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ORIGINAL AND APPLIED RESEARCH

An investigation of skill requirements for business and data analytics positions: A content analysis of job advertisements

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ABSTRACT

Presently, analytics degree programs exhibit a growing trend to meet a strong market demand. To explore the skill sets required for analytics positions, the authors examined a sample of online job postings related to professions such as business analyst (BA), business intelligence analyst (BIA), data analyst (DA), and data scientist (DS) using content analysis. They present a ranked list of relevant skills belonging to specific skills categories for the studied positions. Also, they conducted a pairwise comparison between DA and DS as well as BA and BIA. Overall, the authors observed that decision making, organization, communication, and structured data management are key to all job categories. The analysis shows that technical skills like statistics and programming skills are in most demand for DAs. The analysis is useful for creating clear definitions with respect to required skills for job categories in the business and data analytics domain and for designing course curricula for this domain.

KEYWORDS

Content analysis; data analytics; IS curriculum; skill requirements

Introduction

Analytics programs, especially at the graduate level, exhibit a growing trend. There has been a significant increase in the number of programs and courses offered in analytics (Gellman, 2014). Other labels used for analytics include business analytics, data analytics, and business intelligence (BI). The field of analytics/BI remains an attractive target for information technology (IT) investments. According to a recent survey, SIM (Society for Information Management) IT Trends Study for 2017, "Analytics/Business Intelligence/Data/Mining/Forecasting/big data remained number one on the list of the largest IT investments for the seventh year in a row, and IT pros also identified this as the number one area that should get more investment" (Davis, 2017). A related trend is a high demand for analytics skills in the IT profession. BI/analytics and big data were reported in the group of "the top 10 most sought-after skills" by *Computerworld*. These two skills were sought by 26% and 25%, respectively, of IT manager-level professionals commenting on their plans to hire IT talent as reported in Forecast 2017 survey administered by *Computerworld* (Pratt, 2017).

The aforementioned classifications emphasize the importance of analytics skills for present-day IT talent. Yet, there is a need to provide clarity for the definitions of job categories, as related job requirements can vary significantly. We attempt to develop a job classification consisting of the most representative categories currently in demand in the business and data analytics domain consisting of business analyst (BA), business intelligence analyst (BIA), data analyst (DA), and data scientist (DS). In the present classification, clearly articulated skill sets are mapped to the four job categories. By using a content analysis technique to sift through web-based job postings, we determine the frequencies of specific skills corresponding to each skill set. The analysis of the frequencies will help bring to the forefront most critical skills as well as associated skill sets in our data sample. In this study, we conduct pairwise comparisons between BA and BIA as well as DA and DS. We are not analyzing similarities and dissimilarities between all job categories.

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The job categories investigated in this study (DA, BA, DS, and BIA) represent respectively such professional domains as data analytics, business analytics, data science, and BI. The definitions of data analytics, business analytics, data science, and BI are closely interrelated. The application context, scale of analytical activities, and multidisciplinary nature help establish differences among these concepts. Aasheim, Williams, Rutner, and Gardiner (2015) defined data analytics as an extension of statistical analysis to include capabilities to process large datasets. Further, they defined business analytics as a subcategory of data analytics that is applied in business settings to analyze related problems. Data science, according to Aasheim et al., is a multidisciplinary field closely related to data analytics, which makes use of computer science techniques to derive insights when analyzing large datasets. Aasheim et al. added that the inclusion of business acumen is an important aspect of the data science field such that insights developed in the course of analytical activities support the creation of business value. Shirani and Roldan (2009) referred to BI as an emerging technology domain that emphasizes the use of computer-based analytical tools such as OLAP, dashboards, and scorecards for solving business problems.

For the present study, a critical factor would be geographical localization, as the study focuses on the demand for job categories in the business and data analytics domain in a selection of U.S. states. We decided to focus on a limited number of U.S. states to make research effort relevant for designing/enhancing the requirements for analytics programs at the universities we teach and, accordingly, we concentrated on the states of Arkansas, Florida, Missouri, and Kansas. Limiting the data sample geographically to these four states allowed us to focus this study specifically on the job requirements in the local economies and consequently can help educators compare the offerings of upcoming and existing business and data analytics programs with the skill sets required in a given local job market. In the present study, we analyzed job postings from online job boards and we do not attempt to formulate specific recommendations as far as coursework and related skill sets are concerned.

