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Aligning University of Arkansas Curriculum with Employee Expectations regarding Analytics Graduates

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Aligning University of Arkansas Curriculum with Employee Expectations regarding Analytics Graduates

by

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Abstract

This research paper is designed to determine whether programs, such as the Walton College of Business, need to review and align their curriculum with employee expectations regarding analytics graduates. After interviewing six different companies with various analytics needs, it was revealed that programs could make changes in order to better prepare students for success in analytics fields. It was determined that programs should focus on technical abilities such as data management and provide more hands-on experience with real world data to develop students project management skills. Additionally, it was revealed that programs should also focus on giving students a base knowledge of programming as well as develop certain vocational skills such as intellectual curiosity, critical thinking, and attention to detail.

Introduction

Institutions around the world need talented data analysts that can handle the influx of data being produced. This is driving an even higher need for well-prepared students that can bring value to the company immediately out of undergraduate or graduate programs. Because of this, what they are being taught needs to align directly with skills and knowledge that are required to be effective within organizations from the jump. This paper considers the alignment of higher education curriculum with employee expectations regarding analytics graduates.

The growth of data that has taken place from 2010 to 2020 has been exponential. In just ten years, the amount of data consumed was up 49 trillion gigabytes and by 2022, 35% of large organizations will either be buyers or sellers of data (Press, 2020). As business strategies shift to incorporate data into their business, data analysts and scientists become extremely important. With the growth that has taken place in this field, challenges of data growth in business have subsequently created shortages in the workforce. Even now there is a shortage of skills and talented data handlers to manage the big data ecosystem, and this will continue as big data grows even more in the future (Inside Big Data, 2017). Almost 33% of the top in-demand jobs revolve around data analysis, software developers, and data management (Gartner, 2020). This study will take an in-depth look at how universities can leverage employee expectations in order for students to be sufficiently prepared for entering the analytics workforce.

The field of data analytics and data science has gained traction over the past few years, with many colleges and universities now offering degrees within this field of study. Most programs teach similar software, skills, and knowledge, based on their own philosophy on where the field is heading. But with 90% of all data existing today being created in just the past 2 years (Aparavi, 2021), the landscape and scope of the field is changing rapidly, causing schools to constantly review curriculum or risk teaching outdated skills.

Analysts must have many skills within their arsenal which are valued within the business including being detail oriented, curious, exploratory, and dubious (Pratt, 2013). On top of other soft skills companies seek out in data professionals, there are many different programs being utilized by analysts such as SAS, Python, Tableau, Microsoft Access and Excel, SAP, and Salesforce. Moreover, companies have differing philosophies on what data skill is most important to be well-versed in. Should young professionals focus on developing their storytelling or work on their data visualization techniques? Or should they focus on learning more about models, statistical

concepts, and data interpretation? Sure, all of this could be learned and mastered at some point in a career, but wouldn't it be nice to know where the foundation should begin to excel in this field?

Data is changing the way people and businesses make decisions due to the power of predictive models and explanatory analysis. With that comes a substantial change in the workforce that is currently taking place and evolving. So, what exactly should undergraduate and graduate programs focus on teaching? Data analysis, visualization, and mining are cemented into every program, as they should be. But what about specific programs, skills, and another knowledge? To answer this, a deeper dive into what universities should be focusing on regarding data analytics programs is needed to successfully prepare students for the real-world of data analytics.

Literature Review

In the study "*A Longitudinal Analysis of Job Skills for Entry Level Data Analysts*" (Dong & Triche, 2020) the top skills and programs that are most in demand were determined through nine thousand job postings. By creating a text mining dictionary, the study outlines the skills that are being heavily demanded and notes other skills that are trending down in the field. Completing the study in 2019, they also outlined that the number of jobs available in the field is much higher than the number of qualified professionals. So, the study sets out to determine what skills data analysts need to have to meet field requirements and help university programs align their curriculum with the necessary skills that are in-demand in the job market.

Approach

A text mining approach to job postings via LinkedIn, Monster.com, and Indeed collected thousands of key words surrounding analyst positions. Over 9,000 job postings were analyzed within the research (Figure 1). This includes what type of degree companies are searching for, what skills and programs, and even what states are hiring the most data analysts.

