Aug 10th, 12:00 AM

A Hybrid Introductory Analytics Course: Lessons Learned During The COVID-19 Pandemic

David P. Darcy
Arizona State University (SSO), david.darcy@asu.edu

Asish Satpathy
Arizona State University (SSO), asish.satpathy@asu.edu

A Hybrid Introductory Analytics Course: Lessons Learned During The COVID-19 Pandemic

Completed Research

David P. Darcy
W.P. Carey School of Business
Arizona State University
david.darcy@asu.edu

Asish Satpathy
W. P. Carey School of Business
Arizona State University
asish.satpathy@asu.edu

Abstract

We report on the design & development of an introductory analytics course delivered to over 6,000 students undergraduate business students thus far. The course is delivered in a hybrid mode, arguably the best combination of online and face to face delivery modes. The Pandemic reinforced that lesson, among others. We explore those lessons and suggest directions for further research.

Keywords

Introductory Analytics Course, Hybrid Delivery, Lessons Learned, COVID 19 Pandemic.

Introduction

The application of analytics in business has seen revolutionary change thanks to substantial increase in data availability, increase in breadth and sophistication in analytical methods, a myriad of new tools, storage and processing cost reductions, to name some major contributors (Dinter, Fritzsche, & Kollwitz, 2017; Gupta, Goul, & Dinter, 2015; Jaggia, Kelly, Lertwachara, & Chen, 2020; Schiller, Goul, Iyer, Sharda, & Schrader, 2015; Wixom, Ariyachandra, Douglas, Goul, & Gupta, 2014). Educating the workforce in analytics and keeping up with its evolution has become more imperative and challenging (Firth, King, Koch, Looney, & Pavlou, 2011; Paul & MacDonald, 2020; Rodammer, Speier-Pero, & Haan, 2015; Wilder & Ozgur, 2015; Williams & Elmore, 2021; Zadeh, Schiller, Duffy, & Williams, 2018; Zhang, Chen, & Wei, 2020). As a highly cited McKinsey report makes clear, obtaining analytical knowledge, skills, and abilities (KSA's) is no longer simply desirable but becoming a fundamental toolset for almost any role, function, organization, and industry (Manyika, et al., 2011). There continues to be a widening workforce gap in the supply and demand of those with analytical KSA's (Doshi & Krishan, 2020). In recognition of this need, AACSB has revised its curriculum standards to encompass analytics KSA's (AACSB, 2020). The case has been made that Information Systems (IS) is perhaps the most suitable single discipline to develop and deliver analytics curricula given the already existing interdisciplinary focus of Information Systems (IS) (Agarwal, et al., 2014; Burns & Sherman, 2019). We build on a tradition of analytics curricula development in IS (Gupta, Goul, & Dinter, 2015; Schiller, Goul, Iyer, Sharda, & Schrader, 2015; Topi, et al., 2010; Wixom, Ariyachandra, Douglas, Goul, & Gupta, 2014; Zhang, Chen, & Wei, 2020) by reporting on an introductory analytics course. The question remains, how do we implement a suitable analytics curriculum that will satisfy organizational needs that are interdisciplinary in nature and taught from IS?

The objective for this paper is to detail both the design *and* implementation of an introductory analytics course for undergraduate students across the entire range of business disciplines. Several aspects of the course combine to generate a unique context worthy of further study and provide several valuable lessons. For example, the choice of a hybrid delivery mode (for reasons discussed in Section 2), was made before the COVID-19 Pandemic so dramatically changed the landscape for us all; the pandemic ushered in and accelerated several additional aspects of the course implementation. Reflecting on what occurred in the

course before and during the pandemic really highlighted the unique challenges and benefits of the course. We report on the valuable lessons we learned to the larger community of scholars and educators.

The course discussed in this paper has another novel aspect: much of the curricula cited have a stated goal of educating for analytics roles such as data analysts, data specialists and data scientists (Wilder & Ozgur, 2015). We are educating the entire gamut of business students in using analytics for problem solving as part of their larger role, whatever that role may be. Providing an introductory analytics course to all business students enables departments to then offer discipline specific analytics courses.

Moreover, changing the motivation of a significant part of the audience from "I choose to do this course/major/program" to "I have to do this because it's a requirement" has significant implications for building engagement. These distinctions in audience orientations may be subtle but they have major implications for the course design. Some of the design choices made for the course include the potential to spark curiosity towards the use of data analytics methods without making students fully proficient in data roles at the end of the course.

