Journal of Political Science Education

ISSN: 1551-2169 (Print) 1551-2177 (Online) Journal homepage: https://www.tandfonline.com/loi/upse20

Teaching Quantitative Skills in Online Courses: Today's Key Areas of Focus and Effective Learning Tools

Jennifer Bachner & Sarah O'Byrne

To cite this article: Jennifer Bachner & Sarah O'Byrne (2019): Teaching Quantitative Skills in Online Courses: Today's Key Areas of Focus and Effective Learning Tools, Journal of Political Science Education, DOI: 10.1080/15512169.2019.1677475

To link to this article: https://doi.org/10.1080/15512169.2019.1677475

Published online: 18 Oct 2019.

JOURNAL OF POLITICAL SCIENCE EDUCATION
https://doi.org/10.1080/15512169.2019.1677475

Teaching Quantitative Skills in Online Courses: Today's Key Areas of Focus and Effective Learning Tools

Jennifer Bachner and Sarah O'Byrne

Johns Hopkins University

ABSTRACT

At both the undergraduate and graduate level, an increasing number of students are completing their coursework online or in hybrid formats. As online learning grows and evolves, and new teaching tools emerge, it is useful to review approaches for effective teaching in this modality. This paper focuses, in particular, on proven tools in online teaching that can be employed in courses with a strong quantitative analysis component, such as political methodology and political economy courses. We first highlight critical areas of focus, including text analysis, survey research, artificial intelligence and the communication of results. We then discuss methods and technologies that can be used to teach in these areas, such as social media and news APIs, online labor markets, online meeting spaces and simulation exercises. The final section explores methods for providing meaningful feedback on the types of assignments commonly used when teaching quantitative methods. This review of key areas of focus, learning tools, and methods for providing feedback in online quantitative courses will arm faculty with an understanding of how to develop and deliver courses that encourage participation and impart a deep knowledge of the subject at hand.

ARTICLE HISTORY
Received 5 July 2018
Accepted 27 September 2019

KEYWORDS
Online learning; online teaching; teaching tools; quantitative methods

Introduction

As higher education increasingly moves online, both at the undergraduate and graduate level, it is essential to take stock of innovations that promote student engagement and academic rigor in online coursework. This paper focuses on tools for teaching quantitative skills (such as those taught in statistics, political methodology and economics courses) in key areas and the unique challenges associated with delivering online or hybrid courses in this field.

The first section highlights critical areas of focus in the broader field of quantitative methods. These areas, including text analysis, survey research, artificial intelligence and the communication of key findings to relevant stakeholders, allow students to draw meaningful conclusions from datasets of all kinds and to share those results in accessible ways. While social scientists have been regularly performing research in these areas for some time, courses on these specific topics have only recently been developed for

CONTACT Jennifer Bachner jbachner@jhu.edu Government Analytics Program, Johns Hopkins University, 1717 Massachusetts Ave. NW Suite 104, Washington, DC 20036, USA.
Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/upse.

undergraduate and graduate students. Many academic programs are now planning to initiate or expand their course offerings in these areas in the coming years. Importantly, instruction in these areas is particularly well-suited for online courses because of the heavy use of software.

The second section of the paper examines the best methods and technologies for teaching quantitative methods (based on their cost, ease of use and effectiveness in furthering student learning). Social media APIs, for example, allow students to collect textual data quickly and easily that they can analyze with natural language processing techniques. Online labor markets, such as Amazon's Mechanical Turk, likewise provide a fast and low-cost way for students to collect original data for use in a class project or thesis. Zoom (or other online meeting space) is a useful tool for walking students through challenging software (such as that used to employ artificial intelligence methods). And simulation exercises provide a hands-on method for teaching students about the overall analytic process.

The third section of the paper reviews ways of providing feedback in online quantitative methods courses. Through discussion boards, for example, students can comment on each other's work. Students can post their work-in-progress, such as an abstract, table or figure, for their classmates (and instructor) to critically evaluate. Instructors can also incorporate software into online methods courses that provides adapted problem sets. As students work through a problem set, the software presents them with questions that align with their individual level of understanding.

This review of teaching methods and technologies applied to key areas of focus, as well as proven approaches to providing feedback, will help faculty develop more engaging lessons that enable students to better achieve course learning objectives.