Summary of Comparative Study

The study set out to answer the following 3 questions:

1. What data analyst job skills and knowledge remained steady from 2014-2018?
2. What data analyst job skills were popular in the past, but are less attractive now?
3. What data analyst job skills are gaining attention in the current job market?

A summary of the results from the questions above can be found below.

1. General statistics, Microsoft Office, and software skills such as XML or Teradata have remained steady during the time of the study.
2. No domain skills saw a decrease, but Cognos, SAP, and Microsoft Access saw sharp declines within job postings.
3. The following are skills and software that the study showed as increasing in the job market. The skill is followed by the percentage in parenthesis that skill showed up in all of the job postings.
   - General Statistics (28%)
   - Modeling (21%)
   - Model Development (26%)
   - Data Management (50%)
   - Database Systems (59%)
   - BI (23%)
   - Programming (23%)
   - Enterprise Systems (21%)
   - SQL (18%)
   - Tableau (19%)

- SAS (10%)
- R (12 %)

- Statistical Packages (16%)
- Python (11%)

To conclude, the study overall showed that several domain skills including basic statistics, modeling, and data management are vital in the workforce. The results of this study also showed that software languages and Microsoft Office Suite have remained steady over the period. Moreover, the results identified that understanding programming and having a strong ability to utilize data visualization is sought out in the workforce. Additionally, programs like Microsoft Access, SAP, and Cognos have seen a strong decline over the past few years. The most in-demand skill seen from this study is data management at over 50% of companies holding that skill in high regards for new hires (Figure 2). Python, R, SQL, and Tableau were among the most popular programs that data analysts should have in their arsenal according to the job postings.

This study also shows how quickly the field can change and how adaptive analysts need to be in the coming years. Moreover, data analysts need to be curious about where the field is headed so they can get ahead of the curve. The results from this study are compared to the data that is collected throughout the rest of this research paper to determine whether or not changes have occurred over the last three years since this study was released. By analyzing the changes that do occur, this research will show how quickly the field can transform. Additionally, it will show how vital it is for university programs to stay updated with the latest developments of skills, programs, and knowledge that students should have when entering the workforce. While most departments are recommended to review curriculum every five years (Boston University, 2022), it may be advantageous and even necessary for analytics programs to review curriculum more regularly.

Data and Methodology

For this analysis, six companies were interviewed to determine what businesses are looking for regarding the skills, software knowledge, and overall analytics knowledge of young professionals. By asking each company the same questions about their preferences of analytics professionals entering the workforce, trends in employee preferences are identified. Those trends will be compared to the results of the study mentioned above in the literature review. Afterwards, the data will be compiled and provide the University of Arkansas with unbiased preferences of firms that hire students from the analytics program.

Five quantitative questions and 5 qualitative questions will be asked to each of the six companies. The quantitative questions will be given a scale in which the numbers will correspond to either agreeing or disagreeing with the statement.

Interview participants are a mix of large and small companies with offices in Arkansas and Texas. Some of the companies interviewed have business objectives that revolve completely around analytics and technology, while others use analytics to guide their businesses to success in other industries. The mix of company types allows for the interpretation of results to not be based solely on large analytics firms that need very technical graduates, but instead give us an understanding of what small and medium size organizations are looking for out of analytics graduates. Some interviewees are previous graduates of the University of Arkansas graduate program while others are hiring managers, directors, partners, or executives.

Participants in this study were sent an introductory email and a time was set to be interviewed via Zoom. Attached in the email was the interview questionnaire for interviewees to have an idea of the questions that were coming to maximize their use of time outside their occupations. To capture a multitude of industries that analytics is involved in, different companies are interviewed with a variety of data and technology utilization within their respective business. Half of the questions within the interview are quantitative while the other half are qualitative. All responses are based on preferences within the differing size and nature of the firm. The interviews were approved by the University of Arkansas Institutional Review Board. After verbally consenting to the interview, interviews were held and names of interviewees were not transcribed within the document. The answers of each interview were collected by hand as they were given and stored as a PDF file within a safe folder on a local drive.

Results

Quantitative Questions

Below are the results of the quantitative questions measured on a scale of 0-10. The scale is represented in the table below. A distribution of the quantitative results for each question can be found in Figure 3 in the appendix.