This study contributes to the literature of curriculum development in business and data analytics programs by identifying skills currently in demand for a variety of job categories. The findings of this study could, therefore, be useful for creation/modification of degree programs in the higher education industry to better align with current industry needs. In a similar manner, the results of our analysis can be exploited by employers seeking talent in the domain of data analytics. Clearly articulated skill sets would help create a more structured approach to formulating requirements for jobs in the analytics domain.

The present article is organized as follows. First, we discuss the extant literature on the topic of job requirements in the business and data analytics domain. One stream in the literature focuses on the perspective of employers. The second stream that supports the pedagogical perspective addresses the link between job requirements and related degree programs. The classification framework, method, and data collection will be discussed next. We relied on content analysis for analyzing online job postings. The discussion of findings will focus on the calculated frequencies of skills corresponding to a skill set, which in turn is mapped to a particular job category. In addition, critical similarities/dissimilarities for the two pairs of job categories, BA/BIA and DA/DS, will be discussed. Finally, we present conclusions and outline directions for future research.

Literature review

Extant research on the topic of skill requirements for professionals in information systems, including data analytics, is divided into the perspectives of employers and educators. For the first perspective, the focus is on identification of the most critical skills and areas of expertise that are valued by employers (Aasheim, Shropshire, Li, & Kadlec, 2012; De Mauro, Greco, Grimaldi, & Nobili, 2016; Debortoli, Müller, & vom Brocke, 2014; Kim & Lee, 2016; Lee & Han, 2008; Shirani & Roldan, 2009). Job market demand is typically examined via sifting through online job postings to ascertain the requirements for certain job categories. The proliferation of online platforms for job advertisements has created a readily accessible pool of data for research purposes. Rich data resources, coupled with an automated way of data processing via content analysis, offer valuable research opportunities for classification tasks.

The aforementioned stream of research examined skill sets for a variety of job domains. In the general IS domain, Kim, Hsu, and Stern (2006); Todd, McKeen, and Brent (1995); Webb (2006); and Wilkerson (2012) studied job skills required for the IS positions. De Mauro et al. (2016) recognized business analyst and data scientist as individual job categories in the study that examined job postings related to big data skills. Shirani and Roldan (2009) collected data

from job advertisements to formulate skill sets for BI, data warehousing, and database job categories. Kim and Lee (2016) focused on DS as a job category and associated skill set. They found that statistics, data modeling, programming, database systems, and understanding of specific business domains were the main requirements for the DS positions. Kim and Lee considered DS, DA, BIA, and operations research analyst as closely related occupations. In the present study, we include DS, DA, BIA, and BA to represent job categories in our classification whereas Kim and Lee concentrated on one job category as discussed previously. Thus, we aim to explicitly detect differences/similarities in skill sets for a variety of job categories in the analytics domain.

The pedagogical perspective focuses on the analysis of the coursework in the existing degree programs in the data analytics and related domains (Aasheim et al., 2015; Asamoah, Sharda, Zadeh, & Kalgotra, 2017; Boyle & Strong, 2006; Mills, Chudoba, & Olsen, 2016). Aasheim et al. studied course descriptions to identify similarities and differences in undergraduate programs in data analytics and data science. This collective of authors first collected information, from the extant literature, on skills and competencies essential for these two fields and presented a resultant classification. Then they compared skills and competencies included in the curricula among the studied undergraduate programs using the developed classification. Boyle and Strong surveyed IT professionals implementing or supporting enterprise resource planning (ERP) systems to develop a skill set required for the graduates of ERP programs. They concluded that this skill set included the following competencies: ERP technical knowledge, business functional knowledge, technology management knowledge, industry exposure to ERP, interpersonal skills, and team skills/knowledge.

Prior research has deployed a variety of approaches for creating classifications concerning job categories in the analytics domain. One approach focused on a skill set required for one job category such as DS and ERP professional. A different approach compared skill sets taught in undergraduate programs in data analytics and data science. Yet, a third approach has the overall focus on one skill set such as big data, for which a job classification was developed containing several categories. This investigation seeks to make a contribution to the extant literature by broadening the range of job categories in the analytics domain. In our classification, we focus on BA, BIA, DA, and DS as specific job categories. In addition to introducing a broader range of job categories, we conduct a pairwise analysis of related categories such as BA/BIA and DA/DS. The extant literature focuses primarily on the DA/DS pair, whereas the attention to the BA/BIA pair has been scarce. The job category of BA is of particular interest as the proportion of job advertisements for this category considerably outweighs the respective shares of other categories. Thus, the findings of this investigation aim to shed light on the significant job category in the business and data analytics domain that remains relatively unexplored. Last, the present study contributes to the extant literature by introducing a novel set of skill categories concerning the BA/BIA/DA/DS job categories.

