Communications of the Association for Information Systems

Accepted Manuscript

Teaching Business Analytics During the COVID-19 Pandemic: A Tale of Two Courses

Benjamin Williams
Department of Business Information and Analytics
University of Denver

Ryan Elmore
Department of Business Information and Analytics
University of Denver

Please cite this article as: Williams, Benjamin; Elmore, Ryan: Teaching Business Analytics During the COVID-19 Pandemic: A Tale of Two Courses, *Communications of the Association for Information Systems* (forthcoming), In Press.

Communications of the Association for Information Systems

Research Paper ISSN: 1529-3181

Teaching Business Analytics During the COVID-19 Pandemic: A Tale of Two Courses

Benjamin Williams
Department of Business Information and Analytics
University of Denver

Ryan Elmore
Department of Business Information and Analytics
University of Denver

Abstract:

This paper describes the experiences of two business faculty who taught two different levels of undergraduate business analytics courses during the COVID-19 pandemic. In particular, we focus on two challenges that arose during the shift to Emergency Remote Teaching: student engagement and teaching the use of software. We discuss our efforts to mitigate the effects of these problems and highlight the differences in implementing our strategies in a general-education (i.e., required for business majors) course versus an upper-level elective. Finally, we discuss lessons learned and recommendations for other educators regardless of their teaching modality.

Keywords: Pedagogy, Learning, Analytics

[Department statements, if appropriate, will be added by the editors. Teaching cases and panel reports will have a statement, which is also added by the editors.]

[Note: this page has no footnotes.]

This manuscript underwent [editorial/peer] review. It was received xx/xx/20xx and was with the authors for XX months for XX revisions. [firstname lastname] served as Associate Editor.] **or** The Associate Editor chose to remain anonymous.]

1 Introduction

The coronavirus pandemic of 2020 drove an unprecedented move to remote learning spanning all education levels. The move has been coined Emergency Remote Teaching (ERT) due to the rapid change from face-to-face to online teaching and learning (Hodges et al., 2020). Online learning is not novel and there is a rich literature on the subject. From discussions of best practices for structuring student engagement with respect to synchronous and asynchronous learning (Hrantinski, 2008) to the analysis and availability of learning management systems (LMS) (Rhode et al., 2017), robust research exists.

The pandemic forced educators into online teaching without time to familiarize themselves with the literature nor refine their online pedagogy. Even so, reflecting on the experiences of Spring 2020 presents a valuable opportunity to improve courses for the next academic year and beyond regardless of the teaching modality.

As two business analytics faculty members, we present the challenges we saw and the practices we developed through two Spring 2020 courses. Both classes were meant to be face-to-face but were abruptly moved online. The courses examined herein are both undergraduate classes involving extensive use of Microsoft Excel and programming in the R Software (R Core Team 2020). The first course, taught by Williams, is a general-education requirement for all undergraduate business majors titled Analytics III: Business Modeling and Analytics (hereafter referred to as Analytics III), with all coursework completed in Excel. During the ERT period, two sections of this course were taught, with about 30 students in each section. The second course, taught by Elmore, is an upper-division elective called Topics: Sports Analytics (Sports Analytics). Similar to Analytics III, two sections of Sports Analytics were offered during the Spring quarter with 49 total students with about half in each section. All coursework required the use of R and RStudio (RStudio Team 2020).

We found that while we both incorporated similar tools and practices to overcome online teaching and learning challenges, our implementation of these tools was manifest differently. We attribute these differences to the hierarchy between instructor and students, which is often more pronounced in a general-education course than in an upper-division elective. Courses with a significant hierarchical gap are ones that follow a much more guided and scaffolded structure than those with a narrower gap. Scaffolding learning structures are intentional, potentially interim systems put in place to help students achieve new levels of learning (Lee and Hannafin, 2016; Vygotsky, 1978). Adhering to this concept, our general-education course was designed with more scaffolds than the upper-division elective, such as introductory Excel examples and basic programming assignments..

In this paper, we examine two specific difficulties that arose during the Spring 2020 quarter due the shift to ERT: *student engagement* and *teaching the use of software*. We detail these challenges and our respective solutions in the Challenges and Solutions section of the paper. There, we also contrast the strategies used in the general-education course versus those used in the upper-level elective. Finally, we highlight our lessons learned and recommendations for other educators in the Discussion and Concluding Remarks sections.