Number	0	2.5	5	7.5	10
Scale Equivalent	Completely Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Completely Agree

Some answers collected were between completely agree and somewhat agree. For those responses, a number between the two is taken based on which way the interviewee was leaning more heavily.

Question 1: I am content with the various knowledge of programs and software that I or analytics graduates have had after graduating.

With a median response of 7.5 and an average of 7.66, employers somewhat agree that overall, students graduate with a solid level of knowledge regarding programs and software.

Question 2: I am content with the various skillsets or knowledge that I or analytics graduates have had after graduating.

An average of 6.41 and median of 6.75 for this response, employer responses indicate that they are between somewhat agree and neutral about the skillsets or knowledge of analytics graduates.

Question 3: I believe that the majority of analytics graduates are being taught the correct skillsets (Ex: data management, modeling, statistics, data analytics) to be successful as they enter the industry.

With an average response of 6.25 and median of 6.75, employer responses indicate that they are between somewhat agree and neutral about analytics graduates being taught the correct skillsets.

Question 4: I believe that the majority of analytics graduates are being taught the correct programs and software to be successful as they enter the industry.

An average of 7 and median of 7.5, the consensus of employer responses is that they somewhat agree that analytics graduates are being taught the correct programs and software.

Question 5: I believe that the Walton College of Business should adjust their curriculum to provide students with tools that are needed to be successful in the workforce.

Including all responses collected, there is an average of 5 and median of 4 indicating that employers are neutral that curriculum should be adjusted to meet the needs of the rapidly changing analytics industry. However, excluding an outlier of 10 that completely agrees that curriculum should be altered the average drops to 4.5 and the median drops to 3.

Overall Summary of Quantitative

Based on the small sample size, the median is a better representation of how the sample population feels about analytics graduates and programs. Collective responses indicated that employers were more confident in the knowledge of software and programs then in the skillsets that students had regarding data analytics, modeling, project management, etc. Overall, responses indicated that there is room for improvement regarding curriculum within the Walton College of Business and other analytics programs across the country, as shown in the prior study conducted as well. However, that is not to say the Walton College is not doing a great job in preparing students and teaching them the wrong skills, there is just room for improvement.

Qualitative Questions

Below is a summary of the results from the qualitative interview questions. The portion of questions below demonstrate the differences between the six company's screen for talent in some instances. Differences in culture, business type, and depth of each analytics department are shown within each response. The following are the overarching themes seen throughout this portion of the interview.

Below each summary is a list of consistent feedback items from interviews with employers (see Figure 4). The format will list items that are mentioned in the interviews and then how many interviews that skill or program was mentioned in out of the six companies in parenthesis.

Question 6: What are the main attributes that your company looks for in recent graduates of analytics programs?

The attributes that most mentioned is the ability to communicate effectively both verbally and in writing. Moreover, most mentioned the importance of collaboration within teams, with a specific focus of being a team player. Many responses also listed technical skills such as Python, SQL, and other technical skills that are needed to succeed in their company after completing a degree. Additionally, some mentioned data storytelling, being agile, and having relevant technical experiences is highly important.

Consistent Feedback Items

-Communication (5)	-Collaboration w/ Teams (3)
-Python (4)	-Relevant Technical Experience (3)
-SQL (4)	-Agile (2)

Question 7: What skills or programs are utilized most within your company and do those skills vary across positions or departments?

SQL and Python were mentioned in each interview as tools that analytics graduates need to have in their arsenal. Microsoft Office is standard in each company as well, but many also mentioned other tools such as SAS, Tableau, SSRS, SSIS, and R. While some had specific tools, others weren't quite as precise. All responses noted the importance of the ability to quickly learn another tool or be agile within business or customer requirements.

Consistent Feedback Items

-Microsoft Office Suite (6)   -SAS (4)
-SQL (6)   -Tableau (3)
-Python (4)   -SSRS/SSIS (2)

Question 8: What soft skills are most important for analysts to have?

Again, communication and emotional intelligence, especially within teams, was mentioned in each interview. One skill that was also mentioned in every interview was the importance of intellectual curiosity while doing day to day work. Other skills heavily mentioned were critical thinking, problem solving, and drive.