Key areas of focus in quantitative methods

The explosion in the amount of publicly available data, and a greater understanding of how it can be used to address meaningful challenges related to policy, politics and governance, has motivated degree programs in these areas to update, in substantial ways, their curricula and course offerings. Government-related programs at all levels have become increasingly quantitative. While degrees such as a master's in public policy or master's in public administration have required a sequence of statistics courses for some time, these types of programs are adding coursework in emerging and more specialized areas of analytics. Undergraduate curricula, as well, are being revised to emphasize the shift toward data-driven decision making in the public sector. And new degree programs are being created that focus specifically on the intersection of the study of analytics and policy.

Text analysis

While scholars regularly employ natural language processing techniques in their own research (see, for example, Grimmer 2013; Benoit and Herzog 2017), new means of collecting and analyzing textual data have made teaching these techniques to students, in a single course, feasible. A text analysis allows a researcher to translate qualitative

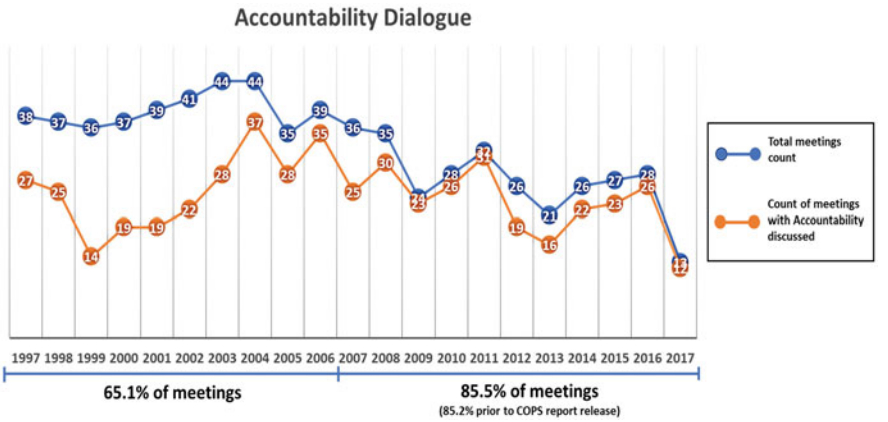

Figure 1. Prevalence of "accountability" discussion at SFPC meetings. Figure from an anonymous student's final project in a Text as Data course. The graph was later incorporated into the student's capstone project for his master's program.

information into numerical data that can be analyzed with a variety of statistical techniques. Researchers can, for instance, perform a sentiment analysis to determine if the information is positive or negative with respect to a particular issue or person, conduct a classification analysis to identify groupings or develop a hierarchical model to demonstrate which issues received the most attention.

There are troves of documents that can be analyzed to provide insight into challenging issues, such as government responsiveness, program effectiveness and agenda setting. These types of documents include meeting minutes, speeches, testimonies, news articles, social media posts, court decisions, legislation, regulations and interviews. In a single course on text analysis, for example, master's students have analyzed whether campaign speeches are predictive of presidential priorities, measured the impact of disability legislation on the promotion of disabled employees and quantified the emphasis placed on cost transparency by the Florida Commission on Healthcare and Hospital Funding.

One student in a Text as Data course analyzed meeting minutes from the San Francisco Police Commission (SFPC) to determine whether the issues discussed at its meetings reflected public priorities. Figure 1, which appears in the student's final project, shows that "accountability" was discussed at a substantially higher proportion of meetings (85.5% versus 65.1%) after the release of a critical Department of Justice report that emphasized areas of improvement for law enforcement agencies around the country.

As part of this project, the student also examined the Commission's discussion of other critical areas, including the use of force and bias. In just 14 weeks, this and the other students in the text analysis course were able to generate and visualize original datasets and thereby contribute to scholarly understanding of a wide range of political and policy areas.

Survey research

Although systematic survey research has been used since the 1940s, it remains one of the most important areas of political methodology. Both political scientists and practitioners, including those who work in government agencies, political consulting firms

and nonprofit organizations, use surveys extensively to measure public opinion. Cutting-edge courses on survey research should focus on advances in both the theory and practice of survey research. On the theoretical side, research has yielded new measurement techniques, such as the use of anchoring vignettes to ensure that responses are comparable across survey participants (Hopkins and King 2010). On the technical side, survey design software like Qualtrics provides a user-friendly way to design sophisticated surveys with advanced question type, survey flow and response validation options. These theoretical and technological advancements, coupled with cost-effective administration options (discussed below), mean that a course on this topic is essential to a political methodology curriculum that has real-world value.