2 Challenges and Solutions

Although students and faculty face unique challenges each academic term, the stay-at-home orders issued by state governments in response to the coronavirus pandemic present their own set of problems in education. Here we address issues specific to both our discipline and the academy at large. We begin by identifying our two problem categories and accompanying solution practices. The challenges and solutions used in each course are summarized in Table 1, located in the Discussion.

2.1 Challenge One: Student Engagement

2.1.1 Background

For this exposition, problems related to student engagement encompass any situation where online learning impedes student engagement. When the courses are on campus, we classify student engagement as either in-class (e.g., answering questions or participating in group work during class) or out-of-class (e.g., attending office hours) (Krause, 2005). We believe engagement generally falls under a

broader category we refer to as classroom community building. This falls in line with the “social presence” model (Anderson et al (1999)) which emphasized the social engagement of students within a classroom as an important aspect of teaching and learning. Building this community should be an initial goal of any online class (Gonzalez, 2020). With the move to online learning, encouraging student engagement became a difficult hurdle.

During the ERT period, we worried students would neither engage with each other nor with us outside of bi-weekly, synchronous Zoom (video-conferencing software) sessions. When in-person, we host office hours on campus. From experience, we know students use that time to clarify understanding and connect with us personally. Without in-person office hours, we surmised that students would feel uncomfortable having a one-on-one video conference with their instructor and would resort to the generally less personal contact method of email. The prospect of solely connecting with students via email, Canvas (our LMS) tools, or Zoom seemed to imply a bleak and impersonal term. Out-of-class engagement is critical to maximize learning. Indeed, research points to increased achievement for students who are more engaged (Kuh, 2009b; McClenney, Marti, & Adkins, 2006). As we moved to online teaching, we needed to stimulate engagement to ensure high levels of learning.

2.1.2 Solution

We encouraged student engagement early and often via three avenues: (1) online surveys to check-in and connect with students, (2) small groups during synchronous meetings, and (3) messaging software to communicate with students individually and as a class unit.

We used Canvas and Google Forms (Google questionnaire platform) to solicit feedback at various points during the courses. These surveys allowed us to acknowledge the difficult circumstances students faced and ask for input on the direction of our courses. As an example, Analytics III students were asked the following questions after the first day of class, “We have made it through our first class! ... Specifically, is there anything you are worried about regarding online learning? Do you have any extenuating circumstances you wish me to know about?” This survey built community straightaway and led several students to ask questions which we immediately addressed.

In Sports Analytics, one survey focused on the use of Twitch (web-based livestreaming platform) as a supplement to poorly-attended Zoom-hosted office hours. Every respondent answered “Yes” or “Maybe” to the question: “Would it be worthwhile to set aside an hour of weekly office hours to watch your instructor stream programming demos on Twitch?” We found this outreach on our part appreciated by the students based on comments in the initial survey as well as the end-of-class student evaluations. This is consistent with our expectations from the literature (Darby and Lang, 2019).

In both courses, we used surveys to kindle community. However, they were used in strategically different ways. In the general-education course, Analytics III, surveys provided additional information with which to make decisions regarding the trajectory of the course. These surveys made sure students’ knew their voices were heard and helped them feel comfortable reaching out to their instructor. Course changes resulting from such student requests include sharing project examples from past years and amending assignment formats and due dates. Conversely, in Sports Analytics, surveys empowered students as co-owners in determining the course direction. That is, in the upper-division course, we treated students as peers and requested they shoulder some responsibility for their learning. The benefit of such student-directed learning is supported in the literature (Stiggins, 2008).

The next practice employed to combat the student engagement problem was our use of small groups during synchronous class sessions. The “breakout room” functionality embedded within Zoom allows creation of small groups. In Analytics III, breakout rooms were used during synchronous meetings so students could work on exercises they then turned in for daily participation credit. Students felt more comfortable asking questions of the professor and group members in the smaller setting, which encouraged deeper personal connections. Sports Analytics also featured breakout rooms which allowed students to work jointly, if they wished, on homework/lab exercises. These assignments were then due at a later date. In both classes the small groups encouraged collaboration, a high impact practice defined as a strategy shown to improve student learning, tenacity, and satisfaction (Kuh et al., 2016).

