Journal of Information Systems Education

Volume 31
Issue 4
Fall 2020

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Recommended Citation: Zhang, L., Chen, F., & Wei, W. (2020). Teaching Tip: A Foundation Course in Business Analytics: Design and Implementation at Two Universities. *Journal of Information Systems Education,* 31(4), 244-259.

Article Link: http://jise.org/Volume31/n4/JISEv31n4p244.html

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| Initial Submission: | 19 September 2019 |
| Accepted: | 14 January 2020 |
| Abstract Posted Online: | 8 September 2020 |
| Published: | 10 December 2020 |



ISSN: 2574-3872 (Online) 1055-3096 (Print)

# *Teaching Tip*
# A Foundation Course in Business Analytics: Design and Implementation at Two Universities

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**ABSTRACT**

The current data-centric business environment has seen an increasing demand for business students with knowledge and skills in the area of business analytics. This article presents the design and implementation of a foundation business analytics (BA) course for undergraduate business students who aspire to become data-literate professionals or entry-level data analysts. The course design is built around two learning objectives and their corresponding learning outcomes and features five learning modules corresponding to a recently proposed BA pedagogical framework. The implementation of this course at two large universities is described in detail, including the timelines, topics, software tools, assignments, projects, and student feedback. Upon successful completion of the course, students are expected to be able to conduct business analytics at basic to intermediate levels using leading industry tools such as Power Pivot, Power BI, Tableau, or R.

**Keywords:** Business analytics, Data visualization, Curriculum design & development, Instructional pedagogy

## 1. INTRODUCTION

Analyzing data to support business operations and decision-making has become one of the most important business trends in recent years. A report issued by IBM (IBM Annual Report, 2015) stated that "data is the world's new natural resource, and it is transforming all industries and professions." As companies take up the challenge to integrate data and analytics into their existing business operations, the biggest issue they face is finding the right people. According to a report by the McKinsey Global Institute (Henke et al., 2016), there is an ongoing shortage of analytics expertise. Half of the surveyed company executives reported greater difficulty in recruiting staff with analytical skills than in filling any other kind of role. The same report also noted that the ability to perform statistical analysis and data mining was one of the most sought-after skills on LinkedIn in 2016.

Corresponding to this increasing demand for business professionals with data analytics knowledge and skills, many business schools have developed certificates or master's programs in business analytics (BA). For schools that do not yet have a dedicated BA program but want to add a course covering BA-related topics to their existing undergraduate curriculum, what might such a course look like? This article addresses this

question by presenting the design of a foundation BA course for undergraduate business programs and describing how it was implemented at two universities.

The course is designed as an elective for business students who have acquired a basic knowledge of information systems (IS) in a prerequisite introductory IS course. These students can be classified into two groups: (1) those aiming to become business professionals equipped with essential knowledge and skills of business data analytics and (2) those continuing to pursue a certificate or degree in the field of BA. Therefore, the primary goal of this course is to lay a solid foundation for undergraduate business students to become data-literate professionals or entry-level data analysts. The course outline we present here covers learning objectives, learning outcomes, and learning modules. We also share our experiences of teaching this course, including details such as timelines, topics, technological tools, assignments, and projects, so that it can be easily adopted by other instructors in their own setting.

The remainder of the paper is organized as follows. Section 2 introduces the course design, with learning objectives, learning outcomes, and corresponding learning modules mapped onto a pedagogical framework. Section 3 describes the implementation of the design at two universities. Section 4 provides evidence of the course's success and shares reflections from its instructors. Section 5 discusses teaching suggestions, and Section 6 concludes the paper.

## 2. CONCEPTUAL DESIGN OF THE COURSE

Prior research has discussed the design of BA courses. Gupta, Goul, and Dinter (2015) presented a comprehensive overview of business intelligence and data analytics topics, with teaching materials (such as readings, PowerPoint slides, and videos) selected from Teradata University Network. Their paper provides useful guidance and resources for new instructors in this field. However, the course design lacks hands-on assignments and information about course delivery for other instructors to adopt. Asamoah, Doran, and Schiller (2015) described an entry-level data analytics course with detailed topics and hands-on assignments, but their course is designed for IS and computer science (CS) majors and requires substantial programming skills and knowledge. This makes it unsuitable for non-IS business students. In addition to addressing the design of BA courses, recent studies have proposed methods to cover specific topics in BA. Wang and Wang (2019) created a half-credit-hour module on a database-centric online analytical process in a BA course for MBA students. The module focuses on basic concepts of databases and teaches students how to use them professionally in BA. In another paper, Nestorov, Jukić, and Rossi (2019) presented the design and implementation of a data visualization course for an undergraduate IS program. The course focuses on visualizing data using Tableau and lists two prerequisites: an entry-level IS course and a course on databases and data warehouses.

Our foundation BA course is intended for undergraduate business students who may not have any programming experience or knowledge of data warehouses. Our design coincides with a recently published pedagogical framework for an introductory undergraduate BA course (Jeyaraj, 2019). This framework, developed and carried out in an undergraduate introductory course to BA, encompasses multiple stages related to the data analytics process, including acquisition, preparation, analysis, visualization, and interpretation. The author provides some information (such as prerequisites, timeline, and classroom instruction) for applying the framework as well as a group project that enables students to gain hands-on experience with different stages of the analytical process. The pedagogical framework can be used as a guideline for designing an entry-level BA course, but Jeyaraj did not include objectives or recommended topics for such a course. Here, we set out the design of a BA course that extends and supplements Jeyaraj's framework with learning objectives, learning outcomes, and detailed materials for teaching the course.

Our course addresses two learning objectives (LOs):

LO1: Students will develop analytical thinking within a data-centric business environment.
LO2: Students will acquire analytical skills by using leading software tools and technologies.