This paper describes a novel design for an introductory analytics course for undergraduate students at the W. P. Carey School of Business at Arizona State University. To ensure a rigorous course platform, we implemented the curriculum inspired by the CRISP-DM framework; learning assessment is evaluated using Bloom's taxonomy. We share the valuable lessons learned about hybrid learning at scale before and during the pandemic through delivery to more than 6,000 students.

The remainder of this paper details the course design, explicating the reasoning behind important design decisions, including the choice to implement a hybrid delivery. It also describes the impact the pandemic had on the course implementation. The paper concludes with lessons learned and future work.

Course Design, Development & Implementation

We believe that the discussed introductory analytics course presents a unique combination of design choices. For example, we offer the course in a hybrid delivery mode. Further, the course has application to students from different majors with a broad range of interests, backgrounds, and capabilities. Having an active learning orientation in the course design increases student engagement (Burch, et al., 2019; Mann, et al., 2020).

Many of our reported course design choices are not new. For example, using a hybrid delivery mode for an analytics course is not unheard of. However, it is in the combination of many design decisions that makes our contribution unique; analysis of these choices, as reported in this paper, is of value for others in similar contexts.

In the remainder of this section, we discuss how the various design decisions were resolved. Specifically, we segment the explication into subsections on course development, content, assessment, hybrid delivery, and pandemic implementation.

Course Development

There has been a tremendous amount of work done in designing analytics curricula to meet organizational educational needs at various levels of higher education, including entire graduate degree programs, graduate, and undergraduate major and minor programs of study, as well as a variety of standalone elective graduate and undergraduate courses. Though analytics is a highly cross-functional field, many of these curriculum development efforts have taken place in Business Schools in general and often in IS departments (Gupta, Goul, & Dinter, 2015; Schiller, Goul, Iyer, Sharda, & Schrader, 2015; Topi, et al., 2010; Wixom, Ariyachandra, Douglas, Goul, & Gupta, 2014; Zhang, Chen, & Wei, 2020).

Senior leadership of the W. P. Carey Business School at Arizona State University projected the critical role that analytics would play in the future, concluding that it needed to be part of the core business curriculum. A cross-disciplinary faculty team confirmed the need through their own research and developed the initial curriculum for evaluation by the curriculum committees. The primary objective in the development of the course was to fulfill the need of a wide variety of roles in an increasingly analytics rich job environment. The course serves as a launch pad for further discipline specific analytics courses.

Starting in Fall 2017, the Business School added an introductory level Undergraduate analytics course as a required upper division 3-unit credit hour course for any student enrolled in any Business School program. Over the past several years, the course substantially evolved to meet all sorts of challenges and opportunities including going from a fully face to face synchronous delivery to a hybrid delivery which was implemented starting in Fall 2019. Currently, more than 3,000 learners engage in the course in an academic year. The necessary coordination among the faculty at that scale (with up to a dozen faculty across three departments and three campuses) partially contributed to the hybrid delivery choice.

A series of guiding principles drove many of the decisions made in designing and implementing the course. The first principle was to maximize learning; maximizing learning is not about covering an exhaustive list of topics and extensive assignments but rather choosing carefully which topics and assessments spoke most to introductory analytics given the constraints of a single 3 credit course for a very wide audience. This principle led us to consider active and engaging course content and assessment. We use contributions from faculty across the Business School to introduce analytics in the context of their discipline, to ensure an engaging motivation was provided for the course. Furthermore, we use real data and business cases in labs, assignments, and group work.

The second principle driving our design decisions was consideration of scale. Educating more than 3,000 students a year leads to certain practical choices and obviates others. For example, as the course ramped up from a few sections in the early semesters to more than 50 per year, a significant proportion of the extensive set of assessments had to be automated. This was carefully done to ensure the same level of rigor of the assessment while maintaining the timeliness of the feedback provided.

Finally, the third principle we worked with was ensuring consistency in the design and implementation. With more than 50 sections of the course across as many as a dozen faculty, across 3 campuses, and across several departments, a very high level of consistency is maintained around course content, assessment, etc. In tandem with this principle and to leverage the breadth of faculty knowledge and experience, substantial coordination across groups including faculty, the IS department, the school administration, and the learning support teams, takes place to maintain a high quality yet continuously improving and engaging course.

Guided by these principles, we continue to develop a highly intriguing & engaging introductory analytics course. It includes a low barrier to entry to enable a very wide range of student learners to get past the initial motivation. As we find more and more liberal art skills are in use in data analytics such as storytelling and effective communication of data insights, in its current design, the course could also be offered to yet a wider audience, including undergraduate students from the Arts and Engineering.

Course Content

Our current design is based on the overall learning objectives as follows.

1. What can analytics do for business?
2. How do we analyze and find insights with data?
3. How can organizations affect the data creation and generation process?
4. How do organizations generate, store, and organize data?

