves business intelligence, data mining, simulation, risk, and what if analysis. Third area has

visualization, which can be taught for business analysts to communicate with decision makers or users. Sarah (2014) categorized the business analytics into four: descriptive analysis, predictive analysis, prescriptive analysis, and decisive analytics. Watson (2015) still described it as optimization analytics, predictive analytics, and descriptive analytics. On the other hand, Neil Chandler (2013) focused on different aspects in order to classify business analytics such as descriptive analytics of what happened, diagnostic analytics of why did it happen, predictive analytics of what is likely to happen, and prescriptive analytics of what should be done about it.

In terms of the course development, Topi et al. (2010) suggested that as technology evolved, undergraduate business analytics courses must include social media analytics. To implement the courses, Chen and Storey (2012) explained that business analytics can be labeled into business analytics 1.0, business analytics 2.0, and business analytics 3.0. According to Novak et al. (2017), business analytics programs in universities were designed to teach and train IS major students' technical skills such as data processing, algorithm understanding, quantitative skills of mathematics and statistics, critical and analytical abilities with creative story-making abilities. Under the fast changing digital environment, IS programs in business schools must adapt to the new opportunity coming from business industry's digital universe by designing and developing business analytics courses and programs, which successfully benefits IS major students.

RESEARCH METHODS AND DATA ANALYSIS

We utilized Web search method to collect necessary data using AACSB website (2017). From its website, we conveniently sampled ninety-four (94) out of 524 U.S. universities and schools listed as of June 25, 2017. It is about 18% of total number of universities and schools listed, and it represents about one of every five schools listed there. Since, as our research title shows, our main focus is on the U.S. universities and schools business analytics program, we selected universities only from the U.S., but we have not included international universities. Researchers, thus, employed the Web search method to collect basic information on the number of students enrolled, degree program and curriculum of business analytics (BA) programs at the undergraduate or graduate level.

Table 1. Basic Data of the Universities

Number of Students Enrolled	Number of Universities (Percentage)
Less than 10,000	28 (30%)
10,000 - 20,000	23 (25%)
20,001 – 30,000	22 (23%)
Greater than 30,000	21 (22%)
Total	94 (100%)

The universities examined are classified by the number of students enrolled. According to the Table1, twenty-eight (28) universities have less than 10,000 students enrolled, and twenty-three (23) universities had students between 10,000 and 20,000. Twenty-two (22) universities have enrolled students between 20,001 and 30,000, while twenty-one (21) universities have enrolled students more than 30,000. According to the Figure 1, out of ninety-four (94) universities, 60 universities currently offered business analytics (BA) programs. 21 universities offered BA programs at both the undergraduate and graduate levels while 30 universities offered master programs, mostly master of science (MS) degrees or master of business administration (MBA) degrees concentrating on BA. Only nine (9) universities offered BA programs only at the undergraduate level.

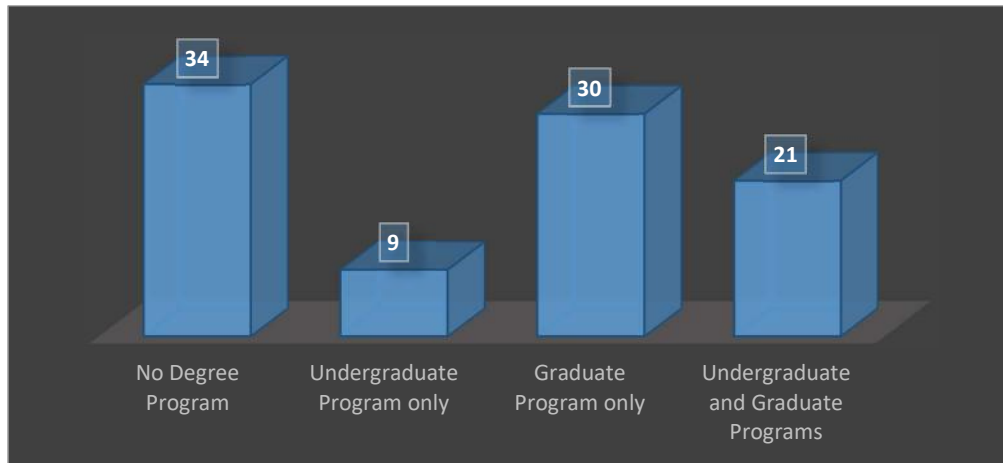


Figure 1. Number of Universities Offering Business Analytics Degree Program

Table 2. Business Analytics Degree Programs Based on the Number of Students Enrolled