Consistent Feedback Items

-Intellectual Curiosity/Creativity (6)   -Critical Thinking (5)
-Problem Solving (6)   -Learnability (5)
-Communication (6)   -Emotional Intelligence (3)

Question 9: What attribute needs to be improved or focused on the most?

A variety of answers were collected from each company for this question. A common response seen from half of the employers was thinking outside the box by applying the knowledge you already have. Employers tended to see the development of skills and knowledge too "cookie-cutter" where students creativity in problem solving wasn't utilized. This relates to another theme seen in the responses: *the importance of agility regarding software knowledge*. Employers are desperate for a strong understanding of a few tools, that can translate easily to other software or homegrown programs. Essentially, companies are looking for well-rounded students that show the ability to learn quickly. ***Intellectual curiosity*** and ***critical thinking*** were other attributes mentioned by employers.

Consistent Feedback Items

-Adaptability & Agility (3)   -Critical Thinking (3)
-Intellectual Curiosity/Creativity in Problem Solving (3)

Question 10: **What skill or program needs to be improved the most?**

Data or application management, project management, SQL, and Python were mentioned heavily throughout the discussion of this question. Programming and coding became heavy topics of discussion, but overall project management was big for each company. Employers are looking for young professionals with the ability to plan, develop, and execute projects that include database building, data preparation and preprocessing, visualization, and data storytelling. Again, employers emphasized the importance of being well-rounded with a strong base knowledge of what is needed to be successful as an analyst.

Consistent Feedback Items

-Python (4)   -Complete Project Management (3)
-SQL (4)   -Data Management and Database Building (2)

Question 11: **Any additional thoughts or comments?**

Additional thoughts from employers brought up many things that were discussed throughout other interviews or reaffirming concepts already discussed in each individual interview. The main comments include getting more experience with Python and SQL, a recurring theme brought up by every employer. Intellectual curiosity and the importance of reaching conclusions via unconventional thinking was mentioned more in this dialogue as well. Additionally, interviewees noted the need for good data handlers that can sort through large amount of data. Also emphasized was the importance of hands-on and broad experiences to lead to better agility and learnability for students. Finally, interviewees highlighted a fundamental aspect of being successful in analytics is to be exceptional in one technical program but have a base understanding of many others.

Consistent Feedback Items

-Well-Rounded in Multiple Software (3)   -SQL (3)
-Programming/Python (3)   -Broader Hands-on Experience (3)

Limitations of Research

The data collected is from a small population with a variety of business needs. While the results may be advantageous for some analytic programs, research from other parts of the country may provide different insights. The sampled employers are based mostly in Arkansas and Texas, so the data collected may be skewed for other areas. Additionally, the data represents a small subset of companies that are looking for distinct skillsets. Firms in more technical industries may have more opportunities, whereas other organizations in less technical spaces believe that analytic programs are teaching the correct subject matter. The variety of firms in size and analytical departments that were interviewed help highlight the overall needs but is by no means the standard for skillsets needed to be successful in every job. The data is subjective towards the needs and identity of each individual firm and the results above are not indicative of what every company is searching for out of analytics graduates.

There are also limitations as to how analytics programs can teach certain soft skills that are mentioned in the results. Intellectual curiosity, work ethic, and agility are difficult to teach and yet they are just as important as the technical skills learned throughout the program. Programs like the Walton College of Business provide opportunities to improve critical thinking and problem solving, but some soft skills are limited to the nature of the student.

Conclusion

The quantitative question results revealed a few key takeaways that should be noted. First and foremost, this study shows the programs could make changes to curriculum that would better prepare students for analytics roles after college. Next, this study showed that the attributes that was brought up most for analysts to have in their skillset was intellectual curiosity and creativity. To summarize the overall findings, companies are searching for agile students that have a strong understanding of the entire management of the data analytics process. Additionally, businesses look for creative students with experience in project management.