Inspired by the CRISP-DM framework for data mining (Chapman, et al., 2000; Jaggia, Kelly, Lertwachara, & Chen, 2020), we have developed a pedagogical framework for teaching the course, as shown in Figure 1. It starts with a basic understanding of the interrelationship between various business functions and the data collected in the process. Knowledge of data type, data quality, and data insights are crucial at the point where students learn to experiment with exploratory data analysis and data visualizations, using a wider range of industry-approved analytics tools such as Excel, Tableau (tableau.com), and JMP Pro (jmp.com) because they are as accessible as Excel and have broader set of analytical capabilities. In the next phase, data preparation includes data cleaning and data transformation for subsequent explanatory analysis. Students get introduced to the foundation of inferential statistics and its applications in real-world problems. A case-based approach to teach such concepts makes applied statistics more engaging to the students. Next, fundamental problem-solving ideas are introduced, such as model building using the supervised learning approach (linear and logistic regression) and unsupervised

learning such as k-Means and hierarchical clustering. Hands-on practice of data analytics using these techniques complements well the overall understanding of the content.

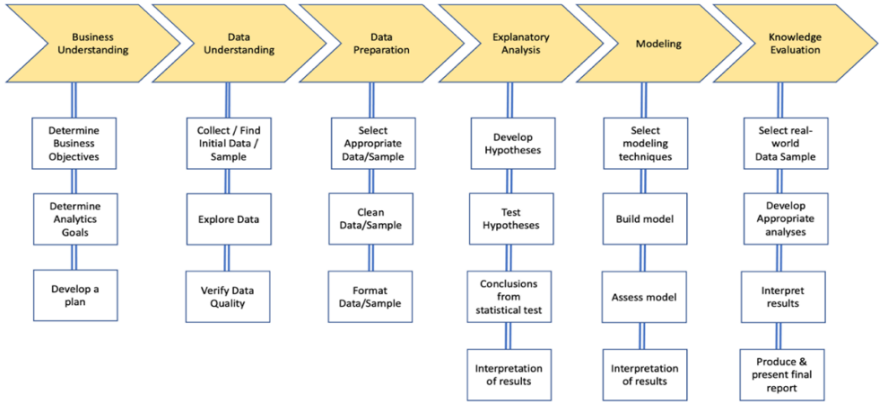

Figure 1: The pedagogical framework (based on CRISP-DM).

With a holistic focus on actionable analytics, how and why organizational data beyond transactional data is collected is also considered, particularly about the potential biases in data collection, interpretation, and decision making. Further, we review data ethical issues including privacy, security, accountability, transparency, and fairness. Towards the end of the course, infusing conceptual knowledge on data storage techniques, big data, and AI builds curiosity and knowledge in the context of value creation for a business. Towards the end of the course, to integrate the course objectives, students apply their learned analytics skills to analyze real-world problems using publicly available data (e.g., Kaggle) in a substantive group project.

The implementation occurs through a course "blueprint" that is created before each semester, based on multiple stakeholder input and course feedback; the blueprint includes structure, content videos, quizzes and assignments, and a group project. The blueprint then propagates to instructors' course shells.

Course Learning Assessment

Bloom's Taxonomy has weathered the test of time very well, having been originally published in (Bloom, 1956), revised in (Krathwohl, 2002), and widely referred to today. It includes six levels of learning that can be assessed in a course. Below, we describe how we utilized Bloom's Taxonomy to ensure rigorous and complete coverage of every aspect of objective educational achievement in our design.

1. Remember: Before each session, the online element of the hybrid mix-the conceptual foundations for the module-is delivered via a variety of lecture videos and articles available to the learners; the remembering of the concepts is assessed through an online quiz before each session, throughout the semester. It means students are doing lower cognitive work (knowledge comprehension) before coming to the class. A higher form of mental work (applications and analysis) is on focus.
2. Understand: Understanding takes place at a deeper level than simple memorization and necessitates more reflection and time to absorb the concepts thoroughly. We move beyond the fundamentals into seeing the application in real-world examples and data. We assess student's comprehension of the subject in a final exam.
3. Apply: Most modules include a hands-on component (labs) using analytics software such as JMP Pro, Excel, and Tableau, where a significant amount of classroom time is devoted to applying the newly learned concepts to reinforce how organizations benefit from analytics. The labs are assessed through weekly applied homework.