Analytical thinking refers to the reasoning and inquiry process to identify a problem or problems to solve (Robbins, 2011). Correspondingly, the learning outcomes for LO1 can be summarized as follows: students will be able to identify the analysis focus, list specific questions that can be answered with a particular dataset or datasets, choose proper analysis methods and tools, interpret data patterns once analyses are done, and propose actionable recommendations based on the data patterns. Analytical skills, on the other hand, refers to the ability to perform data analytics activities. Accordingly, the learning outcomes for LO2 are as follows: students will be able to collect necessary data based on the analysis focus, perform data cleansing and transformation, conduct data analysis based on the questions identified, create visuals to illustrate data patterns, and communicate analysis results and recommendations through formal business reports and presentations. The learning outcomes of LO1 and LO2 are interconnected in a sequential and interlocking fashion. Table 1 maps the LOs onto their corresponding learning outcomes.

Based on the above learning objectives and outcomes, five instructional modules were developed: data collection, data preprocessing, analytical processing, data visualization, and business reporting. Figure 1 illustrates how our five-module design coincides with Jeyaraj's BA pedagogical framework (Jeyaraj, 2019).

## 3. COURSE IMPLEMENTATION

The course design described in Section 2 was implemented at two public universities, one in the Midwestern United States and the other in Canada. These two courses are referred to as Uni-1 and Uni-2, respectively. Both Uni-1 and Uni-2 are introductory BA courses for undergraduate business students. Uni-1 has been offered three times since 2017, and Uni-2 has been offered twice since 2018. The two courses share common learning objectives, outcomes, and modules, and both focus on the analysis of structured data.

| **LO1: Students will develop analytical thinking within a data-centric business environment.** | **LO2: Students will acquire analytical skills by using leading software tools and technologies.** |
|---|---|
| **Learning Outcomes of LO1** | **Learning Outcomes of LO2** |
| 1.1 Identify the analysis focus | 2.1 Collect necessary data based on the analysis focus |
| 1.2 List specific questions that can be answered with the data | 2.2 Perform data cleansing and transformation |
| 1.3 Choose proper analysis methods and tools | 2.3 Conduct data analysis based on the questions identified |
| 1.4 Identify and interpret data patterns from the analysis | 2.4 Create visuals to illustrate data patterns |
| 1.5 Propose actionable recommendations based on the data patterns | 2.5 Communicate analysis results and recommendations with reports and presentations |

**Table 1. Learning Objectives and Corresponding Learning Outcomes**

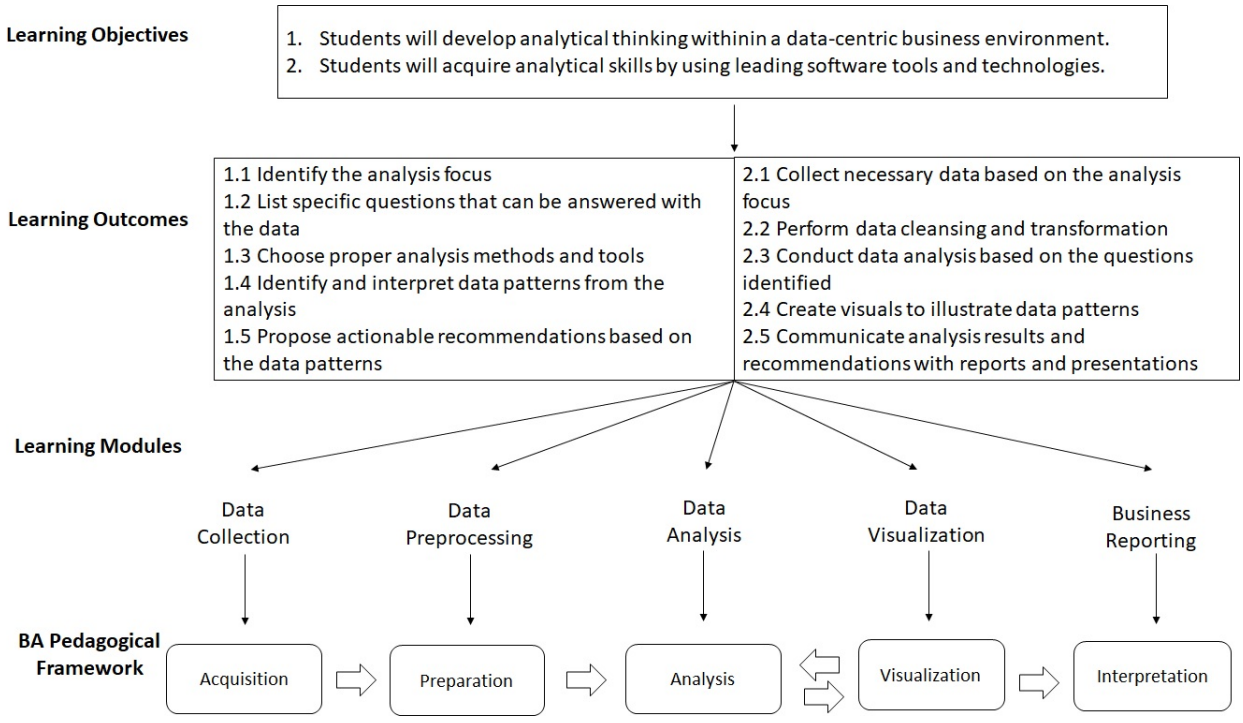


**Figure 1. Design of Foundation BA Course**

### 3.1 Uni-1 Course Design

**3.1.1 Overview.** At the first university, approximately 50% of the course was delivered through lectures and the remaining 50% through hands-on practice. The majority of the lectures were dedicated to helping students achieve LO1 – developing analytical thinking in a data-centric business environment. Table 2 lists the textbooks used in this course.

| | |
|---|---|
| Required | *Business Intelligence, Analytics, and Data Science: A Managerial Perspective* (4th edition) (Sharda, Delen, and Turbin, 2017) |
| Optional | *Power Pivot and Power BI: The Excel User's Guide to DAX, Power Query, Power BI and Power Pivot in Excel 2010–2016* (2nd edition) (Collie and Singh, 2016) |
| | *Analyzing Data with Power BI and Power Pivot for Excel* (Ferrari and Russo, 2017) |

**Table 2. Uni-1 Course Textbooks**

The 5 learning modules were covered during the 15 weeks of a regular semester, allowing 6 weeks for data collection and preprocessing, 4 weeks for analytical processing, 4 weeks for visualization, and 1 week for business reporting. Table 3 lists the learning modules, timeline, topics, assignments, and software tools covered in the course.