Although in both courses we implemented small groups, the motivations for doing so were different. In Analytics III, the goal was to provide prescribed, structured time for students to work together on a common task, namely an Excel spreadsheet due for credit at the end of the meeting time. In Sports Analytics, small groups were an optional opportunity for students to engage in peer collaboration while

completing work due at a later date. The small difference in our use of breakout rooms points to our conviction that students in lower-division courses should have more directed learning while students in upper-division classes should be given space for higher levels of ownership in their learning.

The final solution we implemented revolved around instant messaging software. Slack and Teams are applications allowing instant communication, file sharing, among other uses. We believed these tools would stimulate student engagement during and outside of synchronous class interactions. We also thought they would facilitate communication as a class group (in "channels") and individually (direct messaging). We found these tools streamlined the sharing of student work through posting screenshots of in-class activities (e.g., online examples of graphs of time-series data; individual results from experimenting with an online regression applet) to an "in-class" channel.

In both classes, we also used Slack/Teams for course announcements. Announcements were sent in a separate channel so students could receive quick updates and respond with questions seen by the entire class. Evidence shows students prefer such shorter messaging tools like these over email (Straumsheim, 2016) and our students took advantage of these applications.

Analytics III students were required to post on Slack for in-class exercises and sometimes for homework. They also used Slack for sending direct messages to the instructor with questions about course content. Slack served as a convenient tool which increased and streamlined engagement. In addition to direct messaging, students in Sports Analytics used Teams to share original thoughts and to discuss course content. The students in this upper-level class engaged without an incentive, thus displaying organic interactions and feelings of course ownership.

2.2 Challenge Two: Software

2.2.1 Background

We call the second challenge category: difficulties in learning to use software. These problems are especially relevant in courses relying heavily on analytical tools such as Excel and R but apply to any software. When teaching Analytics III and Sports Analytics in-person, a substantial portion of the class is devoted to teaching and demonstrating using software. In a face-to-face class, we generally project our computer displays to a large screen so students see exactly how we interact with the software. This allows students to follow along on their laptops. It does not, however, translate well to the online environment.

Attempting to mimic the face-to-face experience, we shared our screens on Zoom. Then many of our students faced a dilemma. Either they could watch us program and sacrifice following along on their own computers, or they could sacrifice watching us and try to follow along by listening. We acknowledge this is not necessarily a problem for students with an extra monitor, however, not all students are so fortunate. For students left to navigate learning with a single screen, trying to partition the screen so what we were sharing shows on one half and the software displays on the other can be a difficult task to do quickly and multiple times per class.

An additional manifestation of this problem arises when assisting students with seemingly simple software questions. Example questions we faced were related to installing/updating an R package, downloading files, and filtering values in Excel. In a face-to-face setting we can move around the classroom to observe a student working and provide specialized answers which may only apply to him or her. Online classes make this straightforward task much more difficult.

2.2.2 Solution

To remedy this problem, our strategy involved recording short asynchronous videos. We mainly structured each video according to the following properties: (1) they were four to eight minutes in length (often shorter in Analytics III), (2) each distinct task was introduced in a single video (though a video could feature multiple, previously learned tasks), and (3) the videos were minimally edited, principally to show that errors are inevitably part of programming. The importance of (3) should not be underestimated. We received multiple comments from our students saying they appreciated that we make mistakes too. Additionally, if we do make a programming mistake, it provides an opportunity to demonstrate our debugging strategies.

In both classes, the videos were key components, yet they served different needs. In Analytics III, the videos were designed as supplemental material to the core of what was presented during class meetings.

The recordings were exclusively demonstrations of Excel functions and tasks. In Sports Analytics, the videos were effectively the primary lecture material. They included software demonstrations, programming exercises, and presentations. The lower-level course provided the asynchronous material as an easily consumed reference which was complementary to class time. In the upper-division elective, the videos encouraged individual learning and allowed for class times to be a place for discussion amongst students and the instructor. The response to the short videos was overwhelmingly positive. In their end-of-course evaluations, students pointed out these videos as part of what they most appreciated about the courses.