Number of Students Enrolled	Business Analytics Programs				Total
	No Degree Program	Undergraduate Program Only	Graduate Program Only	Undergraduate & Graduate Program	
Less than 10,000	17	1	4	6	28
10,000 - 20,000	7	3	8	5	23
20,001 – 30,000	5	5	7	5	22
Greater than 30,000	5	0	11	5	21
Total	34	9	30	21	94

As shown in the Table 2, 17 out of 28 (61%) small sized schools whose enrollment is less than 10,000 do not have BA degree programs while 11 out of 28 (39%) small sized ones still offered BA undergraduate or graduate program. While 16 out of 21 (76%) big sized universities whose enrollment is more than 30,000 offered BA degree programs at the undergraduate or graduate level, 11 out of 21 (52%) big sized schools offered only at graduate programs. 16 out of 23 (70%) medium sized schools whose enrollment is 10,000 through 20,000 have BA degree programs at the undergraduate or graduate level while 17 out of 22 (77%) medium sized schools whose enrollment is 20,001 through 30,000 have BA degree programs.

Table 3. Online Business Analytics Programs

BA Programs	In-Class	Online	Hybrid	Optional Online	Total
Undergraduate Programs	8	0	1	0	9
Graduate Programs	23	3	3	1	30
Undergraduate & Graduate Program	17	4	0	0	21
Total	48	7	4	1	60

According to the Table 3, 48 out of 60 (80%) universities offered BA degree programs in the traditional in-class way while 12 universities offered online program. Out of 12 online BA programs, 7 universities offered 100% online programs, and 4 universities offered BA programs in the hybrid way, which means BA classes are offered either in the form of online as well as in-class or mostly online classes with in-class requirements for a couple of weekends in the case of Clemson University. One university, Georgia Institute of Technology offered BA online classes for Master

of Science degree programs as an option. If students for the program take the online option, then it will take two years for the students to complete the program while it takes one year for students to take the traditional in-class program.

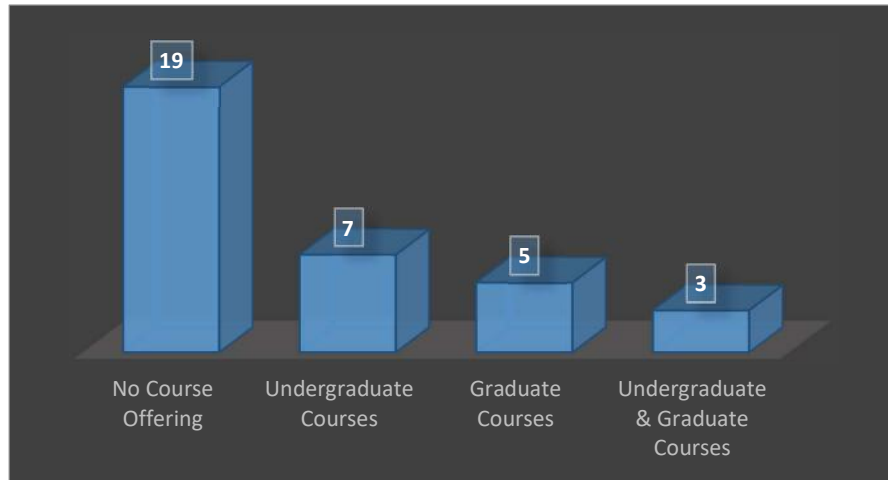


Figure 2. Number of Universities Offering BA Courses without Degree Programs

As shown in the Figure 2, 34 out of 94 universities did not offer BA degree programs. However, 15 out of 34 (44%) universities offered BA classes at the undergraduate or graduate level without having BA degree programs. It seemed that the universities currently offering BA courses at the undergraduate or graduate level would be likely to propose BA degree programs in the future. Most undergraduate degree programs offered about six (6) BA major courses in the curriculum. Master of Business Administration (MBA) degree concentrating BA typically required four (4) BA courses. Besides prerequisite classes, MS degree normally required between ten (10) and twelve (12) BA courses while a couple of universities required 15 BA courses or more.

Usually, prerequisite courses for undergraduate BA courses are mathematics, statistics, and basic computer applications. Prerequisite courses for graduate BA courses are generally probability and statistics, mathematics, programming, database, and business foundations including accounting, finance, management, and marketing. Regardless of BA degree programs, some universities started offering BA courses about the year 2010 to meet the growing demand for data consumers or data scientists from businesses and industries while most of the BA degree programs have been offered within the recent 3 years. It seemed that more schools will propose to have BA degree programs in the near future.