**3.1.2 Software Tools and Technologies.** To address LO2 – acquiring analytical skills by using leading software tools and technologies – the instructor selected a variety of BA tools and resources, including Power Query, Power Pivot, Power BI, Tableau, and Teradata SQL Assistant. Both Power Query (for data transformation) and Power Pivot (for data summarization) are Excel add-ons that can be activated without an additional licensing fee. Microsoft Power BI, on the other hand, is an independent software package that combines the functionalities of Power Query and Power Pivot, and it has additional visualization features and more processing power and speed. The Power BI license is sold independently from Microsoft Excel. For educational purposes, Microsoft provides a free license for using the Power BI desktop version with 1-GB data capacity. Due to time constraints, only the cloud-based online service of Power BI (available through Microsoft 365) was covered in this course. Please see Appendix A for all software tools used in the course.

Tableau is another popular BA tool that is known for its user-friendly interface and quick generation of interactive visualizations. According to Gartner's Magic Quadrant (Gartner's Magic Quadrants 2019, 2019), Tableau is recognized as a long-term leader in the analytics and business intelligence market, alongside Microsoft and Qlik. Tableau's website provides multiple training platforms for anyone who is interested in learning its technology (see Appendix A).

Additional tools covered in this course included Microsoft Access and Teradata SQL Assistant. Microsoft Access is commonly available in business environments and will have been taught in the prerequisite IS course. For this reason, Microsoft Access was used to teach basic data structure. Teradata SQL Assistant is a user interface that allows students to write queries in structured query language (SQL) and extract data from datasets hosted by the University of Arkansas. The Web version of Teradata SQL Assistant, along with several real-world data sources (e.g., Sam's Club, Dillard's Department Stores, and Tyson Foods), are freely available to Teradata University Network members. Teradata also supports online analytical processing (OLAP) functions which make it an ideal platform to perform certain types of data transformation.

**3.1.3 Assignments and Projects.** To enhance students' analytics skills and give them opportunities to apply analytical thinking, several assignments and projects were given during the semester. These assignments and projects were created or adapted from the textbooks mentioned above and from various online sources, including the Teradata University Network and Tableau websites. Individual assignments were aimed at assessing students' comprehension of topics covered in each learning module with an emphasis on Microsoft technologies. The two individual projects, on the other hand, were designed

| Learning Module | Number of Weeks | Topics | Assignments | Software Tools |
|---|---|---|---|---|
| Data collection | 3 | Relational database structure, data warehousing concepts, and dimensional models | A1: Design and query a relational database | Microsoft Access |
| Data preprocessing | 3 | Extraction, transformation, and loading (ETL) process, OLAP and data cube, and SQL query | A2: Create and execute OLAP queries on a real-world dataset | Teradata SQL Assistant |
| Data analysis | 4 | Data analysis and data mining | A3: Analyze a call center services dataset | Microsoft Excel<br>Power Query<br>Power Pivot |
| Data visualization | 4 | Visualization with charts and graphs, dashboard design, and visual analytics | A4: Analyze a company's sales performance | Power Pivot<br>Tableau<br>Power BI service |
| Business reporting | 1 | Business decision-making based on performance measures and key performance indicators | Individual projects and group projects | All of the above |

**Table 3. Uni-1 Course Details**

to integrate knowledge across learning modules and to enhance students' skills in using Tableau. For individual project 1, students were required to first complete a step-by-step introductory tutorial on the basic features of Tableau. After completing the tutorial, students were required to import an Excel data table into Tableau and create a dashboard with four different types of basic charts showing the impact of bird strike incidents on domestic flights in the United States. This dataset is available on the Teradata University Network website. Appendix B contains the project description. For individual project 2, students first completed a tutorial on advanced features in Tableau. Through this tutorial, they learned how to create relationships between multiple tables, calculated fields, dual-axis charts, and specialized charts such as waterfall charts, Pareto charts, and motion charts. After that, students were required to use the features learned in the tutorial to analyze data extracted from the Dillard's Department Stores database. Appendix C provides the instructions for this project.

The group project assigned in the last quarter of the semester required a comprehensive understanding of the BA process and an application of analytical skills to a real-world problem. For the project, students were placed in teams of four to five members and tasked with acquiring, preparing, analyzing, and visualizing a subset of the Dillard's Department Stores database (through Teradata SQL Assistant) and then interpreting the results of their analysis. Each team was assigned a geographic region with four to five Dillard's stores and was asked to provide insights regarding each store's performance during the Christmas season. More specifically, the teams first identified key performance indicators (KPIs) based on the case description and then retrieved relevant data for the specific region within the given time frame from the Dillard's Department Stores database. The retrieved data were saved as text files and subsequently imported into Microsoft Excel. Next, the teams needed to perform data cleansing on incorrect or missing data and then transform the data into a different format or structure as necessary. After all the relevant data had been acquired and prepared, students used Power Pivot to integrate data tables, construct a dimensional model, create measures, and use OLAP operations such as pivoting, slicing, and drilling for analysis. During the visualization stage, students created dashboards with a combination of tables, different types of charts, and slicers. At the end of the semester, each student team presented their project with a demonstration on how to use the dashboards and an interpretation of the results with key findings and insights for decision-making. Appendix D contains the project instructions and grading rubrics.