3 Discussion

The ERT transition due to the coronavirus pandemic forced faculty into a new form of pedagogy. In our experiences teaching two analytics courses which rely heavily on software, we faced challenges both unique to such topics as well as ones any educators might expect. Two notable issues we encountered and overcame involve student engagement and learning to use software. To summarize our solutions, we synthesize three main takeaways.

Build class community. We recommend interacting with students early and often. Whether through surveys or instant messaging tools, building classroom community is an important step toward positively influencing student engagement (Darby and Lang, 2019). This must be a top priority regardless of the teaching modality.

Create asynchronous material in micro-sized units. We advocate recording short videos to demonstrate techniques and concepts which students can then view on their own time. We will certainly implement this practice in the future, regardless of the teaching format. Material created this quarter will be reused in the future.

Be as flexible as possible while meeting learning outcomes. We urge a posture of flexibility to confront whatever situations arise for professors, our students, or the world as a whole. The use of asynchronous videos in *Sports Analytics* was driven largely by student input. In *Analytics III*, due dates were adjusted for students facing extenuating circumstances. To keep up with rapid external changes, both in students' lives and in the world, we had to be willing to change our pedagogical habits to ensure students met our learning objectives. Such flexibility is valuable in education no matter the instructional form.

It is significant that the implementations of our solutions are not consistent across different course levels. Our experiences indicate the implementation is dependent on a gap between students and their professor in the classroom hierarchy. When the hierarchical gap was wide (e.g., general-education course), meaning the class followed a guided, scaffolded learning structure, our strategies involved some notion of welcoming or care going above typical expectations. As mentioned, we surveyed students on the first day of class asking for their concerns about the upcoming quarter and used Slack/Teams as a more comfortable means of contacting the professor. On the other hand, when the gap was narrow, (e.g., upper-division course), students were given greater ownership of the class. In substantive terms, this involved giving the students the responsibility of learning core concepts using pre-recorded videos or using Slack/Teams as a collaborative tool in which to share knowledge freely from student to student. Table 1 summarizes these differences.

Table 1. Differences in implementation of proposed solutions between lower-level general-education courses and upper-level elective courses

Problem	Solution	Analytics III (more pronounced hierarchy)	Sports Analytics (less pronounced hierarchy)
Student Engagement	Surveys	Gather information so instructor can make decisions regarding course trajectory; acknowledge student circumstances and show pronounced care	Invite students to direct the trajectory of the course; foster course ownership

	Small Group Interaction	Require synchronous engagement time for joint completion of a mandatory task	Provide optional synchronous engagement time for collaboration on coursework due in the future
	Messaging Software	Engage students more efficiently and communicate with them in a space they are comfortable and familiar with	Engender a collaborative environment where students share and discuss content of interest to them; encourage students to take ownership for their own learning
Software	Micro-sized Asynchronous Material	Provide additional resources for students to reference as needed	Require students to engage with asynchronous content and complete tasks to stimulate responsibility for individual learning
General	Flexibility	Make clear the desire of instructor to meet students in their current circumstances; change due dates and assignments for case-by-case accommodations	Display trust in student opinions regarding course; change entire course structure in response

3.1.1 Concluding Remarks

Our institution is adopting a Hyflex model (Beatty, 2014) of teaching for the next academic term, giving students the ability to participate in courses in-person, online, or via a blend of each. In a similar vein, Harvard announced all classes for the 2020-2021 academic year will be taught online. More schools will surely follow. The pandemic will affect teaching for the foreseeable future, as higher education incorporates more online and blended learning (Darby, 2020). Teachers must make pedagogical changes to overcome both novel and long-standing obstacles during this time of disruption. We believe our solutions will improve our own teaching, regardless of whether we teach online or in-person. We hope they do so for others.

Acknowledgments

The authors would like to thank Dr. Karen Swanson and Dr. Andrew Urbaczewski for their constructive comments and suggestions on an earlier version of this manuscript. All remaining errors are solely the result of the authors.

References

Anderson, T., Rourke, L., Garrison, D. R., & Archer, W. (2001). Assessing teaching presence in a computer conferencing context. *Online Learning, 5(2)*.

Beatty, B. (2014). Hybrid courses with flexible participation: The hyFlex course design. *Practical applications and experiences in K-20 blended learning environments,* 153-177. IGI Global.