Artificial intelligence (AI)

"AI" is the buzz acronym of the day, and for good reason. AI methods have practical applications across all areas of the private and public sector, including healthcare, energy, financial services and manufacturing. An AI method is one in which the computer solves the problem at hand. These methods can be used to identify clusters, make predictions and detect anomalies. AI methods are particularly useful for making sense of large datasets, which have become increasingly available in recent years.

A political science course on AI can take several forms. One valuable type of course provides a high-level overview of the core principles of AI and its applications. The course "Practical Applications of Artificial Intelligence" offered through the Johns Hopkins University (JHU) Government Analytics program examines various AI case studies, such as how municipal governments are using these methods to improve their service delivery, how engineers are using them to build autonomous vehicles and how the Department of Energy is leveraging AI to modernize the electric grid. As a culminating project, students produce an original use case in a policy area of their choosing.

A second type of AI course is one that focuses on teaching students how to use relevant methods, such as machine learning, neural networks, data mining and social network analysis. These courses can be structured similarly to other methods courses and give students the opportunity to graduate with toolkits that are on the forefront of quantitative analysis.

Interpretation and communication of findings

In addition to offering courses in specialized methodological areas, political science programs are recognizing the importance of teaching students how to apply these methods to meaningful political and policy problems, which requires the interpretation and communication of findings to key decision makers. The JHU Government Analytics program, for example, now offers an online course on healthcare analytics that covers topics such as the prevention of fraud and abuse in the healthcare industry and the application of predictive models to medical records to improve patient management. Another applied methods course in this master's program focuses on urban data analytics. This online course teaches students how to use city-level data to address pressing urban challenges, such as those related to transportation, education and housing.

Over the course of the semester, students move through the complete process of cleaning a dataset from a city government, analyzing the data and developing an evidence-based solution. In both these and similar courses, students are required to consider how results are discussed and presented such that a policymaker can act upon them.

Methods and technologies for teaching in key areas

As the content of political methodology courses changes, so must the teaching methods and tools that are used, particularly when the courses are online. This section discusses how online courses can leverage certain technologies and pedagogical approaches to maximize student engagement and learning while also keeping cost and ease of use in mind.

Social media and news APIs for teaching text analysis

Social media APIs allow researchers to collect postings on sites like Twitter and Facebook while APIs for news organizations allow researchers to collect information such as headlines and article content. Using these APIs is a great way for students to assemble an original, textual dataset on a timely topic. The students can then analyze their new datasets in a variety of ways, such as performing a sentiment or topical analysis.

In one master's level online course on text analysis, during the third week, students are required to pose a research question that could be answered with either social media or news data. They are then required to collect that data and present a graphical image of the data. One student chose to examine news coverage of veteran suicides. The student gathered 5,606 articles that covered this topic from 1920 to 2018 and plotted the article count by year (see Figure 2). This initial examination served as the basis for the student's capstone project, which further investigated when and how the news media cover this important issue.

Other students in the course likewise gathered rich datasets in an extremely short amount of time. One student, who was interested in perceptions of voting, collected 6,869 tweets to show how positive and negative perceptions of voting were geographically distributed across the United States. Another student explored commentary on the UN's Sustainable Development Goals. This student collected and analyzed tweets on this topic to show that discussion of these goals was heavily tied to emissions concerns.

Once students have a basic familiarity with R (from a previous statistics course), it is straightforward to teach them how to use social media APIs to gather data, which they can then analyze and visualize. While there are certainly many other types of textual data students can collect and analyze, the relevance of social media postings to current events makes them of high interest to students. Subsequent weeks in the text analysis course cover alternative ways of collecting data, such as scraping websites for court cases, meeting minutes and speeches.