### 3.2 Uni-2 Course Design

**3.2.1 Overview.** With the same learning objectives, outcomes, and modules in mind, the course was implemented at Uni-2 with several changes. First, the topic of data warehousing was replaced by R programming for institutional reasons. The university was in the process of developing a master's program in data analytics and according to the proposed program, the topic of data warehousing would be covered in a separate course, whereas R programming would be listed as a prerequisite for multiple advanced analytics courses. Therefore, introducing R programming in the entry-level BA course seemed to be a logical choice.

Another change in the course was to make effective visual design principles an important component. The book *Storytelling with Data: A Data Visualization Guide for Business Professionals* (Knaflic, 2015) was used as a textbook for data visualization. Instead of allocating class time to cover the content of this book, the instructor used a self-paced, guided learning method. Students were required to read the 10 book chapters by themselves, take 5 online open-book quizzes, and apply the design principles to their exercises/assignments and projects. Each quiz consisted of 15-20 multiple-choice and true/false questions from 2 chapters, and each quiz was available for 5 days. All quizzes were timed and, once started, had to be completed in 30 minutes. This method forced students to read and understand the assigned chapters before they took each quiz. At the same time, the 5-day window was a positive mechanism for allowing students to learn at their own pace.

Table 4 shows details of the course. All materials were covered in a 13-week term, which is the length of a full semester at the Canadian university where the course was taught.

**3.2.2 Software Tools and Technologies.** All class sessions were held in a computer lab. Only about 20-30% of class time was used for lecturing, and the remaining time was for hands-on learning of software tools and technologies. As with the Uni-1 course, students in the Uni-2 course learned to use Tableau, Excel, Power BI, and Teradata SQL Assistant for their hands-on exercises and projects. In addition to these tools, students also learned how to program in R, using both the R original interface and RStudio. RStudio is a free development environment for R that is much easier to use than the original R interface. Students learned RStudio by following YouTube videos provided by the instructor. The instructor used a website named DataCamp.com for R. DataCamp has been widely accepted by the data analytics learning community. It offers a variety of well-structured mini-courses in R, SQL, and Python. A mini-course on R in DataCamp usually consists of three to six chapters, each of which may take one to two hours for a student to complete, depending on their background or capabilities. Each chapter consists of a recorded video for concept explanation and multiple hands-on exercises which are automatically graded once submitted. The instructor selected mini-courses with the best fit for students with little programming experience. DataCamp charges a monthly or annual subscription fee for access, but it also allows instructors to set up free class access for every student in the class by using their university email accounts. Once students log in, they see the assigned mini-course; the instructor keeps track of students' progress on the DataCamp instructor's dashboard. In the Uni-2 course, students were given 7-10 days to complete each mini-course. A total of four mini-courses were assigned during the semester, as listed in Table 4: Introduction to R, R dplyr package, Extracting Data Using SQL, and Data Visualization with R ggplot2.

| Learning Module | Number of Weeks | Topic | Assignments | Software Tools |
|---|---|---|---|---|
| Data collection | 1 | Relational database modeling | A1: Entity relationship modeling | MS Access |
| Data preprocessing | 3 | Extracting data from a relational database, cleaning and transforming data | A2: Extracting data from the Dillard's dataset<br>A3: DataCamp mini-course: Introduction to R<br>A4: DataCamp mini-course: Extracting Data with SQL | Teradata SQL Assistant<br>DataCamp |
| Data analysis and visualization | 9 | Summarizing data, effective visual design principles, visualizing data with charts and graphs | A5: Analyzing sales and profit of Superstore dataset<br>A6: Analyzing Bird Strike dataset<br>A7: DataCamp mini-course: Data Manipulation with R dplyr package<br>A8: DataCamp mini-course: Data Visualization with R ggplot2 package<br>A9: RStudio | Tableau<br>Power Query<br>Power Pivot<br>MS Power BI<br>R dplyr package<br>R ggplot2 package |
| Business reporting | From week 4 to the end of the term | Identifying key performance indicators (KPIs), making actionable recommendations /insights based on KPIs and business context | A5, A6, and the project | PowerPoint |

**Table 4. Uni-2 Course Implementation Details**

**3.2.3 Assignments and Projects.** All assignments were done either individually or in pairs. The project was done by teams of two or three students. The project required teams to analyze a real-world dataset and develop actionable recommendations. Out of the nine teams in the class, only one decided to use the Dillard's Department Stores database (accessed through Teradata SQL Assistant). The remaining teams chose datasets from Kaggle.com, a website that provides more than 200 datasets from the real world. The datasets used for team projects included Boston police data, Los Angeles police data, air pollution data from five large Chinese cities, crude oil spills in the United States, Airbnb data from New York and San Francisco, Kickstarter (a crowdfunding platform) data, and LendingClub (a peer-to-peer lending platform) data. Each team wrote a formal report and made a class presentation on their findings. Appendix E contains the group project instructions.

## 4. EVIDENCE AND DISCUSSION

This section presents feedback collected through student surveys regarding the design and implementation of the foundation course and discusses future improvements based on this feedback.

### 4.1 Uni-1 Course Feedback and Reflection

Student feedback was collected through the university's official teaching evaluation surveys during the three times the course was offered. For all items on the surveys, average student ratings ranged between 4.3 and 4.6 out of 5 (1 indicating "very poor" and 5 indicating "very good"). Overall, the course was well-received by students. Students liked the course structure and the practical tools and technologies learned in the class. In particular, students appreciated the hands-on learning sessions on Tableau, Teradata, Power Pivot, and Power BI. Students responded with comments such as "no matter where I go to work, I have some experience," "a hands-on course where you learn about business intelligence, data analytics, and data mining in both theoretical and practical ways," "I think it has practical uses in the business world," and "I would tell other students that this class is very interesting and educational." One student who completed a summer internship after taking this course emailed the following to the instructor: "When I was interning I was frequently using Tableau, power pivot, and other applications. I have been so surprised just how often I am using the skills and applications we learned in [this course]."