Employers stated that they are more content with analytics graduates knowledge of software then they are with their technical skillsets and knowledge. Correspondingly, employers are also more confident that students are being taught the correct programs and software then the technical knowledge being taught. To summarize, employers are less confident in the technical skillsets and knowledge of analytics graduates than all other skills. While neither are completely content and interviewees confirmed that more could be done to improve in both areas, it is clear that companies are highly interested and in need of strong technical skillsets. This notion is also seen in the comparative study found in the literature review, *A Longitudinal Analysis of Job Skills for Entry Level Data Analysts.* With fifty percent of employers requiring a strong understanding of data management and twenty-eight percent requiring a large base knowledge of general statistics (Dong & Triche, 2020), current research in this study indicates that is still the case. The quantitative results also indicated that employers are confident in the current curriculum of analytics graduates yet acknowledge that there is room for improvement. This leads to the belief that the Walton College of Business and other programs could make changes that could help students be more successful in data analyst roles by especially focusing on technical skills, such as data management.

Based on the qualitative results of the research, employers are looking for five or six main soft skills in data analysts when hiring or interviewing them. First, employers iterated the vitality of problem solving and critical thinking. They want analysts to be able to work through problems or find alternate solutions in a timely manner. Correspondingly, the attribute that was brought up most for analysts to have in their skillset was intellectual curiosity and creativity. Employers want analysts to think: Can this be done differently? Why is nobody doing it this way? What is another way to solve this problem? The cookie-cutter ways of doing things aren't always going to work in business, that's why this skill and the ability to be agile between different software is so important to companies when interviewing new hires. For this skillset to improve, programs need to focus on giving students real world data experience with the ability to solve it as they choose.

One of the obvious skills analysts need to have in their arsenal is good communication, both written and oral. In addition to a good technical skillset, the ability to communicate ideas, problems, and takeaways are also vital skills. Communication for analysts often resides in their ability to tell a story about the data and what it means for the business.

In regard to technical skills and software, there are also some consistent feedback items from the interviewees. The first item to note is the demand for graduates having some experience in Python or another coding language and SQL. Employers highly stressed the importance of programming and database querying now and in the coming years. In order for prospective hires to be well-prepared for an analytics job, a base course or period of time in class must be spent in these areas. Programs should consider requiring an introduction to programming course and include data querying heavily into another portion of the curriculum. Microsoft Office Suite, SAS, SSRS/SSIS among other tools were mentioned as well, but not to the extent of the previous two mentioned. However, employers are looking for students with well-rounded abilities regarding software knowledge. While programming is becoming a skill that can help young professionals become much more successful, the skill also shows students how to be methodical, detail oriented, and think critically. These are all skills that data analysts should have in their arsenal and learning a programming language will reinforce these much-needed skills.

Programs would also be wise to continue teaching the likes of Excel, SAS, Power BI, Tableau, and so forth. According to interviews, the Walton College does a great job of giving students hands-on experience with these programs. These tools seem to be the baseline for what students should know and be experienced in coming out of college. Companies expect students to be familiar with these products, especially Microsoft Office Suite. Interviewees mentioned that Excel and Tableau will continue to be leveraged throughout business for many years to come. In addition to needing to know these programs, being experienced in them allows students to easily move from one software to another, which is vital in the analytics industry.

Finally, interviewees also stressed the importance of complete project management and hands-on experience with large amounts of data. Moreover, more analytical firms are desperately searching for prospects that can build data repositories and data lakes. While that may take experience in the industry, preparing students by having them go step by step through the data process is a requirement according to employers. Companies are genuinely searching for students that have managed a project from beginning to end at some point during their degree program.

In comparison to the study found in the [literature review](), the results from this study corroborated the findings from 2019. Microsoft Office and domain skills such as general statistics and data management have remained steady in the industry. While skills such as XML and Teradata weren't mentioned, other software mentioned in the study have remained important within the businesses interviewed. Next, the current study shows no decline in domain skills, though the predominant toolset changed a bit as the companies interviewed didn't bring up Cognos, SAP, or Microsoft Access. Finally, the research found within this study also corroborates that the findings of skills and software that were being highly used within the industry in 2019 are still vital to companies today such as Microsoft Office Suite and SQL.

By comparing *A Longitudinal Analysis of Job Skills for Entry Level Data Analysts to* current research we have found that in two and a half years, many of the same skillsets are being used. However, there has been an increase in the need for programming, database querying, and data visualization based on the results from the interviews within this study. Programs need to note the high use of new software and determine how it can be included within their curriculum. Moreover, programs should note the slight increase in certain domain skills (data and project management, database building, general statistics) and emphasize the importance of these skills to students.