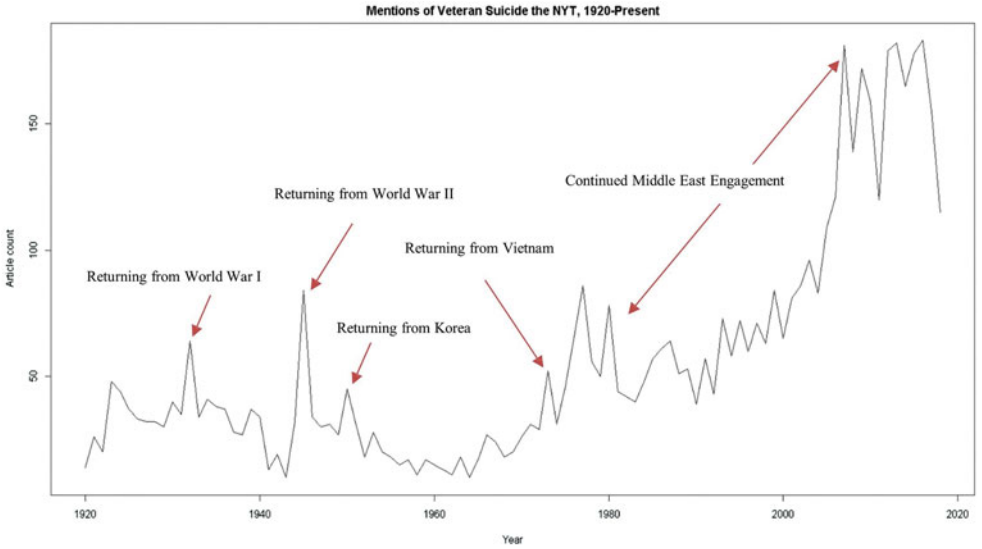

Figure 2. New York Times Coverage of Veteran Suicide. Figure from student Coriene Hayes's final project in her Text as Data course.

Online labor markets for teaching survey research

Another way students can collect original data in a course context is to use an online labor market. In an online labor market, individuals around the globe complete tasks for small payments. Retailers, for example, use these markets to assist with categorizing their merchandise and testing the aesthetic appeal of their websites. Academics have used these markets for surveys, and in particular, survey experiments (Buhrmester, Kwang, and Gosling 2011). Amazon Mechanical Turk (MTurk) is the most popular of these markets in academia, likely because the researcher has a fair amount of control over who participates. MTurk allows the researcher to screen for individuals who reside in a country (based on the user's IP address) and for those who have a high rating based on their past participation. The researcher can then use survey questions to further screen participants to fulfill demographic quotas. Obtaining a representative sample is, therefore, quite achievable. Moreover, MTurk surveys have proven useful for conducting survey experiments (in which internal validity is often the priority).

The use of an online labor market is a great opportunity for students to participate in the survey process from beginning to end. Students can design their own survey questions, pretest them on a small sample, administer the survey to the full sample and then analyze the results. Each step in the process provides opportunities to deal with the challenges that typically arise in survey research, such as misunderstood questions and item non-response. Further, students obtain an original dataset that can serve as the basis for a thesis or capstone project.

At JHU, several online courses have used MTurk surveys with great success. In the Survey Methodology course, students compile a class survey that contains a standard set of demographic questions as well as a separate block of questions written by each student. One student, for example, was interested in studying public support for gun control legislation. This student conducted a survey experiment to examine whether

Table 1. Public opinion on gun control: an MTurk survey experiment.

Version 1: The issue of gun violence is at the forefront of our national dialog. Do you support new gun reform laws?		*Version 2: The issue of gun violence is at the forefront of our national dialog. Do you support new gun reform laws that would . . . .? Select all that apply.*	
Yes	82 (56%)	Require universal background checks on gun sales	124 (78.5%)
No	**41 (28%)**	Prevent the sale of guns to criminals	126 (79.7%)
Not sure	23 (16%)	Limit gun magazine capacities	76 (48.1%)
		None of the above	**15 (9.5%)**
N	*146*		*158*

The lines in bold show, for each treatment question, the percentage of respondents expressing opposition to all new gun reform laws.

opposition to new gun laws is dependent upon whether individuals are asked about gun control laws generally or presented with specific propositions. Table 1 presents the experimental findings. When asked about their support for new gun reform laws (generally speaking), 28% of respondents expressed opposition. When presented with specific gun control reforms, however, only 9.5% expressed opposition to all of them. These results demonstrate that there is far more consensus on this critical issue than is often acknowledged in popular media.

Conducting a survey in a class context is not without challenges. Important lessons learned include allowing substantial time for revision to students' questions, ensuring students familiarize themselves with the existing literature before writing their questions and encouraging survey experiments (in light of generalizability concerns when using MTurk or similar crowdsourcing sites). The benefits outweigh these challenges, however, as the process empowers students to gather original data on a wide variety of topics, including global warming, gun control and defense spending. They have then been able to produce truly insightful statistical findings and visualizations that they have shared with each other through recorded presentations. In one evaluation, a student praised the course for providing "both theoretical and practical exposure." The use of MTurk brings the theory of survey research to life in an online class setting.