4. Analyze: Beyond labs, assignments analyze data from business case situations. These weekly assignments assess critical thinking and applying their analytical and technical capabilities to a real-world problem.
5. Evaluate: Students evaluate business cases and make recommendations. It culminates in a practical exam where business data and problems are addressed by learners using the entire variety of tools and techniques presented in the course to that point.
6. Create: Student teams investigate real-world data and develop actionable recommendations to present to their peers for feedback and evaluation. The learners gain significant experience in the art of storytelling and convince their peers that they generated solutions of considerable value to a business.

Research has provided a variety of learning outcomes such as declarative and procedural knowledge acquisition and skill acquisition (Colquitt, LePine, & Noe, 2000). Our current assessment framework utilizes declarative and procedural knowledge acquisition elements combined with substantial skill acquisition in our attempt to design a rigorous and engaging introductory analytics course (Marjanovic, 2012). Throughout the course, students are assessed on different areas of knowledge acquisition, as shown in Figure 2.

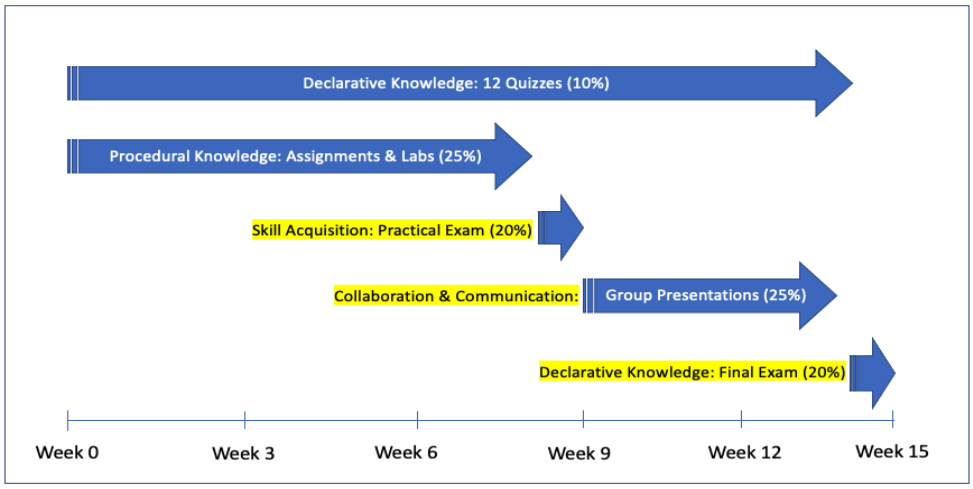

Figure 2. Assessment of learning for the introductory analytics course.

Hybrid Course Delivery

For centuries, the dominant form of learning delivery has been the so-called "chalk and talk" or "sage on the stage" style. Correspondence courses and distance learning have existed for more than a century (Wikipedia, "Distance Education"). The rise of the internet has contributed to a furthering of delivery mode experimentation and the implementation of viable alternatives to the conventional chalk and talk style. The main modes of learning include synchronous delivery ("live"), asynchronous delivery ("recorded") and various hybrid or blended versions of both.

Hybrid learning captures the benefits of both face-to-face and online instruction, integrates in-person and online content, based on in-person and online education best practices. In hybrid, a substantial portion (between 30-79%) of the course content is delivered online with a reduced number of face-to-face meetings (Allen, Seaman, Poulin, & Straut, 2016). Assessments that cover both online and in-person activities is necessary. Despite the face-to-face mode of delivery being generally considered the richest way to learn (Dennis, Fuller, & Valacich, 2008), prior meta-analysis suggests students in hybrid settings had better learning among peers when compared to face-to-face learning (Means, Toyama, Murphy, Bakia, & Jones, 2009). Though that reference is highly cited with thousands of referring papers, it may be considered a little dated (where was Zoom then?); more recent evidence continues to report hybrid delivery adding to learning effectiveness (e.g., Noetel, Griffith, Delaney, Sanders, Parker, Cruz, Lonsdale,

2021; Scaringella, Gorska, Calderon, & Benitez, 2022; Wang, Griffiths, Christensen, D'Angelo, Condon, 2022)

Our decision to develop this introductory analytics curriculum in a hybrid format is based on applying the guiding principles of maximizing learning, at scale, and consistently across a range of students and instructors that we established earlier in the course development process. We believe that a hybrid design enabled us to best implement a variety of learning and assessment strategies which we outline below.

