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Article

# The Development of Accounting Data Analytics Curriculum

**Cindy Durtschi**[1] | **Tawei (David) Wang**[2]

[1]School of Accountancy & MIS, College of Business,DePaul University, United States

[2]School of Accountancy & MIS, College of Business,DePaul University, United States

**Correspondence**
Tawei (David) Wang, School of Accountancy & MIS, College of Business,DePaul University, United States
Email: david.wang@depaul.edu

Accounting programs are now being encouraged to incorporate data analytics into their programs. This article will provide suggestions on how to set up a data analytics program in a school of accountancy, answer why it is important to incorporate data analytics within accounting programs, and finally how to create a well-integrated curriculum.

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## 1 | INTRODUCTION

Accounting programs are currently encouraged or required to expand curriculum to include data analytics. The motivation comes from meeting accreditation guidelines, and the change in accreditation standards is the result of pressure from the accounting profession. The profession is rapidly moving toward more digital platforms in an effort to improve quality, efficiency and communication with clients in more easily interpreted visual formats.
The move to data analytics can feel exciting as well as intimidating as we confront a series of questions. For example:

1. What exactly do accounting firms mean by "data analytics?"
2. How does one put together a coordinated data analytics curriculum?
3. Where does data analytics belong in a curriculum?
4. What happens to curriculum when platforms change, as they do in rapidly changing technology?
5. What challenges arise when bringing a data analytics curriculum into operation?

The authors created a data analytic program and this article offers some thoughts on the answers to these five questions gleaned from the six years of experience with our program. We deliver the program to master's level students. It integrates the accounting knowledge from their undergraduate education, data analytics, forensic accounting and

internal audit (controls). We are currently integrating a data analytics program into the undergraduate curriculum. When dealing with undergraduates, many of the same approaches apply with the several caveats. First, the data analytics problems chosen must not outpace the student's accounting knowledge. Second, consider the student's overall experience to avoid overwhelming the undergraduate's already tight schedule. Third, undergraduate accounting education is focused on content and certificate preparation so data analytics, by necessity should have a dual purpose, enforcing accounting knowledge while conveying basic skills. The rest of this paper will share what we have learned.

**What do accounting firms mean by data analytics?**

To accounting professors, data analytics means PhD-level statistics and programming. Luckily, we came to realize this is not what accounting firms expect. Hours of talking with accounting firms made it clear that they can, and do hire data scientists for more technical tasks; the problem is that data scientists do not understand accounting or auditing. So, what firms are looking for in new accounting hires is:

**1)** An understanding of the limits and potential of programming
**2)** The ability to know what accounting questions to ask of the data
**3)** The ability to interpret the results of the analytics
**4)** The ability to use accounting knowledge to know what questions to ask next
**5)** Knowing how to prioritize business issues, and
**6)** Understanding statistics and alternative methodologies to know when results are meaningful.

In other words, firms need a link between the data scientists and accounting; someone who can link data with the operational decisions. When forming a data analytics program for accounting, that link between analytics knowledge and business operations, policies and procedures must be in the forefront. In summary, what firms' desire is accountants who can leverage analytics to facilitate the decision making process, who understand the data results in the context of accounting, and can put those results into reports which communicate (e.g., visualizations) important accounting and auditing information effectively to clients.

**How does one put together a coordinated data analytics curriculum?**

Data analytics, like accounting, builds from basic concepts to techniques that are more challenging. Because of this, we found it imperative to coordinate and integrate our curriculum. We have not yet found a series of textbooks that mirror an accounting curriculum at the graduate level, in that they begin with simple concepts and become more complex over a series of courses. Therefore, we built our curriculum slowly, and changed it frequently. We also found that accounting students want their data analytics problems to deal with accounting issues. They much prefer to work with accounting numbers and have the problems they solve include questions they might see on a job. That is, teaching them pure methodology without specific contexts may create some barriers.

Accordingly, we consider students accounting knowledge as we build analytical problems that move sequentially from easier concepts to relatively more advanced techniques. We start with the program's learning objectives and learning outcomes to ensure we have a consistent and coherent design. We overlay the accounting maturity level with the analytics maturity level starting from descriptive analytics to diagnostic, to predictive, then prescriptive.[1] We realized

[1] Descriptive analytics focuses on what has already happened and/or what is happening. For example, we may observe more transactions between $9,000 and $10,000 (i.e., a pattern that has already happened). Diagnostic analytics emphasizes making sense of the observed pattern. That is, based on business operations and all the imposed mechanisms (e.g., internal controls or incentive schemes), are we able to explain the observed information and provide

the importance of considering the level of taking analytics tasks in succession when we found that students could not discuss predictive tasks without an understanding of basic statistics. We rearranged our courses to require each student to complete a basic (but customized to our needs) statistics course.

We also found that the particular analytic tools and programs chosen for class was less important than we first believed. Class time spent helping students see different possibilities and how to link data with operational decisions is more important than time spent learning a tool. Students can easily access and learn different tools online for a low price or even free. A better goal for students is to learn how to approach the problem, how to start the analysis, how to interpret results and how to communicate findings.