Research methodology

Classification framework development

In this section, we explain how we have developed a classification framework which is essentially a common set of skills and competencies that we are going to map against each job category. We used a list of skills and competencies contained in Aasheim et al. (2015) as a starting point to develop our list. Each component of the aforementioned categorization structure was analyzed and modified if needed so that perspectives found in prior research and authors' viewpoint would be reflected. Also, we added more skill categories with associated skills. To measure the reliability of the categorization structure, we asked four independent raters (university faculty members) to provide their expertise by placing skills and competencies in appropriate categories. The initial intercoder reliability based on the alpha coefficient from Kim and Lee (2016) was .918. We will next present categories and associated skills arranged in Table 1.

Method

Our methodology is summarized in Figure 1. We used data contained in online job boards. In particular, Indeed.com is one such widely used resource that allows employers to publish information regarding the positions they advertise. Data collected at Indeed.com was analyzed using content analysis (Neuendorf, 2016). Content analysis is a qualitative method that supports, on the basic level, the tasks of identification of relevant information and counting the number of occurrences when searching for specific words/phrases.

We used web scraping as the method for data collection. R software (R Foundation for Statistical

Table 1. Classification framework: Skill categories and associated skills.

Skill Category	Skills
Enterprise systems software	ERP, CRM, SCM, SAP, PeopleSoft, Oracle, Integration, SAAS
Visualization techniques	Visualization, Tableau, Lumira, Crystal Reports, d3, d3.js
Specialized analytics solutions	Google Analytics, ArcGIS, GIS, QGIS
Programming skills	Mathematical programming, Scala, Python, C#, C++, VB, Excel Macros, PERL, C, Java, Visual Basic, VB.NET, VBA, COBOL, FORTRAN, S, SPLUS, BASH, Javascript, ASP.NET, JQUERY, JBOSS
Project management	Project management, PERT, CPM, PERT/CPM, change management, project budget, project documentation, PMP, Microsoft Project, Gannt Chart
Advanced modeling/analytics techniques	Neural networks, linear programming, integer programming, goal programming, queuing, genetic algorithms, expert systems
Web scraping	Scraping, web scraping, crawling, web crawling
Hardware	Hardware, architecture, devices, printer, storage, desktop, pc, server, workstation, mainframe, legacy, system architecture
Networking	Internet, LAN, WAN, networking, cloud computing, client server, distributed computing, network security, ubiquitous computing, TCP/IP
Statistical packages	Statistics, SPSS, SAS, Excel, Stata, MATLAB, probability, hypothesis testing, regression, pandas, scipy, sps, spotfire, scikits.learn, splunk, h2o, R, STATA, Statistical programming
Data mining techniques	Classification, text mining, web mining, stream mining, knowledge discovery, anomaly detection, associations, outlier, classify, association, estimation, prediction, forecasting, machine learning, decision trees
Structured data management	SQL, relational database, Oracle, SQL Server, DB2, relational DBMS, Microsoft Access, data model, data management, entity relationship, data warehouse, DBMS, transactional database, sql server, db2, Cassandra, mongo db, mysql, postgresql, oracle db
Big data management	Big data, Unstructured Data, Data Variety, Data Velocity, Data Volume, Hadoop, Hive, Pig, Spark, MapReduce, Presto, Mahoot, NoSQL, Spark, shark, oozie, zookeeper, flume
Decision making skills	Reporting, analysis, modeling, design, problem-solving, implementation, testing, analytical, strategic thinking
Communication skills	MS Office, MS PowerPoint, presentation, MS Word, communication, documentation
Organization skills	Teamwork, matrix, ethics, self-motivated, leadership, organization, team, manage, interpersonal
Business domain	Finance, healthcare, marketing, supply chain, accounting, computer science, functional, domain