Students' experience

Such a course at an introductory level has not been offered widely in business schools, and hence there is no established path that presents students' interest and passion for us to model. We, therefore, focused on developing content that would appeal to a wide range of students who are from a variety of different academic backgrounds. In part, we achieve this goal by implementing active learning techniques (Prince, 2004). Many proponents of active learning suggest that the effectiveness of this approach depends on the students' attention span during the lecture, which we see progressively diminishing because of available technological distractions during class. At the same time, instructors with varying experience and abilities to teach with experiential pedagogy could find the task challenging when teaching this course at scale. A shared hybrid platform is very helpful for maintaining uniformity of students' understanding and overall experiences across sections. It enables us to facilitate most of the first exposure to new conceptual learning outside the class primarily via lecture videos on a learning management system. It then uses the class time for knowledge assimilation through problem-solving, discussions, and hands-on analytics.

Improved flexibility

Adding flexibility to the course delivery method is always a prime design consideration. Several other flexibilities to the hybrid design that we considered are (1) students learning in their own time frame, (2) enabling different learning styles, (3) enhancing students understanding of the relationship between concepts and their applications in the real world and (4) a flipped classroom that encourages students to engage more. In addition, the design choice harbored a flexibility boon in disguise that only materialized when the Pandemic resulted in an unprecedented disruption to learning. Transitioning a hybrid delivery mode to pure synchronous online was relatively easy and seamless with little additional preparatory effort when the Pandemic struck and enabled a global engagement for the course with students engaging from around the globe including across the US, Europe, Asia, and the Middle East.

Supportive learning environment

To be successful, the course must provide an environment where students and teachers can discuss content, exchange ideas and debate and share their thoughts. A hybrid mode facilitates more engagement in the class and, hence, overall learning. Especially for an analytics course when forming questions about a specific business problem and analyzing to address underlying business challenges. Given the wide range of student preparedness and capabilities, the preference is for the learning environment to be "interactive and engaging," enabling students to learn through discovery and fun. A once-a-week meeting during the class proves adequate for students to engage in a conversation and apply the concepts they learned previously from online modules to work by practicing real-world data analytics in class.

Collaborative Knowledge Building

In collaborative knowledge building, group activities are centered around sharing responsibility for learning, distributing expertise, and building on each other's ideas (Hmelo-Silver & Barrows, 2008). For the introductory analytics course, this idea of collaborative knowledge building could prove extremely valuable and must be considered for the design choice. A hybrid design, with the aid of an integrated learning environment, is an efficient platform choice to accommodate collaborative learning. With available technologies and applications such as Slack, Google Doc, iClicker, etc., students can collaborate effectively and engage in knowledge building both in and outside the classroom. Combining tools support and in-person interactions multiplies the opportunities for collaborative knowledge building. In addition, faculty can facilitate the experience by monitoring progress and providing appropriate feedback.

Teaching efficacy

Among faculty, there can be a hesitancy to teach fully online courses. The existence of an apparent gap between students' perceptions, expectations from the subject and provided content in the online platform

is a fundamental uncertainty that directly affects teaching efficacy. A hybrid design makes it easy for faculty to bridge these gaps while bringing their analytics expertise to the classroom and sharing a unique student experience during the weekly in-person meeting. Students enrolled across many sections of this course could then study the same content while experiencing a unique teaching approach from their faculty. Our course adds another layer of challenges for faculty when incoming students to this course fall in a broad spectrum of preparation to be successful in the class. It could potentially affect teaching efficacy reflected in teaching evaluation. We addressed this problem with a hybrid design choice by providing additional resources (recorded videos, online tutoring by teaching assistants outside the classroom) for students with greater challenges. With no standard textbook proscribed for the course, the faculty can practice creativity and innovation to individualize teaching and learning. The overall learning outcome can be positive with proper coordination of this introductory course across various sections and a shared course design aspect discussed and consistently adopted by all faculty.

Sustainability

Though not originally considered as part of the design, given its increasingly pertinent nature, we also consider sustainability. An aspect of our hybrid design is that instead of meeting physically twice a week throughout the semester, the class meets physically once a week. This can have an implication in terms of reducing travelling, parking, and physical space requirements. This course is thus likely to have a lower carbon footprint than comparable face to face courses. There is surprisingly little commentary on this topic in the literature. Given contemporary interest in this topic, more research needs to be done. If we can confirm the hybrid design as better for learning, the sustainability of the design is a bonus.

Pandemic Implementation

With the advent of the COVID 19 Pandemic, the University went from regular instruction to providing instruction over zoom. This change was announced at the start of the one week-long Spring Break in 2020 and was implemented for the remainder of the Spring Semester. That style persisted through the Fall 2020, Spring 2021, and Summer 2021 semesters with a return to the in-person classroom for the Fall 2021 semester with students and faculty required to wear masks. Almost exactly 2 years after the initial changes brought about by the pandemic, over the spring break of 2022, in-class learning was changed to mask optional, marking the final chapter in returning to “normal.” While the pandemic raised significant challenges for educator communities worldwide, we experienced very little disruption in the course given the choice of hybrid format that was already implemented. Moreover, the Pandemic provided an environment for further examining and evolving the design.