In the spring semester of 2018, an additional survey designed by the authors of this paper was conducted to collect subject-specific feedback from the students. Appendix F lists the survey questions. Out of 44 students registered in the course, 40 responded to the anonymous survey. The assessment results indicated that the course was a success. Eighty percent of the students commented that their analytical thinking had improved as a result of taking the course, and 82.5% reported that their analytical skills had improved. In addition, 82.5% of the students thought this course was a good elective for all undergraduate business students and would recommend or strongly recommend that others take the course. Similar to the results of the university surveys, the students also gave favorable scores to the hands-on assignments, projects, and in-class exercises. All students but one thought that the amount of hands-on work should be kept the same (82.5%) or increased (15%). The students' written feedback concurred with the above results. Hands-on experience, learning how to use various software tools, and applying concepts to solving real-world business problems were their favorite aspects of the course. Some students suggested including more coverage of new tools, such as Power BI and Tableau, and spending less time on data warehouse design and OLAP. Students also

suggested changes to the group project, such as reducing the group size and allocating more class time to reviewing the project.

Based on student feedback, a number of changes could be made to the course in the future. First, the coverage of data warehouse design and OLAP could be reduced since modern BA tools (such as Power BI and Tableau) only require a basic understanding of these concepts. Second, because the course is designed for undergraduate business students, it would be beneficial to increase hands-on time on business-user-oriented software platforms such as Power BI and Tableau. Third, the size of the project group could be reduced from four to five students to three or four to give each student more opportunity to apply and enhance their analytical thinking and skills. Assigning students with complementary skills and diverse business knowledge to a team would also help improve their experience and project outcomes. Finally, some class time could be allocated to project review sessions, as suggested by the students, to ensure a successful completion of the project by each group.

### 4.2 Uni-2 Course Feedback and Reflection

There were 22 and 24 students registered for the Uni-2 course in 2018 and 2019, respectively. In 2019, the instructor made a significant change to the course by adding the R programming language as a BA tool. Therefore, the following discussion focuses on the class offered in 2019.

We conducted two surveys to collect student feedback in 2019. The first was the formal teaching evaluation designed by the university, and the second was the same survey designed by the authors of this paper and used for Uni-1. Seventeen students (71%) participated in the university survey. For all items on the survey, the average student ratings were between 4.4 and 4.6 out of 5 (1 indicating "very poor" and 5 indicating "very good"), indicating that the course was a success. Eight students responded to the second survey which was emailed to the class after the course ended. Out of these respondents, 87.5% commented that their analytical thinking and skills had improved as a result of taking this course. In addition, 62.5% thought this course was a good elective for all undergraduate business students and would recommend or strongly recommend that others take the course.

In particular, students liked the textbook, R programming, and the hands-on learning approach. Students commented that the textbook was easy to read, informative, and had illustrative examples. Students also commented that R was an employable skill in high demand, and they appreciated the online resources that the instructor provided, such as the DataCamp website and real-world datasets. Some students indicated that what they learned in this course could be applied to other course work and to their future jobs. Four students told the instructor that they had obtained a summer internship or a full-time job as a result of having taken this course.

The instructor felt that providing timely and detailed feedback to students' assignments was the most, or one of the most, important mechanisms that made the hands-on learning approach work. For all exercises and assignments, the instructor critiqued sample work (such as charts) submitted by students and provided improvement suggestions. As for the interpretation of analysis results, the instructor demonstrated to students what good, actionable recommendations are, what additional "drilling-down" questions could be asked, and what additional data items needed to be collected for further analysis. As a result, students acquired analytical thinking by taking this course. At the beginning of the course, students could only list a few data patterns and gave simple interpretations. By the final project, all teams demonstrated an ability to interpret complex data patterns, present actionable recommendations and insights for solving business problems, and specify follow-up questions for management to investigate before making final decisions.

In addition to having acquired an analytical mindset, almost all students evolved from novice visual designers to effective designers. Their final projects demonstrated that they were able to apply all the visual design principles learned in the course to their charts and diagrams, including choosing appropriate chart types and colors, using descriptive yet concise labels on charts, making charts less cluttered, and making the data patterns easy to understand. Several students commented that the visual design principles they had learned for creating charts and PowerPoint slides would be useful in other courses and future work, regardless of the discipline. Two students majoring in computer science and minoring in management commented that this course was particularly useful as they had learned how to view and analyze data from a business perspective.

In the future, the instructor plans to improve the course by introducing RStudio earlier in the semester – specifically, right after the DataCamp mini-course on "Introduction to R" – so students can practice what they have learned from DataCamp in RStudio. In this way, students will gain sufficient familiarity with R programming to use it in their final project. In the 2019 class, only one team used R in their project. In future classes, all teams will be required to use R for either manipulating data or creating visuals for the final project.

## 5. TEACHING SUGGESTIONS

As mentioned earlier, the primary goal of this entry-level BA course is to lay a solid foundation for undergraduate business students to become data-literate professionals or entry-level data analysts. To accommodate these two groups, a wide range of concepts, tools, and technologies were introduced in the two implementations of the course design. Business students from different disciplines gained a broad understanding of various stages of the BA process along with relevant hands-on skills. This course could also be used as a prerequisite for advanced undergraduate BA courses such as data mining, machine learning, and marketing intelligence and analytics courses. It could also be modified and adapted to serve as a foundation course for a graduate-level BA program.

The implementation of the course design at two universities demonstrates that a variety of topics and tools can be taught to achieve the learning objectives of this course. Instructional approaches may also differ based on an individual instructor's teaching style, availability of technologies, and delivery methods. In terms of the five learning modules, the following topics were covered in both Uni-1 and Uni-2 courses: relational database structure; data extraction, cleansing, and transformation; summarization and visualization of key performance indicators (KPIs); and making actionable recommendations/insights based on the KPIs. Common BA tools that were introduced in both Uni-1 and Uni-2 included Power Query, Power Pivot, Power BI, and Tableau. We

recommend that other instructors who plan to offer such a course cover these tools as they are freely available and widely used by businesses. It is worth noting that Power BI comes in two distinct versions, a desktop version and an online service. However, Power BI desktop is currently only available for Windows-based computers. The Power BI online service, on the other hand, can be used through a Web browser and is freely available through Microsoft 365, but it is very limited in terms of functionality. The Uni-1 course used the Power BI online service, whereas the Uni-2 course used the Power BI desktop version. Both were well-received by students. Future instructors could choose either one depending on their own instructional environment.