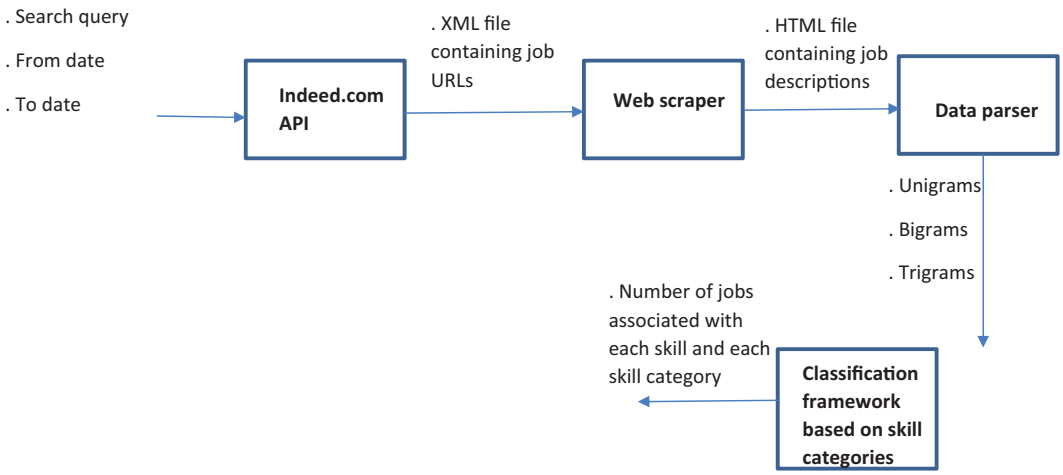

Figure 1. Summary of solution method.

Computing, Vienna, Austria) was the tool used to write the code for the web scraping. Indeed.com provides an API for requesting searches and returns an XML file with the search results. The searches were performed among the job titles hosted at Indeed.com for a specific time period of three months between December 2016 and February 2017. The query phrases such as BA, BIA, DIA, and DS were used and job titles containing these query phrases were searched. The search results of the API call contain relevant information such as job title, job URL, location, company, posting date, and a job summary. However, this job summary is brief and is insufficient to conduct the content analysis because it lacks useful information such as programming experience, statistical packages, and database skill sets. Therefore, we created a parser to extract the complete job descriptions from the job URLs collected from search results of the Indeed.com API. This task is benefited from the fact that jobs hosted at Indeed.com are constructed using a default template based on the same HTML tags.

The parser extracts the job description of each job URL, which is part of the search results of the Indeed.com API. The job description contains relevant

Table 2. Number of job postings in the dataset.

Job category/state	Arkansas	Florida	Kansas	Missouri	Total
Business analyst	33	526	48	209	816
Business intelligence analyst	3	23	8	11	45
Data analyst	10	176	24	72	282
Data scientist	6	46	5	35	92

information such as position type, salary, academic qualifications, and required software experience. This job description serves as an input to our content analysis method, which counts the number of jobs associated with each skill category. The keywords related to the different skill categories are listed in Table 1. All unigrams, bigrams, and trigrams in the job description are gathered and subsequently compared with the skills belonging to a specific skill category. If a match is found, we conclude that a given job posting is associated with the corresponding skill in the specific skill category. This process is repeated for each skill category for all job postings. At the end, for a specific job title, we collect the number of jobs associated with each skill and also the number of jobs related to each skill category. These data will be used in the next section to analyze a relative importance of skills and skill categories for different job categories.

Results

A total sample of 1,235 job postings satisfying our criteria was collected from Indeed.com within the period of December 2016 and February 2017. The sample size of this present study closely resembles a representative sample size for content analysis studies (Kim & Lee, 2016; Surakka, 2005). The distribution of job postings by the four separate job categories (BA, BIA, DA, and DS) and four different states (Arkansas, Florida, Kansas, and Missouri) is presented in Table 2.

Next, we investigate the skill set requirements for each of the four job categories. The five most frequently listed skill categories required for each job category with associated skills are reported in Tables 3–6. These skill categories are ranked with respect to the number of job postings in which at least one skill related to the skill category is present. For each skill category, we also report the top five skills. These skills are ranked with respect to the percentage of the number of related job postings associated with a specific skill (as described in Section 3.2) relative to the total number of job postings for a specific job category as reported in Table 2. Due to the fact that we report the top five skill categories and corresponding five skills, the percentage of the total counts does not equal to 100%.

Table 3. Business analyst.