Weekly sessions over Zoom replaced in-class meetings where enrolled students in each section joined from their location at their respective class times. Each synchronous session lasted for 75 minutes, was recorded via Zoom, and was shared among students. Doing so benefited quite a few, especially those who could not attend the live class because of a time zone conflict, where they were enabled to review the videos at a convenient time. We performed the weekly lab activities (hands-on data analytics techniques using Excel, JMP Pro, and Tableau) via Zoom sessions. It was engaging as students were able to ask questions immediately for any doubts and technical difficulties. Troubleshooting any technical problems was greatly facilitated via the screen sharing feature of Zoom. Although we saw a decrease in the student-teacher interaction, we also observed an uptick in student content interaction in the learning management system as measured by the average time spent on the learning management system. At mid-semester, we proctored a practical exam during class time via Zoom as a stand in for doing it in a physical class setting.

At the beginning of the Pandemic-era instruction, there was a heightened concern among students for overall success in the class. Over time, however, their fears subsided when they started to engage in the classroom through attendance and polling features available via Zoom. Students were able to ask questions via Zoom's private and public chat feature that were sometimes answered by a fellow student in the class. Discussion and debates in breakout rooms among group members were enriching for a lot of students. It brought an engaging atmosphere during the course. Students were able to embrace this new teaching method rather quickly because of the user-friendliness and straightforward nature of the Zoom application. The University had an enterprise implementation of Zoom before the Pandemic struck and many of the faculty were already familiar with it. This greatly facilitated the ease with which the faculty pivoted to teaching the course over Zoom, thus lowering student anxiety about using Zoom.

Lesson Learned & Outlook

Instruction via Zoom is not the same as classroom instruction. We cannot assume that students' behavior remains the same, and they stay focused to the same degree in a virtual room while listening to the lectures and making eye contact with their instructors with their cameras turned on. Recent studies found that it is difficult for students to balance their studies with the pressure of home and work commitments during a crisis such as this Pandemic (Jankowski, 2020) and that despite the increasing ubiquity of online technologies, we not be ready for online learning (Power, Conway, O Gallchoir, Young, & Hayes, 2022). Understanding students' needs is critical; showing empathy throughout the course was essential to boost self-fulfillment among students. A pedagogy that gives importance to students' needs is always a winner, and our experience with this introductory analytics course is no surprise. Online education has found a new face for teachers to get excited about, and the Pandemic has made us innovative in the classroom.

Having a single textbook flex to cater to the entire set of course needs was a challenge. Ultimately, we chose to develop and use our own materials which is a very intensive process though it provided the most flexible environment during course evolution. Another choice with significant challenge was to use multiple analytics tools (currently including Excel, Tableau & JMP Pro). While the use of multiple tools mirrors real job environments, the technical challenges of doing so in a college course are significant. We ultimately chose these 3 tools for their lower learning curve and availability of a site license.

A potential challenge to this course arises as we consider inclusiveness. It is not common at universities to require bringing personal laptop in the classroom. Classes that have technical components such as that discussed here often take place in computer labs. However, the hybrid delivery mode adopted for this course gave rise to a concern, particularly as so many of our institution's students come from lower income households. Not having the in-person lab sessions in a computer lab and having assessment activities (such as the practical exam) in a classroom not equipped with computers and requiring the students to use their own laptops meant that some proportion of the student body could struggle to effectively participate. To date, with over 6,000 students having completed the course and laptops being so fundamental to so much college activity, we have had only a handful of situations where this digital divide has arisen. We easily overcame these cases such as during the Pandemic, laptops were available to borrow on a short-term basis from the main campus libraries. We continue to monitor this issue.

To date, we have observed no significant change in students' performance as we went from in-person hybrid (Fall 2019-first half of Spring 2020) to a Zoom-based hybrid (second half of Spring 2020) and back again to an in-person hybrid (Fall 2021). Moving from an in-person class meeting to a zoom meeting does not change the synchronicity of the delivery and this might explain the lack of any measurable student performance difference. What we do not yet understand is the effect, if any, on longer term learning retention. Nevertheless, as with many aspects of Pandemic life, this synchronous zoom-based mode of instruction has shown significant potential for learning introductory analytics, if not beyond.