Zoom for teaching artificial intelligence

Because courses that teach AI techniques are often quite advanced, synchronous interaction between students and the instructor can be essential for explaining difficult concepts and unpacking the reasoning behind different methods. Zoom (or other online meeting software like Adobe Connect) is a useful tool in this regard, as it allows instructors to walk online students through complicated concepts. Because it allows screen sharing, students can view, in real-time, changes in graphs or maps as the underlying data is altered. Students can interject with questions that allow the instructor to expand on areas that need further clarification. It also allows classmates see their peers' reasoning in a way that may open up new understandings of the material as well as alleviate anxiety (as students see that classmates have similar difficulties or questions as themselves). For example, in a course on machine learning and neural networks, the instructor used online meeting software to host synchronous review sessions prior to the midterm and final exams.

In terms of access, Zoom allows students to connect through any combination of text, audio or video. This is especially important when students have varied bandwidths

and access to technology. Further, sessions can be recorded to share with those not able to attend a synchronous session. Because Zoom facilitates immediate communication with the instructor as well as document/screen sharing, online students often prefer it when asking questions about new, advanced material over the more commonly used discussion boards (Cappiccie and Desrosiers 2011).

Lastly, the use of Zoom or similar technology is useful for conducting individual tutorials with students. The ability to share screens means that the instructor can directly see the difficulties a student is encountering, such as an intractable R or Python coding error, rather than trying to interpret a vague description of the problem in an email or by phone.

Simulations for teaching how to interpret and communicate findings

The use of simulations in online courses is an extremely effective way to facilitate applied learning. In a simulation, students assume various roles and, in these roles, complete one or more learning tasks. In the Applied Performance Analytics online course at JHU, students each assume the role of a city official who can benefit from an increased reliance on data: the mayor, police commissioner, human capital director, budget director, public works director and public health director. Within their groups, students are presented with information about their role and are expected to become experts in their assigned area. Throughout the course, students tackle policy challenges, using data and analytics, from the perspective of their roles. Further, they are required to consider issues such as budget constraints and the interests of external stakeholders. Figure 3 is a slide from the course's introductory lecture that explains how the simulation works.

A primary goal for the course is for the assignments to resemble the processes through which analyses are actually conducted in city governments. To advance this goal, the instructor posts media questions each week addressed to specific group

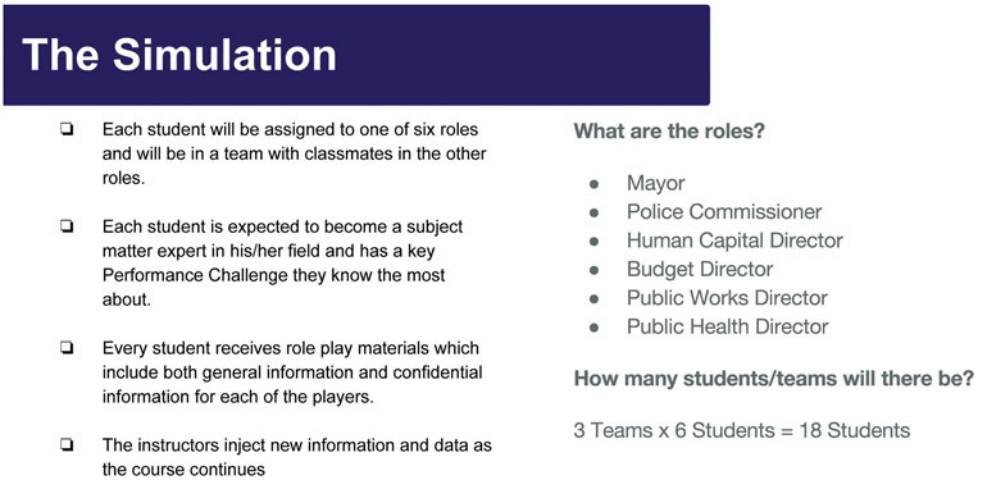

Figure 3. Simulation Set-up in Applied Performance Analytics. This slide, developed by Johns Hopkins University adjunct faculty member Carter Hewgley, appears in the course's introductory video.

members. For example, during a lesson on "doing more with less," the instructor posts a media question directed to the mayor about how he/she would be able to keep a campaign promise to cut the real estate tax given the city's worrisome financial status. Students who have taken on the role of mayor are required to describe, using empirical evidence, how they intend to keep this campaign promise while staying on budget. Thus, through the use of these media questions, students are required to conduct, interpret and communicate a statistical analysis of the data they are given for the purpose of answering meaningful policy and political questions.