Overall, what employers are looking for are agile students with valuable experiences in managing the entire data analytics process. Additionally, companies are searching for students with experience in Python and SQL, as well as having a base knowledge of other software such as SAS and Tableau. Some of the more technical companies mentioned data governance as well as database and data repository building, however most are in desperate need of exceptional data handlers and project managers. Personality wise, interviewees made it a priority to emphasize the importance of strong communication, intellectual curiosity, creativity, and problem solving. For most, to succeed out of college these were the two key attributes that recruiters are looking for. While the Walton College is obviously doing many things right with their analytics program, incorporating these additional insights could launch their program to new heights and help their graduating students immensely.

As the technology and data industry continues to advance quickly, it is important for analytics programs to keep up with the changes that occur. Whether curriculum be analyzed at the end of each full year or each semester, it is vital that analytics programs determine what the market trends are in order to prepare students to the best of their abilities. For companies to remain or advance to the forefront of the analytics realm, innovative students with exceptional technical abilities will be desperately sought after. Therefore, the most influential piece to the success of the entire industry, will be the educators and programs that produce data analysts.
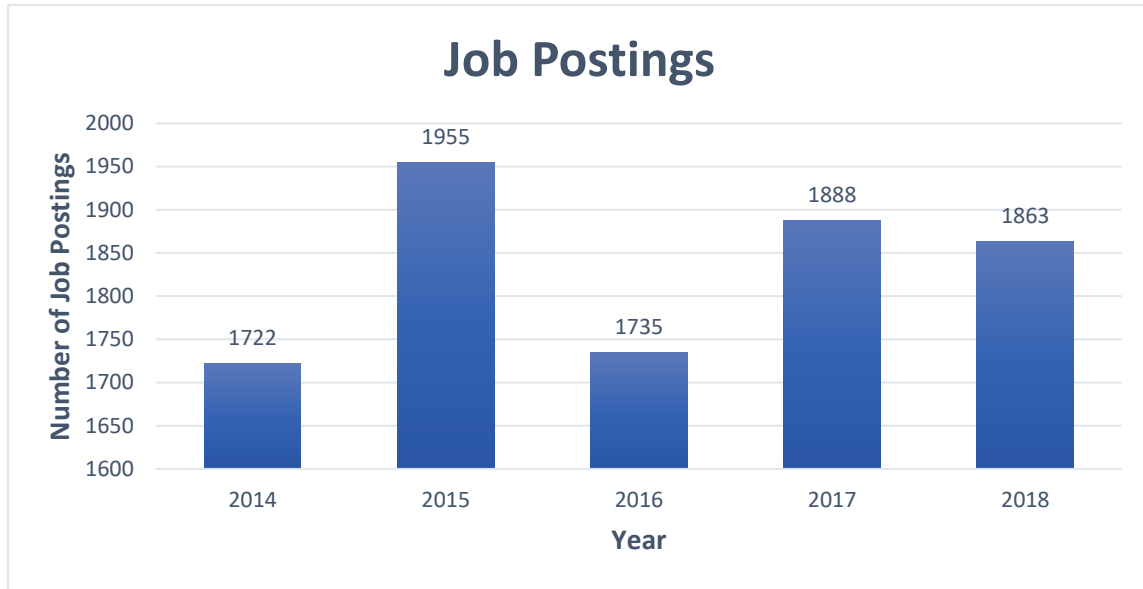
Appendix