Future Work

While a substantial quantity of the previously cited analytics curricula was designed with industrial participation, we intend to complement that work by vetting this design from the students' learning process perspective. We will empirically research the learning process, course engagement, enthusiasm about the course and analytics in general from the student's perspective. Understanding students' sentiments for this course is also of interest that could drive design improvements. We will leverage the relevant results from these explorations to make further enhancements to the design, content, and assessment. Another direction for future development is to further practice inclusiveness by examining relevant case studies and data. The scale of this course continues to grow and another way in which we are looking at to handle this issue is to embrace AI enabled tools to assist in the grading and feedback process. Finally, we will also develop an advanced version of this course for Honors College students.

Conclusion

We have successfully designed and delivered an introductory analytics course for all incoming undergraduates (more than 3,000 per academic year) from the School of Business. The content and course assessments met all design goals and curriculum guidelines for our undergraduate programs. The

integration of industry-standard analytics tools into the curriculum was complementary to the learning experience and added to students' curiosity.

The novelty of this work is that we developed a hybrid course on introductory analytics that we offer at scale, targeted to all incoming business undergraduates. Our course model has proven easy to embrace for onboarding faculty to teach the course with relatively minimal preparation. Also, the integration of accessible analytics tools such as Excel, JMP Pro, and Tableau makes this course unique for students from diverse backgrounds. Based on informal student feedback, our design provides self-fulfillment in learning analytics and serves the purpose well. Our explication can serve other faculty in a similar situation.

Our course design and implementation have been battle tested through the Pandemic and by thousands of students; it serves well our objectives of maximizing learning across a diverse student body, comfortably handles scale, and can be coordinated with little friction.

Acknowledgements

The authors also acknowledge the input received from course learners, all other participating faculty, school administration, technology support team, and teaching assistants during the course development and delivery across more than 100 sections to date.

REFERENCES

AACSB. (2020). 2020 Guiding Principles and Standards. AACSB.

Agarwal, R., Bapna, R., Yong Goh, K., Ghose, A., Shmueli, G., Slaughter, S., & Tambe, P. (2014). Does Growing Demand for Data Science Create New Opportunities for Information Systems? Thirty Fifth International Conference on Information Systems, (pp. 1-7). Auckland.

Allen, E., Seaman, J., Poulin, R., & Straut, T. T. (2016). Online Report Card: Tracking Online Education in the United States. Babson Survey Research Group and Quahog Research Group, LLC.

Bloom, B. (1956). Programming languages: Python is on the verge of another big step forward. Cognitive Domain, 1.

Burch, G. F., Giambatista, R., Batchelor, J. H., Burch, J. J., Hoover, J. D., & Heller, N. A. (2019). A Meta-Analysis of the Relationship Between Experiential Learning and Learning Outcomes. Decision Sciences Journal of Innovative Education, 17(3), 239-273.

Burns, T., & Sherman, C. (2019). A Cross Collegiate Analysis of the Curricula of Business Analytics Minor Programs. Information Systems Education Journal, 17(4), 82-90.

Chapman, P., Clinton, J., Kerber, R., Khabaza, T., Reinartz, T., Shearer, C., & Wirth, R. (2000). CRISP-DM 1.0. Retrieved from https://www.the-modeling-agency.com/crisp-dm.pdf

Colquitt, J. A., LePine, J. A., & Noe, R. A. (2000). Toward an Integrative Theory of Training Motivation: A Meta-Analytic Path Analysis of 20 Years of Research. Journal of Applied Psychology, 85(5), 678-707.

Dennis, A. R., Fuller, R. M., & Valacich, J. S. (2008). Media, Tasks, and Communication Processes: A Theory of Media Synchronicity. MIS Quarterly, 32(3), 575-600.

Dinter, B., Fritzsche, A., & Kollwitz, C. (2017). Teaching Data Driven Innovation – Facing a Challenge for Higher Education. Americas Conference on Information Systems, (pp. 1-10). Boston.

Doshi, R., & Krishan, N. (2020). Winning the War for Talent: An Enterprise Guide to Building a Sustainable Workforce Strategy. Everest Group.

Firth, D., King, J., Koch, H., Looney, C. A., & Pavlou, P. (2011). Addressing the Credibility Crisis in IS. Communications of the Association for Information Systems, 28(13), 200-212.

Gupta, B., Goul, M., & Dinter, B. (2015). Business Intelligence and Big Data in Higher Education: Status of a Multi-Year Model Curriculum Development Effort for Business School Undergraduates, MS Graduates, and MBAs. Communications of the Association for Information Systems, 36(23), 450-476.

Hmelo-Silver, C. E., & Barrows, H. S. (2008). Facilitating Collaborative Knowledge Building. Cognition and Instruction, 48-94.

Jaggia, S., Kelly, A., Lertwachara, K., & Chen, L. (2020). Applying the CRISP-DM Framework for Teaching Business Analytics. Decision Sciences Journal of Innovative Education, 18(4), 612-634.