Darby, F. (2020). Sorry not sorry: online teaching is here to stay. *Chronicle of Higher Education*. Retrieved from https://www-chronicle-com.du.idm.oclc.org/article/Sorry-Not-Sorry-Online/248993.

Darby, F. & Lang, J.M (2019). *Small teaching online: applying learning science in online Classrooms*. San Francisco, CA: Jossey-Bass.

Gannon, K. (2020). How to make your online pivot less brutal. *Chronicle of Higher Education*. Retrieved from https://www.chronicle.com/article/How-to-Make-Your-Online-Pivot/248239.

Gonzalez, J. (2020). 9 ways online teaching should be different from face-to-face. *Cult of Pedagogy*. Retrieved from https://www.cultofpedagogy.com/9-ways-online-teaching/.

Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). The difference between emergency remote teaching and online learning. *Educause Review*. Retrieved from https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning.

Hrantinski, S. (2008). Asynchronous and synchronous e-learning. *EDUCAUSE Quarterly,* 31(4). Retrieved from https://er.educause.edu/articles/2008/11/asynchronous-and-synchronous-elearning.

Kuh, G. D. (2009b). What student affairs professionals need to know about student engagement. *Journal of College Student Development*, 50: 683–706.

Kuh, G. D., Watson, C. E., Rhodes, T., Penny Light, T., & Chen, H. L. (2016). Editorial: ePortfolios – the eleventh high impact practice. *International Journal of ePortfolio, 6(2)*. Retrieved from http://www.theijep.com/pdf/IJEP254.pdf.

Krause, K. (2005). *Understanding and promoting student engagement in university learning communities*. Paper presented as keynote address at James Cook University Symposium 2005, Townsville/Cairns, Queensland, Australia.

Lee, E. & Hannafin, M. J. (2016) A design framework for enhancing engagement in student-centered learning: own it, learn it, and share it. *Educational Technology Research and Development*, 64(2) 707-734.

McClenney, K., Marti, C. N., & Adkins, C. (2006). Student engagement and student outcomes: Key findings from CCSSE validation research. Austin, TX: University of Texas at Austin, Community College Leadership Program.

R Core Team (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing. http://www.R-project.org/

Rhode, J., Richter, S., Gowen, P., Miller, T., & Wills, C. (2017). Understanding faculty use of the learning management system. *Online Learning, 21*(3) 68-86.

RStudio Team (2020). RStudio: Integrated development for R. RStudio, PBC. URL http://www.rstudio.com/.

Redden, E. (2020). Go home? For some students it's not easy. *Inside Higher Ed.* Retrieved from https://www.insidehighered.com/news/2020/03/12/colleges-confronting-coronavirus-tell-students-move-out-many-urge-attention-needs.

Stiggins, R. J. (2008). *Student-involved assessment for learning*. Pearson Merrill Prentice Hall.

Straumsheim, C. (2016). Read and unread. *Inside Higher Ed*. Retrieved from https://www.insidehighered.com/news/2016/03/02/study-explores-impact-social-media-texting-email-use.

Vygotsky, L. S. (1978). *Mind in society: The development of higher mental process*. Cambridge: Harvard University Press.

Wood, D. Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry*, 17(2) 89-100.

About the Authors

Ben Williams is an Assistant Professor in the Department of Business Information and Analytics in the Daniels College of Business at the University of Denver (DU). His PhD is in Statistical Science, which he earned from Southern Methodist University. His research focuses on blending data sources, especially big data sets. Ben's other research interests include sampling, text-mining, statistical computing, and sports analytics.

Ryan Elmore is an Assistant Professor in the Department of Business Information and Analytics in the Daniels College of Business at the University of Denver. He earned his Ph.D. in statistics at Penn State University and worked as a Senior Scientist at the National Renewable Energy Laboratory prior to DU. He has 19 peer reviewed publications in outlets such as *Journal of the American Statistical Association, Biometrika, The American Statistician, Big Data, Journal of Applied Statistics,* among others. He is currently an Associate Editor for *Journal of Quantitative Analysis in Sports* and recently organized the international conference "Rocky Mountain Symposium on Analytics in Sports" hosted at DU.