The student feedback for this course consistently demonstrates the effectiveness of the simulation for bridging the gap between academia and the real world of government and politics. One student commented, "The material was relevant and applicable to everyday situations many of us involved in government work face, and I plan to use several of the lessons within my own day to day work." Other students remarked that the simulation was "unique," "realistic" and "interesting." Moreover, 100% of the students in the course gave it the highest rating available the in "encouraged and managed participation" category, whereas this percentage for other online courses is typically between 20 and 50%.

E-Portfolios for putting it all together

E-portfolios are a great way for students to organize all of the significant work they complete in either an individual course or throughout an academic program. An e-portfolio is an online collection of work that can include research papers, memos, presentations, visualizations, datasets and code used to conduct analyses. The portfolios can be made available only to students and faculty in the student's program or to the public as well.

From a learning perspective, e-portfolios are useful in that they "provide a strong impetus for students to take ownership" (Rennie and Morrison 2013, 85). Students are often motivated to produce higher-quality work because they know the work will be saved and made available to others. Moreover, if students are expected to provide feedback on each other's e-portfolios, the desire to present good work is even higher.

An e-portfolio is also valuable from a career advancement perspective. Students can share their e-portfolios with members of their professional networks and prospective employers. They allow students to showcase their quantitative skills and the types of analyses they are capable of producing.

Effective approaches to delivering feedback in all areas of political methodology

Just as important as teaching the right topics with the right tools is providing good feedback. In all courses, but particularly in online courses, students need frequent feedback on their work to ensure any misunderstandings are resolved and that they are meeting a course's learning objectives. Discussion boards, adapted problem sets and videos are three effective modes of providing substantive feedback in online courses.

Discussion boards

The discussion board is ubiquitous in online education, though it tends to have a poor reputation among instructors and students. As online education has developed however, we have learned that, used creatively, discussion boards can promote critical thinking and higher learning. Levine (2007, 70) explains that discussion boards can help at the top levels of Bloom's Taxonomy (analysis, synthesis and evaluation). In quantitative courses, an instructor can pose a problem in a thread and invite students to respond. The problem can be something like a coding challenge, research design issues or strange statistical result that needs interpreting. Students can then propose different solutions or suggestions for how to approach the problem. It is instructive for students to see how others tackle a quantitative challenge, as learning *how* to solve a statistical problem is just as important as understanding the solution itself.

There are several additional benefits to using the discussion boards in this way. This mode of learning promotes interaction among the students, which is often challenging in online quantitative courses. Further, the asynchronous nature of the medium works well for students who need time to consider and make sense of the ideas that are posted.

Similarly, instructors can use discussion boards as a forum for students to post their work-in-progress, such as an abstract, table or figure from a paper. Their classmates (and instructor) can then critically evaluate this work. This approach ensures that students receive feedback from multiple individuals. Moreover, the process of digesting their classmate's ongoing analyses and offering constructive criticism is an extremely worthwhile exercise for students. In sum, when used appropriately, discussion boards can certainly be part of a set of best practices for providing feedback.

Adapted problem sets

Interactive online textbooks offer another useful means of providing feedback in quantitative courses. An integral part of many of these online textbooks is their adaptive problem set systems. One of the most popular of these is Aplia, produced by Cengage Publishing. It can be used in conjunction with Cengage texts, including their most popular economic and statistics texts (and there is also a textbook-agnostic version). JHU's Economics for Public Decision-making online course has successfully used the system for the past four years.

Problem sets in Aplia incorporate several different interactive tools including graphs, calculators and tables. There are also tutorials that explain basic concepts and include both pretest and posttest questions to check mastery of the material. A particularly useful feature of these problem sets is the Grade It Now feature. This allows students to try up to three different versions of the same problem. Problems are randomized across students. Such problem sets have the potential to address the need for (1) prompt and detailed feedback, (2) active learning, and (3) the application of the course material to real-world problems.