Aside from the common topics and tools discussed above, we recommend several topics that are optional but would be particularly beneficial to students who plan to take advanced BA courses or pursue an advanced degree in BA. Data warehousing has long been at the center of business intelligence and structured data analytics. The Uni-1 course covered this topic with a focus on data warehouse architectures and dimensional models. In the Uni-2 course, R was taught as an advanced BA tool. A popular programming language among statisticians and data analysts, R provides powerful data manipulation and visualization capabilities. For most of the datasets that were available to students, Tableau, Power BI, and R could be used to produce similar results. It is beneficial for students to be exposed to a variety of BA tools, as these are all commonly used by companies in a wide range of industries.

Depending on the specific student groups in the course, instructors may also choose to teach Python as an alternative tool for BA. Similar to R, Python is also an open source programming language. For someone who has no prior training in either, the learning curves of R and Python are comparable. For students with some programming experience, picking up Python is relatively easy. R is traditionally considered the de facto analysis tool for statistics. Over the years, a great number of packages have been developed for R to make a large variety of analyses possible. R also comes with very neat and elegant capabilities in communicating analysis results, such as plotting. Python, on the other hand, is a general-purpose language that has been enhanced with data analysis and machine learning libraries in recent years. It is considered to be more scalable and robust than R.

Although this course was offered in a computerized classroom at both universities, it can be implemented as an online or hybrid course. In fact, the Uni-2 instructor taught a condensed version of the course (worth 1.5 credit hours) as an online MBA course in the summer of 2018. The online version did not cover Power BI or R because of time limitations. The transition from face-to-face delivery to online instruction was smooth, which can be explained by the fact that about 80% of the course content was delivered through self-learning, even in a face-to-face environment. The only major difference was the way of providing feedback on students' work. In the face-to-face environment, the instructor talked to individuals or teams about their own work and also demonstrated and critiqued some students' examples for the entire class. For the online course, the instructor provided similar feedback but in writing. Detailed comments were provided to students regarding their individual or group work. The instructor also compiled a document that consisted of students' sample work, demonstrating good examples versus those that needed improvements. In this way, students not only learned from their own errors and mistakes but also from other students. Students were also given the opportunity to opt out if they did not wish to share their work with the class. If the course is offered in a hybrid format (online and face-to-face), we recommend providing face-to-face feedback which is more efficient and effective compared to written feedback.

## 6. CONCLUSION

As noted in a report from the McKinsey Global Institute (Henke et al., 2016), the last step in realizing the value of data analytics relies on "business translators" who understand domain-specific business environments, are able to identify business problems and seek solutions using appropriate BA tools, and can transform insights discovered in the data into business gains. This paper presents the design of a foundation BA course that lays out a path for students who want to become data-literate business professionals or entry-level data analysts. The course can be delivered as a stand-alone elective for undergraduate business students or as a prerequisite for advanced analytics courses in a BA certificate or degree program.

This foundation BA course was taught at two universities with the same targeted students, learning objectives, learning outcomes, and learning modules. However, details such as topic coverage, software tools and technologies, and instructional materials varied. Both courses offered students valuable learning experiences as they worked through various stages in the analytical process. Both were well-received and perceived by students as having improved their analytical thinking and skills. Besides the course design and teaching methods, the detailed instructional materials and concrete recommendations included in this paper will assist other instructors in adopting this course at their own institutions.

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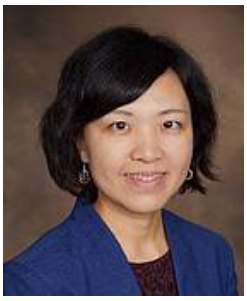

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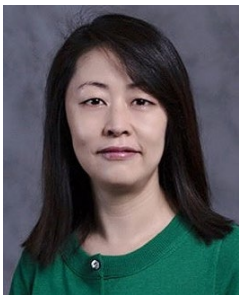

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**APPENDIX A**
**List of Software Tools and Datasets**

(Additional teaching materials, other than the ones included in the appendices, can be requested by emailing the authors.)

| | | |
|---|---|---|
| Tableau | Instructor download site | https://www.tableau.com/academic |
| | Student download site | https://www.tableau.com/academic/students |
| | Online training videos | https://www.tableau.com/learn/training<br>https://www.youtube.com/watch?v=GkJwcyI_1vc |
| Power BI | Desktop version download site | https://powerbi.microsoft.com/en-us/ |
| | Cloud-based service version | Available through Microsoft 365 |
| | Online training modules | https://docs.microsoft.com/en-us/learn/ |
| DataCamp | DataCamp for the classroom sign-up page | https://www.datacamp.com/groups/education |
| RStudio | Download site | https://www.rstudio.com/products/rstudio/download/ |
| | Online learning | https://www.rstudio.com/online-learning/<br>https://www.youtube.com/watch?v=5YmcEYTSN7k |
| Teradata SQL Assistant | Access request page | https://walton.uark.edu/enterprise/teradata-university-network.php |
| Datasets | From the University of Arkansas | https://walton.uark.edu/enterprise/datasets.php |
| | From the Kaggle website | https://www.kaggle.com/datasets |
| | From the Tableau website | https://community.tableau.com/docs/DOC-10198 |

**Table A1. List of Software/Resources Used**

**APPENDIX B**
**Uni-1 Course Individual Project 1 Instructions**

The objective of this project is to create a Tableau dashboard based on the Bird Strikes dataset by completing the following steps:

1. Download and open the BirdStrikes.xlsx Excel workbook in Tableau. The data contains records of US flights (from 2000 to 2011) during which planes were struck by birds.
2. Create a geographic map to answer the following two questions: 1) "*Which departure state has the highest total monetary costs as a result of bird strikes*?" 2) "*What is the average speed for the airplanes with bird strikes from the states of origin*?"
3. Create a bar chart to determine the impact of these strikes on the bird population in terms of total costs. Sort the chart in descending order of the total cost. Then use the Color tool to highlight the bird species that have caused large number of incidents (use the Number of Records measure.) Finally, add a filter to show only those species that have cost a minimum of $11,000,000.
4. Create a packed bubbles chart that helps answer the question "*Which airline/operator has the highest total cost due to bird strikes*?" Filter the results to show airlines/operators that have a minimum total cost of $7,000,000. Use the Color tool to show the bubbles in different colors based on the total number of records.
5. Create a stacked bar chart that displays the number of incidents at each phase of flight and their impact to flight.
6. Create a dashboard with the above four charts displayed on one screen and export the dashboard to a PDF file.