Skill category	Skill	Percentage
Decision making		
	Analytical	69.49
	Design	44.98
	Testing	42.03
	Implementation	40.69
	Reporting	32.60
Organization		
	Teamwork	63.48
	Manage	34.80
	Organizational	34.31
	Leadership	28.19
	Interpersonal	23.04
Communication		
	Communication	60.78
	Documentation	38.73
	Microsoft Office	14.34
	Presentation	11.52
	Microsoft Word	2.82
Domain		
	Functional	42.16
	Financial	30.15
	Computer science	19.49
	Healthcare	16.05
	Accounting	11.40
Structured data management		
	SQL	27.21
	Database	19.73
	SQL Server	7.11
	Data warehouse	3.43
	Data management	3.80

Having reported the breakdown of skill sets and associated skills per each job category, we turn to the analysis of collected data. Prior research suggests that analysis is conducted via two main approaches. The first approach focuses on one job category such as data scientist (Kim & Lee, 2016) and ERP specialist (Boyle & Strong, 2006). The second approach involves comparison of two job categories or skill sets such as data scientist and data analyst (Aasheim et al., 2015); data warehousing and BI (Shirani & Roldan, 2009). Following Aasheim et al. and Shirani and Roldan, we compare two pairs of job categories, BA and BIA as well as DA and DS. This breakdown allows us to compare business analytics-oriented job categories separately from data analytics-oriented categories.

From Table 3 and 4, we conclude that structured data management skills are relatively more important for BIA compared with BA. There is a higher demand for skills in statistical software in case of BIA compared with BA. The BA jobs place more emphasis on domain-specific knowledge than the BIA jobs do. Specific areas that employers emphasize in the BA jobs are finance, computer science, healthcare, and accounting. While the statistical packages required for BIA consist of Excel, SAS (SAS Institute, Cary, NC), and R, one clear leader (Excel) dominates tools required for BA in this skill category.

Table 4. Business intelligence analyst.

Skill category	Skill	Percentage
Decision making		
	Analytical	73.33
	Design	60.00
	Reporting	55.56
	Implementation	46.67
	Problem solving	44.44
Structured data management		
	SQL	73.33
	Database	48.89
	Data warehouse	26.67
	SQL Server	26.67
	Relational database	17.78
Organization		
	Teamwork	75.56
	Manage	44.44
	Organizational	33.33
	Interpersonal	31.11
	Leadership	22.22
Communication		
	Communication	55.56
	Documentation	35.56
	Presentation	26.67
	Microsoft Office	6.67
	Microsoft Word	4.44
Statistics		
	Microsoft Excel	57.78
	Statistics	26.67
	SAS	13.33
	R	6.67
	Regression	2.22

Table 5. Data analyst.

Skill category	Skill	Percentage Count (%)
Decision making		
	Analytical	64.18
	Reporting	48.58
	Design	30.50
	Problem solving	19.86
	Modeling	16.31
Organization		
	Teamwork	57.45
	Organizational	41.84
	Manage	21.63
	Leadership	17.73
	Interpersonal	15.25
Structured data management		
	SQL	47.52
	Database	30.14
	Data warehouse	8.87
	SQL Server	8.52
	Data models	7.80
Statistics		
	Microsoft Excel	51.42
	Statistics	19.86
	SAS	10.99
	R	10.64
	SPSS	4.26
Communication		
	Communication	48.23
	Presentation	21.28
	Documentation	19.86
	Microsoft Office	17.73
	Microsoft Word	2.84

Similarities for the BA and BIA jobs, on the other hand, can be observed in decision making, organization, communication, and structured data management skills. Both job categories require analysis, design and reporting skills within the broad framework of decision-making skills. Regarding organization skills, the BA and BIA job categories emphasize team management and leadership skills. From Tables 3 and 4, we conclude communication skills are similarly crucial for both BA and BIA. This skill set includes documentation and presentation skills using MS Office tools such as MS Word and MS PowerPoint. As we observed in Table 3 and 4, the key structured data management skills required for BA and BIA are established data management tools such as SQL and SQL Server.

The technical skills such as programming and visualization appear to have a minor significance for the two discussed job categories, as they do not appear in the top five skill categories. We conclude that main differences between BA and BIA positions are present in the areas of statistics and domain-specific knowledge. The BA jobs place a higher emphasis on domain-specific knowledge while the BIA jobs prefer candidates with expertise in statistical software packages. On the other hand, there are multiple similarities. Thus, such areas as structured data management, decision-making, organization and communication skills are highly emphasized by employers for the two positions.