**Where does data analytics belong in a curriculum?**

It is not enough to provide students with one or two data analytics courses. This is not to advocate for a longer series of courses, rather to promote the notion that repetition will increase the chance that students will retain the knowledge and skills learned in such a course and be better able to apply them in the future. In our program we consciously integrate data analytics in all courses. We encourage students in each course in the program to incorporate any skills they have learned in prior courses. For example, in our in our forensic accounting courses, students are encouraged to use their data analytics skills to solve the forensic accounting cases. The data analytics cases often have a forensic accounting or audit story embedded in the data. The internal audit classes apply to both the forensic accounting and data analytics cases as both rely students understanding of internal controls.

The purpose of this approach is that students must integrate their accounting knowledge and data analytics skills in each problem they confront. An example of a data analytics problem we have used is to give students data from accounts receivable. Students should first know what questions to ask (i.e., does the data set contain accounts long overdue?). Second, if an aging analysis shows many long-overdue accounts is that unusual? (i.e., they should know to compare across time). Finally, if it seems to be a new phenomenon, what additional questions should they ask? (i.e., was a single individual responsible for granting credit to customers that were not creditworthy? Was there a corresponding increase in the allowance for doubtful accounts? Were those delinquent accounts removed from the books in a timely manner?)

No data analytics problem is complete without a client presentation. Students must decide what information is important to convey to the client. They must anticipate client questions and prepare answers, finally, they must think about the value their analysis can create for the company.

**What happens to curriculum when technology changes?**

This is where coordination between data analytic faculty is important. While we meet formally as a faculty, the data analytics faculty meet informally to coordinate their courses as well. Each faculty member may have his/her own preferences but consistency across the program is still needed. However, the change in technology implies a change in all teaching materials and handouts even when tools are just for illustrative purposes (i.e., "here is one tool similar to those you may use on the job"). The coordination involves two levels: one is about the tool and the other is about the content. Choosing the tool is a challenging task as we will discuss in the next section, even though it should be

recommendations? In the previous example, it may result from the policy requiring more approvals when the transaction is more than $10,000. Predictive analytics, as the name suggests, turns our attention to predictions. For instance, are we able to predict the problematic transactions that are arranged intentionally to avoid the additional approvals? Last, prescriptive analytics attempts to answer the question "how can we go from where we are now to where we want to be." Through a series of, for example, "what-if" analysis or sensitivity analysis, we may be able to change processes or reallocate resources to reach the goal.

chosen for illustrative purposes. The content also has to be updated regularly to reflect the new practices and new possibilities. More importantly, as students grow to become more comfortable with this new skillset, we are required to make changes to push them to the next level. This means coursework requires a regular patch or even redesign of the curriculum.

**What is needed to operationalize the program?**

Our experience is that settling on a curriculum turns out to be a far cry from operationalizing it. The number one requirement to operationalization is **talent**. The difficulty in finding talent (those who are able and willing to take on a data analytics course) lies in the fact that as an accounting professor we are accustomed to textbooks that lay out the curriculum in an organized manner, that have problems and supplemental materials or even an online homework manager. Teaching data analytics is much more free form. Classes need to be built, but at the same time require a lot more flexibility than a typical accounting course. For example, finding or creating data analytics problems requires a different level of time and effort on the part of the professor. Adding another layer of complication is the fact that data analytic problem solutions are easily transferrable from one semester to the next so the continual creation of challenging problems is a relentless process. Another issue is that there is less lecture and more hands-on interaction with students as each student runs into unique difficulties with the problems and the technology. This requires that instructors have a level of comfort with the technology as well as the problems being set for the class.

As mentioned earlier, given our focus is on the analytics mindset and critical thinking skills, choice of software or tools becomes for illustrative purposes. However, even then, selection of an illustrative software is one of the most challenging tasks to confront the instructor when designing the curriculum. Each tool has its own benefits and limitations that are affected by multiple factors: (1) The expected learning outcome. The software has to match the learning outcome. For example, if the goal is visualization, a statistic software, though it can also do some visualization, probably does not fit. (2) Mac users. Many business applications do not run on a Mac. If a school has a limited availability of computer labs or when students are online, the tool must work easily on different platforms. (3) Level of coding and data manipulation. Our main objective is not training a computer scientist. We choose tools that reduce the level of coding and data manipulation required by students so our focus can be on higher-level skills, such as how to think through a problem, how to interpret results and how to communicate data. These skills are also transferrable to different technologies.

Finally, the **grading** rubrics are different from normal accounting questions as there are written reports, and data presentations that must be weighed and judged, usually on a comparative basis rather than an absolute solution. We have found grading rubrics that focus on critical thinking displayed by students work better for analytics type assignments.

## 2 | CONCLUSION

The creation and execution of a data analytics program in accounting is a challenging and rewarding task. It can do much to prepare students for the future they will face in the workplace. It also comes with challenges and hard work for instructors. While it is easy for an administrator to ask someone to create such a program, it is imperative that those who work in these programs get support in finding good faculty, accessing the technology needed, and recognition for the extra time involved in creating and maintaining these courses.