**APPENDIX C**
**Uni-1 Course Individual Project 2 Instructions**

For this project, you will use Tableau to analyze the business performance of Dillard's Department Stores MSA 2680. The required dataset is provided in an Excel workbook: Dillards_2680.xlsx, which includes the following tables:

- **DailySales** - Aggregated daily sales (purchases) by store and department from 11/26 to 12/31
- **Departments** - List of department codes, descriptions, and types

**Part 1**

1. Follow the steps below to prepare the data for analysis in Tableau
    1) Import the Dillards_2680.xlsx workbook into Tableau
    2) Create inner join relationship between DailySales and Departments
    3) Make sure that the lists of dimensions and measures are correct (you may need to convert certain fields from measure to dimension)

2. Create a stacked column chart that shows total sales (use the ACTUAL field) of each store by product type. Use store as the X-axis and total sales as the Y-axis. Each stacked column must show sales volume of each product type (use the TYPE field). Rename the chart to Sales by Store. (Chart 1)

3. Create a calculated field called Markdown Percent using formula: (ORIG-ACTUAL)/ORIG, then create a bar chart showing average markdown percentage for each department across all stores in the MSA. Use department description as Y-axis. Sort the chart by Markdown Percent. Rename the chart to Markdown Percent by Dept. (Chart 2)

4. Create an area chart that shows the running total of daily sales (use ACTUAL field) across all stores from 11/26 to 12/31. Rename the chart to Running Total of Daily Sales. (Chart 3)

5. Create a motion chart that illustrates how sales change each day across all stores. Your chart must show the animation as a line that moves from left to right (from 11/26 to 12/31). Rename the chart to Daily Sales Animation. (Chart 4)

**Part 2**

1. Create a dashboard that includes the four charts from Part 1.
2. Save your Tableau file in the format of [Lastname][FirstInitial].twb.
3. Create a PDF file of your dashboard. Make sure the PDF file is named in the format of [Lastname][FirstInitial].pdf.
4. Submit both the twb file and the pdf file by the due date.

**APPENDIX D**
**Uni-1 Course Group Project Instructions**

Description of this project is an adaptation of Andy Borchers' Dillard's Christmas Dashboard assignment available from Teradata University Network (https://www.teradatauniversitynetwork.com/)

**Scenario**

It is Christmas season of 2004. You work for a Dillard's Department Store regional manager. The regional manager is interested in the performance of her MSA (Metropolitan Statistical Area) and individual stores, each of which operates approximately 60 departments. Each MSA has a sales target for the Christmas season, as shown below:

| MSA | MSA Name | Store Count | Sales Target |
|---|---|---|---|
| 3600 | JACKSONVILLE, FL | 4 | $4,619,736 |
| 3760 | KANSAS CITY, MO-KS | 5 | $6,350,839 |
| 4120 | LAS VEGAS-PARADISE, NV | 4 | $6,484,739 |
| 4400 | LITTLE ROCK-NORTH LITTLE ROCK-CONWAY, AR | 4 | $7,017,718 |
| 5560 | NEW ORLEANS-METAIRIE-KENNER, LA | 5 | $9,098,243 |
| 5720 | VIRGINIA BEACH-NEWPORT NEWS, VA-NC | 5 | $4,553,875 |
| 5880 | OKLAHOMA CITY, OK | 5 | $6,876,504 |
| 7240 | SAN ANTONIO, TX | 4 | $6,149,333 |

**Table A2. Sample Data from The Dillard's Dataset**

Your boss has asked you to create dashboards with KPIs (key performance indicators) that she could use to evaluate the success of her stores and departments in meeting performance objectives. In addition to the sales targets (total actual sales not counting returns) listed in the above table, you need to also consider the sales of the first 10 days of the holiday season, which should be 25% of the target sales. The third key target is the mark-down percentage, which has been 33% historically. The mark down percentage is calculated based on the original sales and actual sales.

You join a team of 4-5 members and together you will complete the following requirements for the assigned MSA:

1. Write one or more SQL queries to retrieve the relevant dataset from the UA_DILLARDS database on Teradata SQL Assistant.
2. Carefully examine the data and perform any necessary cleaning and transformation, such as removing wrong or missing data, aggregating, summarizing, filtering, and sorting.
3. Select **5-6 KPIs** based on the dataset. The KPIs must be quantifiable measures that reflect the business performance from various aspects, and at both the store and the department levels. Retrieve additional data from the UA_Dillards database if needed.
4. Use Excel and Power Pivot to create two dashboards (on two separate worksheets) based on the KPIs. The first dashboard will demonstrate the sales performance during the 10 days after Thanksgiving. The second dashboard will demonstrate the sales performance of the whole Christmas season (36 days). Alternatively, you may create one dashboard for both the 10-day and 36-day datasets with a mechanism to switch between the two.
5. Prepare a memo by inserting a new worksheet in the same workbook. Your memo must have the following three sections:
    - Names of all the students participating in this project and contribution of each student.
    - Description of each KPI on your dashboards and how it should be used day by day as the Christmas season progresses.
    - Key findings from the dashboards and recommendations to the manager.