The second pair of job categories that we compare are DA and DS. Our analysis concluded that, similar to BIA and BA, decision making is the top skill for both categories. Requirements in the decision making skill set for DA and DS are similar. They comprise of analysis, design, modeling, and reporting. This is similar to the requirements for decision-making skills for BA and BIA. Next, we will comment on the soft skills for DA and DS such as organization and communication. The organization skills such as teamwork and leadership are critical for both job categories. As far as communication skills are concerned, they are more relevant to DA compared with DS.

A stronger emphasis is placed on technical skills for the DS category compared with the DA category, as stated in the literature (Aasheim et al., 2015). In particular, this difference is more pronounced for programming skills, data mining and big data tools. DS is the most technical in nature among the categories considered. In particular, a DS professional is required to have significant programming expertise.

As for similarities, both DA and DS categories require a thorough understanding of statistics. In terms of statistical packages, the DS jobs require a firmer grasp of fundamental statistical concepts like regression. Both job categories use statistical software

Table 6. Data scientist.

Skill category	Skill	Percentage
Decision making		
	Analytical	72.83
	Modeling	54.35
	Design	52.17
	Implementation	26.09
	Reporting	17.39
Statistics		
	Statistics	60.87
	R	56.52
	SAS	40.22
	Microsoft Excel	21.74
	Regression	21.74
Organization		
	Teamwork	66.30
	Organizational	23.91
	Leadership	22.83
	Manage	15.22
	Interpersonal	13.04
Domain		
	Computer science	39.96
	Marketing	39.13
	Financial	18.48
	Healthcare	7.61
	Supply chain management	6.52
Programming		
	Python	45.65
	Java	15.22
	C	10.87
	Scala	5.43
	PERL	3.26

Table 7. Relative importance of each skill category for each job category.

	BA	BIA	DA	DS
Decision making	1	1	1	1
Organization	2	3	2	3
Communication	3	4	5	–
Domain	4	–	–	4
Structured data management	5	2	3	–
Statistics	–	5	4	2
Programming	–	–	–	5

like Excel, SAS, and R. However, the use of R is more prominent for DS compared with DA. With respect to structured data management, the DA jobs require established database tools like SQL and SQL Server. Programming skills are highly critical for DS compared with DA. In addition to traditional programming languages such as C and Java, employers seeking talent for the DS jobs advertise newer programming languages like Python.

Apart from the basic understanding of decision-making and organization skills, the two job categories differ in many aspects. In particular, the DS jobs rely heavily on statistics and programming skills. We can, thus, conclude that the DS jobs are more technically oriented and require fewer soft skills compared with the DA jobs.

The high-level similarities and differences between the four job categories are highlighted in Table 7. This table presents the relative importance of each skill category for each job category on a scale of 1 to 5, with a priority rank of 1 being the most important and a priority rank of 5 being the least important. The dashed entry for any skill category indicates that it does not appear on the top five ranking.

Conclusions and future research

In this study, we analyzed the job descriptions for the four types of analytics positions in four U.S. states. We relied on the content analysis method to rank skill categories required for each job category. Thereafter, we conducted a pair-wise comparison of the top five skills for BA and BIA as well as DA and DS. We found that decision making is the most desired skill for all four job categories. To a varying degree, other skill categories such as organization, communication, and structured data management are also in demand for all categories.

The BA category appears to be the least technical of the four studied job categories. The BA jobs require a high degree of domain knowledge whereas the BIA jobs focus strongly on structured data management skills along with some knowledge of statistics. The requirements for DA overlap with those for DS in the areas of decision-making and organization skills. Compared with the DA jobs, the DS ones strongly rely on statistical and programming skills.

The present study has identified and ranked skills currently in demand for a variety of analytics positions. The studied skills are categorized via a number of skill sets that represent an aggregated level of requirements for the job categories studied. The implications of research findings are two-fold. First, they can guide development/modification efforts for degree programs in data analytics, business analytics, and data science. Our study discusses a broad job classification for the aforementioned fields and related skill sets providing the results that could be useful for designing/modifying related undergraduate and graduate programs. Second, the findings can be useful for the hiring managers who are in search for candidates for the analytics positions. Concise and well-structured skill sets would help make job definitions clearer; thus, saving employers resources and time in the process for formulating requirements for jobs in the analytics domain.