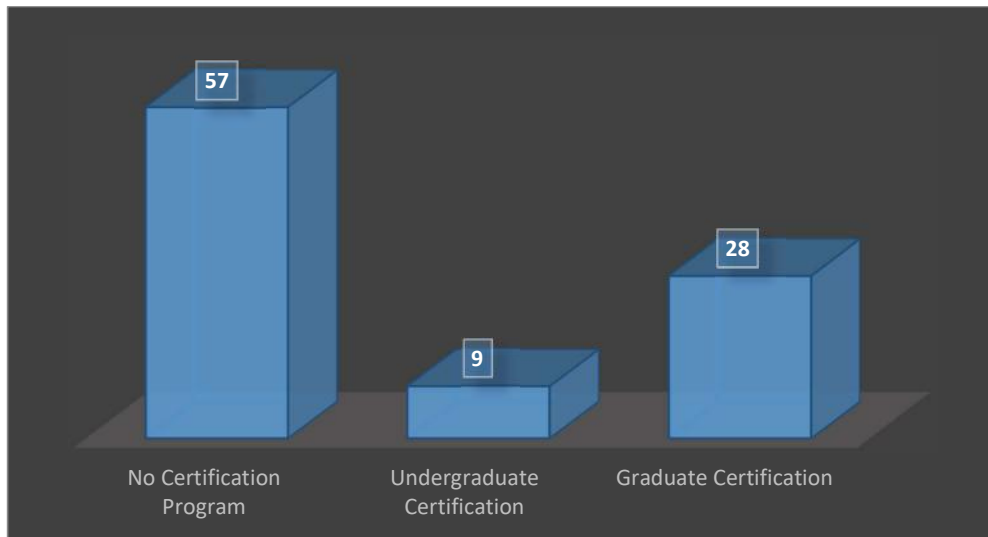


Figure 3. Number of Universities offering the BA Certification

While 57 out of 94 universities did not offer the BA certification program, 9 out of 94 universities offer undergraduate certification programs, and 28 out of 94 universities offered graduate BA certification programs. Universities required between 3 and 6 courses to complete for the BA certification, and nineteen (19) universities required 4 courses to complete for the certification regardless of the undergraduate or graduate certification program. Most universities offered vendor neutral BA certification programs while several universities offered vendor specific certification programs linked with software companies like SAS (i.e., Cleveland State University, University of South Florida, University of Tennessee at Chattanooga) or SAP (i.e., Lamar University).

There are varieties of BA courses offered in the undergraduate and graduate BA degree programs. Even though titles of courses are so much diverse, classic courses for the undergraduate and graduate BA programs are listed in the Table 4. According to the master level BA program of the Case Western Reserve University, courses are classified into three categories, such as, business core, analytics core, and applied business analytics core. Firstly, the business core means that students need to understand the business context of the data, particularly in the areas of accounting, finance, operation, and marketing. Secondly, the analytic core means that students should know how to handle and present data, and apply tools such as IBM’s CPLEX, R, SPSS, SAS, SQL, and STATA to conduct BA in the areas of statistics, data mining and visualization, and predictive modeling. Thirdly, the applied business analytics core means that students need to know how to apply the BA skills to make decisions in the business areas of accounting, finance, operation, and marketing.

Table 4. Undergraduate and Graduate Curriculum for BA Degree Programs

	Undergraduate Curriculum	Graduate Curriculum
Prerequisite Courses	Mathematics Basic Computer Applications	Probability and Statistics Database Programming Basic IT Business Foundations
Required Courses	Introduction to Business Analytics	Advanced Statistics
	Advanced Business Analytics	Advanced Programming (Python, SAS)
	Big Data/Business Data Analytics	Managing Big Data <ul style="list-style-type: none"> - Tools - Technologies - Applications
	Data Mining	Knowledge Discovery and Datamining <ul style="list-style-type: none"> - Transaction Mining and Fraud Detection - Web Mining - Social Network Analytics
	Structured Data Analysis	Unstructured Database Management
	Predictive Modeling	OR Modeling and Methods <ul style="list-style-type: none"> - Predictive Modeling - Optimization - Simulation
	Data Visualization and Digital Dashboards	Data Analytics and Information Visualization <ul style="list-style-type: none"> - Geographical Information Systems for Analytics
		Machine Learning
	Competing through Business Analytics <ul style="list-style-type: none"> - Marketing Analytics - Operations Analytics 	
	Business Analytics Capstone (Project)	

CONCLUSION

This study examined how U.S. universities have designed and implemented business analytics programs and courses in terms of the degree program at the undergraduate or graduate level, the number of courses, and certificate program. Ninety-four (94) U.S. universities selected from the AACSB (2017) list were investigated using their Web sites. Based on the Web search, sixty (60) universities have developed business analytics programs at the undergraduate or graduate level. Thirty-seven (37) universities offered BA certificates at the undergraduate or graduate level. Also, the study explored curriculum of BA programs, which would suggest curriculum development for schools that will design and develop the BA program in the future.