For example, one of the Aplia problem sets includes a question in which students are asked about the elasticity of a demand curve. The student is given three attempts to answer the question. If the student answers incorrectly all three times, the student is

immediately shown the correct answer. The instructor can choose how much partial credit to award students who answer the question correctly on their second or third attempts (or the questions can simply be used for self-checks, with no points assigned).

Regarding feedback, students often receive graded assignments long after they have finished learning the material, rendering that feedback less useful (Hattie and Timperley 2007). One of the advantages of Aplia and similar programs is that they provide instant feedback and, in the case of the Grade It Now feature, allow students to try a missed problem again immediately. Further, research consistently demonstrates that students benefit from a detailed explanation that accompanies a wrong answer (Williams 2012). Adaptive problem sets provide detailed explanations of the correct answers in addition to letting students know, instantly, if their answers are right or wrong.

A key to acquiring expertise in statistics and other quantitative subjects is active learning and frequent practice (Nyguyen and Trimarichi 2010). However, assigning and grading frequent problem sets can be burdensome for the instructor. Aplia allows the instructor to assign frequent problem sets without adding to the instructional burden and tailor the assigned material to the needs of individual students (as Aplia reports detailed information on each students' progress and areas of difficulty).

While the features of systems such as Aplia are potentially beneficial, it is important to evaluate their efficacy in practice. Some research finds no significant difference in learning outcomes between traditional versus Aplia questions as measured by exam outcomes (Flannery, Kennelly, and Considine 2013; Lee, Courtney, and Balassi 2010), yet other studies have uncovered small but significant increases in class averages (Nyguyen and Trimarichi 2010), particularly when the problems are required rather than optional. Multiple choice and graphic exercises appear to be the most beneficial (Snowball 2014).

Importantly, however, many students exhibit a preference for Aplia assignments when given the option between these and traditional paper assignments, and the Aplia assignments have higher completion rates. Feedback from student evaluations in JHU's political economy classes confirms that students enjoy completing assignments through this medium.

It also worth noting that many of the existing studies on the efficacy of these software programs compare them with traditional learning methods. In the online classroom, however, traditional approaches are usually not replicable. Moreover, Williams (2012) notes that there are potential advantages to these types of assignments that may not be measured by exam outcomes, such as instructor satisfaction and student engagement with the content. As mentioned above, much of the existing literature on learning technologies focuses on using them as part of a flipped classroom approach, which does not translate well into the fully online classroom (Reyneke and Fletcher 2014). Nonetheless, these studies support the view that having students complete these type of assignments leaves more time for the instructor to interact one-on-one or in groups with students using Zoom or similar formats to discuss areas not fully mastered by working through the problem sets.

Video feedback

Frequent, personalized communication is important in all courses, but particularly so in online, quantitative courses in which students commonly feel isolated and daunted by

the material. Consistent communication increases student motivation and persistence in learning challenging material (Betts 2009). The advantage of video communication (meaning the instructor provides comments on student work through videos) is that it personalizes the student experience and provides the audio and visual components of communication that are missing in textual feedback. Studies have shown that videos increase students' sense of presence and feelings of belonging, in addition to increasing understanding of course content (Borup, West, and Graham 2012). These findings are supported by student feedback on a course on comparative democracies. In this course, the instructor created short videos each week outlining practical, course-related matters, as well as commenting directly on students' performance in the previous week and tying their contributions to ongoing current events. Students reported that receiving feedback from these videos made them feel that the instructor was highly involved and connected to the course.

While video feedback for all components of a course may not be feasible, or even desirable, it is useful to have diversity and frequency with respect to communication. And creating these videos need not be arduous. A feedback video can be quite short and still be effective. Some existing tools for online instructors, such as Turnitin's grading software, already offer the option of providing audio feedback, which is a good alternative if creating videos is not feasible.

Conclusion

This paper has highlighted key areas of focus, teaching tools and feedback methods that can be used in online, quantitative courses to improve students' learning experience. As online education expands and new teaching approaches and technologies emerge, the optimal online course – one that is both academically rigorous and has a high level of student satisfaction – will need to rely on a combination of techniques. We hope this overview has provided valuable insights into several of them.