The future researchers should look at expanding this study to include more states, preferably all of United States. In addition, scholars can expand the scope of the present study to include job descriptions in a variety of professional fields such as marketing,

accounting, finance, and healthcare. Another direction for future researchers is analysis of the curricula of degree programs in the analytics domain. The findings of the present study could be useful for research aiming at distinguishing similarities/dissimilarities in the skill sets for the studied job categories and skill sets backed by the coursework of degree programs in the field of business and data analytics. This research direction could make recommendations as far as distinct programs, specific courses, and related skill sets are concerned.

References

Aasheim, C., Shropshire, J., Li, L., & Kadlec, C. (2012). Knowledge and skill requirements for entry-level IT workers: A longitudinal study. *Journal of Information Systems Education*, *23*, 193–204.

Aasheim, C. L., Williams, S., Rutner, P., & Gardiner, A. (2015). Data analytics vs. data science: A study of similarities and differences in undergraduate programs based on course descriptions. *Journal of Information Systems Education*, *26*, 103–115.

Asamoah, D. A., Sharda, R., Zadeh, H. A., & Kalgotra, P. (2017). Preparing a data scientist: A pedagogic experience in designing a big data analytics course. *Decision Sciences Journal of Innovative Education*, *15*, 161–190. doi: 10.1111/dsji.12125

Boyle, T. A. & Strong, S. E. (2006). Skill requirements of ERP graduates. *Journal of Information Systems Education*, *17*, 403–412. doi:10.1287/isre.1060.0084

Davis, J. (2017). IT Headed for Fundamental Changes, SIM Survey Shows. *InformationWeek*, 12/8/2016, retrieved on 04/23/2017.

Debortoli, S., Müller, O., & vom Brocke, J. (2014). Comparing business intelligence and big data skills: A text mining study using job advertisements. *Business & Information Systems Engineering*, *6*, 289–300. doi:10.1007/s12599-014-0344-2

De Mauro, A., Greco, M., Grimaldi, M. & Nobili, G. (2016). Beyond data scientists: A review of big data skills and job families. International Forum on Knowledge Asset Dynamics 11th, IFKAD 2016, Dresden, Germany.

Gellman, L. (2014). Big data gets master treatment at B-schools. *Wall Street Journal* Retrieved from https://www.wsj.com/articles/big-data-gets-master-treatment-at-b-schools-1415226291

Kim, J. Y., & Lee, C. K. (2016). An empirical analysis of requirements for data scientists using online job postings. *International Journal of Software Engineering and Its Applications*, *10*, 161–172. doi:10.14257/ijseia.2016.10.4.15

Kim, Y., Hsu, J., & Stern, M. (2006). An update on the IS/IT skills gap. *Journal of Information Systems Education*, *17*, 395–402.

Lee, C. K., & Han, H. J. (2008). Analysis of skills requirement for entry-level programmer/analysts in fortune 500 corporations. *Journal of Information Systems Education*, *19*, 17–27.

Mills, R. J., Chudoba, K. M., & Olsen, D. H. (2016). IS programs responding to industry demands for data scientists: A comparison between 2011-2016. *Journal of Information Systems Education*, *27*, 131–140.

Neuendorf, K. A. (2016). *The content analysis guidebook*. Thousand Oaks, CA: Sage Publications.

Pratt, M. K. (2017). 10 hottest tech skills for 2017. *Computerworld*, 12/07/2016, retrieved on 04/23/2017.

Shirani, A., & Roldan, M. M. H. (2009). Data warehousing and business intelligence skills for information systems graduates: Analysis based on marketplace demand. *Issues in Information Systems*, *10*, 333–339.

Surakka, S. (2005). Analysis of technical skills in job advertisements targeted at software developers. *Informatics in Education*, *4*, 101–122.

Todd, P. A., McKeen, J. D., & Brent, R. (1995). The evolution of IS job skills: A content analysis of IS job advertisements from 1970 to 1990. *MIS Quarterly*, *19*, 1–27. doi:10.2307/249709

Webb, G. K. (2006). The market for IS and MIS skills and knowledge: Analysis of on-line job postings. *Issues in Information Systems*, *7*, 253–258.

Wilkerson, J. W. (2012). An alumni assessment of MIS related job skill importance and skill gaps. *Journal of Information Systems Education*, *23*, 85–98.