As the limitation of the study, the web search employed for the study did not provide enough data on faculty qualifications, availability of funds for faculty training, future plans or proposals for the expansion of BA courses or programs, the number of students admitted to BA programs, and students' job placement after graduation, which can be collected and analyzed by the communicating with professors teaching BA courses or BA program directors through e-mail or phone calls. As a result, we may do further analysis after revising research method by improving our research method so that this research as a whole can be a more valuable one, and useful to creating business analytics program in the future.

REFERENCES

- AACSB International (2017). AACSB-Accredited Universities and Schools [online]. Available: <http://www.aacsb.edu/accreditation/accredited-members/global-listing>
- Ayres, Ian (2007). Why Thinking-by-numbers is the new way to be smart, Super Cruncher [online]. Available: <http://credu.bookzip.co.kr/resource/englishbook/pdf/ae30231.pdf>
- Beal, Vangie (2017). Big Data, WebOpedia [online]. Available: http://www.webopedia.com/TERM/B/big_data.html
- Chandler, Neil (2013). Agenda Overview for Analytics, Business Intelligence, and Performance Management, Gartner [online]. Available: <https://www.gartner.com/doc/2293025/agenda-overview-analytics-business-intelligence>
- Chen, H. C., Chiang, R. H. L., & Storey, V. C. (2012). Business Intelligence and Analytics: From Big Data to Big Impact. *MIS Quarterly*, 36(4), 1165-1188.
- CNN Money (2017). 100 Best Jobs in America, CNN Money [online]. Available: <http://money.cnn.com/gallery/pf/2017/01/05/best-jobs-2017/41.html>
- Cooper, Adam. (2012). Analytics? Definition and Essential Characteristics. CETIS Analytics Series, 1(5).
- Davenport, Thomas and Patil, D. J. (2012). Data Scientist: The Sexiest Job of the 21st Century, October 2012 [online]. Available: <https://hbr.org/2012/10/data-scientist-the-sexiest-job-of-the-21st-century>
- Evans, James (2016). Business Analytics: Methods, Models, and Decisions, Pearson Publishing, p. 3-7.
- Granger, M, Dick, G. Luftman, J. Slyke, C. V. and Watson, R. T. (2007). Information Systems Enrollments: Can They Be Increased? Communications of the Association for Information Systems (Volume 20, 2007) 649-659 [online]. Available: <http://aisel.aisnet.org/cgi/viewcontent.cgi?article=2624&context=cais>
- Marr, Bernard (2014). Big Data: The 5 Vs Everyone Must Know [online]. Available: <https://www.linkedin.com/pulse/20140306073407-64875646-big-data-the-5-vs-everyone-must-know>
- Novak, David & Hung, Do. (2017). Business Analytics Concentration in the Grossman School of Business [online], Available: https://www.uvm.edu/business/business_analytics_concentration

O'reilly, Tim (2007). What's Web 2.0 [Online]. Available: <http://www.oreilly.com/pub/a/web2/archive/what-is-web-20.html?page=3>

Shah, Tadrash (2014). Business Analytics – Applications and Practices for Continuous Iterative Exploration [online]. Available: <https://www.linkedin.com/pulse/20140716025330-163247341-business-analytics-applications-and-practices-for-continuous-iterative-exploration>

Topi, H., Valacich, J. S., Wright, R. T., Kaiser, K. M., Nunamaker, J. F., Jr., Sipior, J. C., & de Vreede, G. J. (2010). IS 2010: Curriculum Guidelines for Undergraduate Degree Programs in Information Systems. Communications of the Association for Information Systems, 1-81 [online]. Available: <https://www.acm.org/education/curricula/IS%202010%20ACM%20final.pdf>

Turner, Vernon (2014). The Digital Universe: Data Growth, Business Opportunities, and the IT Imperatives [online]. Available: <https://www.emc.com/leadership/digital-universe/2014iview/executive-summary.htm>

Varian, Hal (2009). The McKinsey Quarterly, January 2009 [online]. Available: <https://flowingdata.com/2009/02/25/googles-chief-economist-hal-varian-on-statistics-and-data/>

Watson, Hugh (2015). Business Analytics Insight: Hype or Here to Stay? *Business Intelligence Journal*, Student Edition 2015, 33-37.