Figure 1. Number of Job Postings for Data Analysts from 2014-2018. Data via "A Longitudinal Analysis of Job Skills for Entry-Level Data Analysts" ((Dong & Triche, 2020)
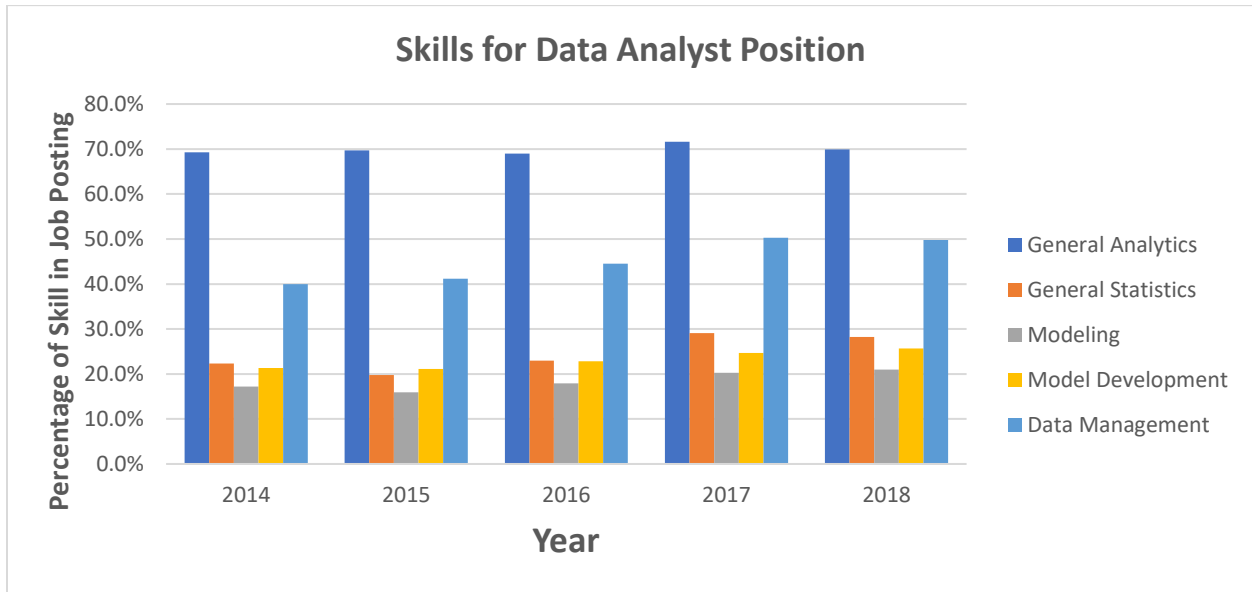

Figure 2. Percentage of Skills in Job Postings for Data Analysts. Data via "A Longitudinal Analysis of Job Skills for Entry-Level Data Analysts" (Dong & Triche, 2020)

Question Number	Completely Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Completely Agree
Question 1	0	0	0	6	0
Question 2	0	0	3	3	0
Question 3	0	1	2	3	0
Question 4	0	0	2	4	0
Question 5	0	3	1	1	1

Figure 3. Summarization and distribution of results from quantitative interview questions on the Likert Scale

Figure 4- Top Eight Consistent Feedback Items from Qualitative Study

Bibliography

Aparavi. (2021, December 1). *Big Data Growth Statistics to Blow Your Mind*. Retrieved from Aparavi: https://www.aparavi.com/resources-blog/data-growth-statistics-blow-your-mind

Boston University. (2022). *Reviewing the Department's Curriculum/Revising Existing Degree and Non-degree Programs*. Retrieved from BU Arts and Sciences: https://www.bu.edu/cas/faculty-staff/faculty-staff-handbook/curriculum/

Dong, T., & Triche, J. (2020). A Longitudinal Analysis of Job Skills for Entry-Level Data Analysts. *Journal of Information Systems Education*, 312-326,312A.

Gartner. (2020, October 19). *Gartner Top 10 Trends in Data and Analytics for 2020*. Retrieved from Gartner: https://www.gartner.com/smarterwithgartner/gartner-top-10-trends-in-data-and-analytics-for-2020

Inside Big Data. (2017, February 16). *The Exponential Growth of Data*. Retrieved from Inside Big Data: https://insidebigdata.com/2017/02/16/the-exponential-growth-of-data/

Pratt, M. (2013, December 6). *5 Traits of a Good Data Analyst*. Retrieved from Business.org: https://www.business.org/hr/recruitment/traits-good-data-analyst/

Press, G. (2020, December 30). *54 Predictions about the State of Data in 2021*. Retrieved from Forbes: https://www.forbes.com/sites/gilpress/2021/12/30/54-predictions-about-the-state-of-data-in-2021/?sh=3c077420397d