Notes on contributors

Jennifer Bachner, PhD, is Director of the Government Analytics program at Johns Hopkins University. She is the author of *What Washington Gets Wrong* (with Benjamin Ginsberg, Penguin Random House) and the editor of *Analytics, Policy and Governance* (with Benjamin Ginsberg and Kathryn Wagner Hill, Yale University Press). Her report, Predictive Policing: Preventing Crime with Data and Analytics, has been published by the IBM Center for the Business of Government. As an expert on government analytics and political behavior, she has been quoted and/or cited in the Washington Post, Wall Street Journal, Baltimore Sun, Roll Call, Government Executive, and on NPR. Bachner received her PhD in government from Harvard University and undergraduate degrees in political science and social studies education from the University of Maryland, College Park.

Sarah O'Byrne, PhD, is Program Coordinator for the Center for Advanced Governmental Studies at Johns Hopkins University. She has been teaching in the program since 2007 and currently teaches courses in global political economy, economics for public policy, political economy of development, corruption and comparative democracies. She received an Excellent in Teaching Award in 2014. Her research and writing take an interdisciplinary approach that combines

political science and economic perspectives. She is currently examining the role of epistemic communities on policy outcomes, specifically in the area of development aid and corruption. She holds a BA in Economics from Trinity College, Dublin, and an MA in Economics and PhD in Political Science from Johns Hopkins University.

References

Benoit, Kenneth, and Alexander Herzog. 2017. "Text analysis: Estimating policy preferences from written and spoken words." *Analytics, Policy and Governance*. Yale: Yale University Press.

Betts, Kristen. 2009. "Lost in Translation: Importance of Effective Communication in Online Education." *Online Journal of Distance Learning Administration* 12(2):1–13.

Borup, J., R. E. West, and C. R. Graham. 2012. "Improving Online Social Presence through Asynchronous Video." *The Internet and Higher Education* 15(3):195–203. doi:10.1016/j.iheduc.2011.11.001.

Buhrmester, Michael, Tracy Kwang, and Samuel D. Gosling. 2011. "Amazon's Mechanical Turk: A New Source of Inexpensive, yet High-Quality, Data?" *Perspectives on Psychological Science* 6(1):3–5. doi:10.1177/1745691610393980.

Cappiccie, Amy, and Patricia Desrosiers. 2011. "Lessons Learned from Using Adobe Connect in the Social Works Classroom." *Journal of Technology in Human Services* 29(4):296–302. doi:10.1080/15228835.2011.638239.

Flannery, D., B. Kennelly, and J. Considine. 2013. "Paper and Online Assignments in Economics: A Comparison with Panel Data." *International Review of Economics Education* 13:31–43. doi:10.1016/j.iree.2013.04.016.

Grimmer, Justin. 2013. *Representational Style in Congress: What Legislators Say and Why It Matters*. Cambridge: Cambridge University Press.

Hattie, John, and Helen Timperley. 2007. "The Power of Feedback." *Review of Educational Research* 77(1):81–112. doi:10.3102/003465430298487.

Hopkins, D. J., and G. King. 2010. "Improving Anchoring Vignettes: Designing Surveys to Correct Interpersonal Incomparability." *Public Opinion Quarterly* 74(2):201–222. doi:10.1093/poq/nfq011.

Lee, W., R. H. Courtney, and S. J. Balassi. 2010. "Do Online Homework Tools Improve Student Results in Principles of Microeconomics Courses?" *American Economic Review* 100(2):283–286. doi:10.1257/aer.100.2.283.

Levine, S. Joseph. 2007. "The Online Discussion Board." *New Directions for Adult and Continuing Education* 113:67–74. doi:10.1002/ace.248.

Nyguyen, Trien, and Angela Trimarichi. 2010. "Active Learning in Introductory Economics: Do MyEconLab and Aplia Make Any Difference?" *International Journal for the Scholarship of Teaching and Learning* 4(1):1.

Rennie, Frank, and Tara Morrison. 2013. *E-learning and Social Networking Handbook: Resources for Higher Education*. New York: Routledge

Reyneke, F., and L. Fletcher. 2014. "The Impact of an Inverted Traditional Teaching Model on First Level Statistics Students." Paper presented at the Ninth International Conference on Teaching Statistics, Flagstaff, AZ.

Snowball, J.D. 2014. "Using Interactive Content and Online Activities to Accommodate Diversity in a Large First Year Class." *Higher Education* 67(6):823–838. doi:10.1007/s10734-013-9708-7.

Williams, Amanda. 2012. "Online Homework vs. Traditional Homework: Statistics Anxiety and Self-Efficacy in an Educational Statistics Course." *Technology Innovations in Statistics Education* 6(1):1–19.