**Demonstration**

At the end of the semester, you will make a short presentation to demonstrate your dashboards to the class. The demo should be approximately 8-10 minutes. All the group members must participate in the demo and be prepared to answer questions from the audience.

**Grading Rubrics**

The project is worth a maximum of **100 points**. Grading will be based on:

- **Technical requirement**: The team demonstrates technical proficiency of using Teradata SQL Assistant, Power Pivot, and Tableau in extracting, transforming, and analyzing the data.
- **Information Displayed**: The KPIs were carefully selected and displayed in a way to "tell a story" to the managers.
- **Monitor at a glance**: The dashboard allows the managers to view and interpret all the key information at a glance. Some interactive features (such as drill up/down, slide, and dice) are provided as needed.
- **Visual appearance**: The dashboard is visually appealing and consistently formatted. Appropriate graphics are used for maximum effectiveness.
- **Recommendations**: The team provides useful business insights and makes convincing recommendations based on the KPIs and the information presented.

**APPENDIX E**
**Uni-2 Course Group Project Instructions**

Your team will analyze a real dataset and find several actionable insights by applying data analytics techniques that you have learned in the class. The deliverables of the project include a formal report and a class presentation.

**Report Content**

- **The title page** including a title (concise but descriptive) and team members' names.
- **A table of contents** (nicely formatted and aligned)
- **An executive summary** (summarizing the key points of your report)
    - You must summarize in such a way that a reader will understand all your key points without reading the entire report. Maximum length: one page for this part.
- **An introduction/summarization of the data set**
    - Include at least the following: Datasource, dataset size, and dataset description
- **The analysis focus and drill down questions**
    - Analysis focus: be analytical, creative, and practical. For example, if you use the Dillard's dataset, you can analyze the performance of stores for a particular time period (such as Christmas) or performance of a particular department in a region.
    - You need to list specific questions for your analysis focus
- **The actual analysis**
    - Include a concise summary of key findings of data patterns
    - Include at least three actionable insights or recommendations
    - Include effective visuals to illustrate key findings
        - You must use at least two of the three tools (Tableau, R, Power BI) to create charts
        - Create at least eight charts
- **Lessons learned from the project**
    - Explain what you learned from doing the project (note: this is not about the data pattern that you found from the dataset, it is about doing the project as a learning process)
    - Specify who has done which tasks
- **Appendices**
    - If you chose to use the Dillard's dataset, you must list all SQL statements that you have executed to extract the data. You don't need to list the results, just the SQL statements.

**Other requirements**
*Page length*: about 8-12 pages excluding title page, table of contents, and appendices. Charts should be included in the report and labeled as "Figure 1," "Figure 2," etc.
*Style and format*:

- Arial, 12 point
- 1 inch margin all around
- 1.5 line space

**Marking Guidelines**:

- **Quality and usefulness of your analysis**: for example, if you use the Dillard's dataset, can the COO or store managers apply your recommendations to increase profit and/or reduce loss. The bottom line: how can Dillard's make more money? If your entire report only discusses sales, not analyzing anything about return or margin, you missed the target. If you use other datasets, you will need to define your own goal for the project.
- **Breadth vs. Depth of the analysis**: you need to have appropriate breadth and depth. For example, if you use the Dillard's dataset, if you choose to analyze a few particular products, then you need to analyze them in the whole year for at least a region, not just one store. If you analyze all stores in a particular state (e.g., Arizona or Colorado), you may want to identify the top performing products and bottom performing products.
- **Visual effectiveness**: all of your charts will be marked at the professional level. You need to apply the effective visual design principles learned from the textbook to your charts. Default charts created by Tableau or Excel may not be good enough; in fact, most of them are not good enough – you need to make changes. Each of the charts will be given a score, and the lowest score will be dropped; but if you don't have enough charts, the lowest score will be kept. The average score of the charts will be counted as the score for the chart part.

**APPENDIX F**
**Student Survey of the Business Analytics Course**

Q1. Overall, I rate this class.
1. Very easy
2. Easy
3. Ok (not too easy and not too difficult)
4. Somewhat difficult
5. Difficult

Q2. I have learned something new from this class.
1. Strongly disagree
2. Somewhat disagree
3. Neutral
4. Agree
5. Strongly agree

Q3. As a result of taking this class, my analytical thinking has been improved.
1. Strongly disagree
2. Somewhat disagree
3. Neutral
4. Agree
5. Strongly agree

Q4. As a result of taking this class, my analytical skills have been improved.
1. Strongly disagree
2. Somewhat disagree
3. Neutral
4. Agree
5. Strongly agree

Q5. As a result of taking this class, I want to learn more about data analytics.
1. Strongly disagree
2. Somewhat disagree
3. Neutral
4. Agree
5. Strongly agree

Q6. Out of all the time that I spent for this class (including class time and non-class time), I spent ____ of the time to do hands-on exercises/assignments/projects.
1. under 30%
2. between 30% and 50%.
3. between 50% and 70%
4. between 70% and 90%
5. above 90%

Q7. I feel that the amount of hands-on exercises/assignments/projects in this class _____.
1. should be decreased.
2. should be kept the same.
3. should be increased.

Q8. I think this course is a good elective course for all business undergraduate students.
1. Strongly disagree
2. Somewhat disagree
3. Neutral
4. Agree
5. Strongly agree

Q9. What did you like about the class?

Q10. What should be changed, deleted, or added for the class if offered in the future?


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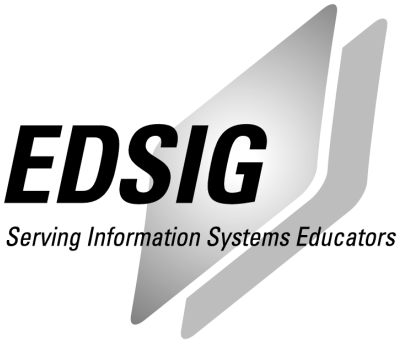


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ISSN 2574-3872