Jankowski, N. A. (2020). Assessment During A Crisis: Responding to a Global Pandemic. National Institute for Learning Outcomes Assessment.

Krathwohl, D. R. (2002). A Revision of Bloom's Taxonomy: An Overview. Theory Into Practice, 14(4).

Mann, L., Chang, R., Chandrasekaran, S., Coddington, A., Daniel, S., Cook, E., . . . Maclean, F. (2020). From problem-based learning to practice-based education: a framework for shaping future engineers. European Journal of Engineering Education, 1-21.

Manyika, J., Chui, M., Brown, B., Bughin, J., Dobbs, R., Roxburgh, C., & Byers, A. H. (2011). Big data: The next frontier for innovation, competition, and productivity. McKinsey Global Institute.

Marjanovic, O. (2012). Using the revised Bloom's Taxonomy to scaffold student learning in Buisiness Intelligence/Business Analytics. European Conference on Information Systems Proceedings. Barcelona, Spain.

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2009). Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies. U.S. Department of Education Office of Planning, Evaluation, and Policy Development Policy and Program Studies Service.

Noetel, M., Griffith, S., & Delaney, O., Sanders, T., Parker, P., Cruz, B. D. P., Lonsdale, C. (2021). Video Improves Learning in Higher Education: A Systematic Review. Review of Educational Research, 91(2), 204-236.

Paul, J. A., & MacDonald, L. (2020). Analytics Curriculum for Undergraduate and Graduate Students. Decision Sciences Journal of Innovative Education, 18(1), 22-58.

Power, J., Conway, P., O Gallchoir, C., Young, A., Hayes, M. (2022). Illusions of online readiness: the counter-intuitive impact of rapid immersion in digital learning due to COVID-19. Irish Educational Studies 41(2).

Prince, M. (2004). Does Active Learning Work? A Review of the Research. Journal of Engineering Education, 1-9.

Rodammer, F., Speier-Pero, C., & Haan, J. (2015). The Integration of Business Analytics into a Business College Undergraduate Curriculum. Twenty First Americas Conference on Information Systems, (pp. 1-9). Puerto Rico.

Romanow, D., Napier, N. P., & Cline, M. K. (2020). Using Active Learning, Group Formation, and Discussion to Increase Student Learning: A Business Intelligence Skills Analysis. Journal of Information Systems Education, 31(3), 218-231.

Scaringella, L., Gorska, A., Calderon, D., & Benitez, J. (2022). Should we teach in hybrid mode or fully online? A theory and empirical investigation on the service–profit chain in MBAs. Information & Management, 59(1).

Schiller, S., Goul, M., Iyer, L. S., Sharda, R., & Schrader, D. (2015). Build Your Dream (Not Just Big) Analytics Program. Communications of the Association for Information Systems, 37(40), 812-826.

Sircar, S. (2009). Business Intelligence in the Business Curriculum. Communications of the Association for Information Systems, 24(17), 290-302.

Topi, H., Valacich, J. S., Wright, R. T., Kaiser, K. M., Nunamaker, Jr., J., Sipior, J. C., & de Vreede, G. (2010). Curriculum Guidelines for Undergraduate Degree Programs in Information Systems. IS 2010 Curriculum Guidelines, 1-85.

Wang, S., Griffiths, R., Christensen, C., D'Angelo, C., Condon, K. (2022). An evaluation of a first-of-its-kind hybrid law degree program. Journal of Computing in Higher Education

Wilder, C. R., & Ozgur, C. O. (2015). Business Analytics Curriculum for Undergraduate Majors. INFORMS Transactions on Education, 15(2), 180-186.

Williams, B., & Elmore, R. (2021). Teaching Business Analytics during the COVID-19 Pandemic: A Tale of Two Courses. Communications of the Association for Information Systems, 48(1), 32-39.

Wixom, B., Ariyachandra, T., Douglas, D., Goul, M., & Gupta, B. (2014). The Current State of Business Intelligence in Academia: The Arrival of Big Data. Communications of the Association for Information Systems, 34(1), 2-12.

Wymbs, C. (2016). Managing the Innovation Process: Infusing Data Analytics into the Undergraduate Business Curriculum (Lessons Learned and Next Steps). Journal of Information Systems Education, 27(1), 61-74.

Zadeh, A. H., Schiller, S., Duffy, K., & Williams, J. (2018). Big Data and The Commoditization of Analytics: Engaging First- Year Business Students with Analytics. e-Journal of Business Education and Scholarship of Teaching, 12(1), 120-137.

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.