THE USE OF TECHNOLOGY AND SOCIAL MEDIA IN TEACHING STATISTICS

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When teaching an applied subject such as Statistics it is important to be up-to-date with modern teaching methods and take advantage of any available teaching "tools". Technology can play an important role in this, with the use of social media, interactive online applications and videos. The use of these tools allows the teacher to take advantage of flipped-classroom approaches and for the student to grasp difficult statistical concepts (e.g. regression, simulation, confidence intervals, etc) easier through visualisation and a hands-on approach. In this paper, I will present how a lecturer can take advantage of some of the available "tools" that I used (e.g. Shiny, R Markdown, Screencast-O-Matic, Twitter, etc) in such a way that class time could be spent in stimulating debate and discussion.

INTRODUCTION

I feel that any lecturer should be aware of research areas related to innovative learning methods and take advantage of advancements in technology with online teaching assignments, interactive graphics, and online videos that provide the opportunity for learning through activities in class. This belief, along with the facts that one of the courses I had to teach for the first time (i.e. Advanced Data Analysis) did not have a specified syllabus and I was interested in trying something different, gave me the freedom to use flipped-classroom methods and present some well known statistical notions in a different way.

Each lecture is now available online and consists of a theory section, an application section, and the code to reproduce all the graphs. Furthermore, for each lecture, I created and uploaded 2-3 short videos explaining important concepts about the lecture (these can be found on the Moodle page of the course). The slides and videos were uploaded a week before class; thus class time could be spent using that knowledge in collaborative ways.

FLIPPED CLASSROOM APPROACHES IN STATISTICS

According to Tucker (2012) lecturers that use the flipped classroom model agree that viewing the recorded videos outside class time are not enough to make the model successful. Rather, it is how teachers integrate these instructional videos into an overall approach that makes the difference. Thus, I let students know that having the videos online does not mean that they should not ask me questions about the material but just that they have to be prepared for exercises on it. This had as a result that I could spend more time during class with struggling students than with a traditional lecturing approach (since advanced students had more freedom to learn independently). In general though, using this approach I feel that time becomes available for students to collaborate with other students, engage more deeply with the actual content, and receive immediate feedback from their lecturer. Specifically, students were organised into groups and handed a real life dataset each week with minimal instructions on how they could work through the questions. At the end of the class session there was a short talk by each group's representative about their analyses of the dataset. This proved really helpful since groups could listen what other groups did differently and what was the reasoning behind it. Finally, I took advantage of social media (i.e. Twitter) and frequently uploaded material related to the aforementioned course throughout the week.

Strayer (2012), Wilson (2013),and Peterson (2016) applied flipped classroom approaches on their Statistics courses, which they were previously teaching in a lecture format, and make some really interesting "discoveries". Amongst them, is that students under the flipped format i) perform better and ii) are more open to cooperative learning. Both "discoveries" do have some issues

though since course grades can be a bad measure of true knowledge for a lot of reasons and there could have been the issue of grader bias also. Furthemore, Strayer (2012) found that students in the flipped classroom were less satisfied with how the format oriented them toward the relevant learning goals of the course. Having said that, the findings were (in general) in favour of flipping the classroom for a Statistics course. More importantly, these were the only studies that I could find that contrasted the flipped and traditional approaches in a Statistics course and were really important in my decision to try something similar. O'Flaherty and Phillips (2015) reviewed flipped lectures by doing a survey on 28 articles across a range of disciplines. Students' perceptions of the flipped class were generally positive with a small minority having negative views.

TEACHING "TOOLS"

There is a wide array of teaching "tools" that one may use to take advantage of technology. I felt that I should focus only on a couple of applications which are easy to use and require minimal effort for the user to get to grips with them. Having said that, I spend a couple of weeks researching what are the "best" options for what I wanted to do. Even though these applications can be applied into a wide array of courses, this does not mean that they are always the best option. Furthermore, I feel that lecturers should not put the focus on the technologies used on a course but rather on the material.

Since I had the advantage of being an R user and I wanted to create something that my students could not just understand but also be able to reproduce it and adjust it to their needs in their computers (or the labs at the school); I decided to create documents that can include (and run) R code. The fact that R is the main programming language that the students use was really helpful since I didn't have to spend a lot of time explaining basic commands in R.

- R Markdown is a file format for making dynamic documents with R. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. It also allows you to create interactive documents using Shiny and include raw LaTeX for advanced customization of PDF output. (free)
- RPubs is a publishing service that makes it easy to upload and share these documents online on RPubs. (free)
- Screencast-O-Matic is a screen and webcam recorder to record on-screen activity for tutorials and presentations. The Pro version ($29/3 years) allows you to add much more to your videos (e.g. annotations, zooming option, etc) and also to edit the audio as well.
- Twitter is an online news and social networking service where users post and interact with messages, known as "tweets". Twitter can be helpful for giving additional information to students.

Having said all that, and no matter how much I feel that this approach benefits the students, nothing will happen if the students do not do the assigned readings on time. Their first exposure to the material must be on their own, outside class because if they come to class unfamiliar with the material, they can't do anything with it. Nilson (2016) mentions some measures that we, as lecturers, can take to encourage the students to do the readings to make it easier for them to get value from their readings while making it more difficult or costly for them to ignore the readings. A lot of these measures stem from the fact that we do not, usually, help the students on learning how to navigate through reading material (e.g. how to take notes, what they should retain for class, what they should be looking for as they read, etc).

CONCLUSION

These approaches would tend to work if the course includes lab sessions where students can get a hands on approach to the problems and questions of the specific subject. It would be an additional advantage if the course is applied and has some difficult concepts that can be presented through interactive visualisations. Finally, it is really important be consistent with the timing of the uploaded material since for most of the students this is their first time participating in a course that is "taught" this way. Finally, we have to decide to follow the path we had on our minds from the start of the course despite the initial feedback we might receive.

Having said that, even though I am in favour of using technology for teaching and learning purposed there were a couple of papers that challenged my assumptions about learning with technologies. An urban legend that Kirschner et al. (2013) is the one that is related to learners being digital natives that know by nature how to learn from new media, and for whom "old" media and methods in teaching/learning do not work anymore. Even though the paper has confirmed a lot of things that I had in mind (I found myself having a lot of deja vu moments while I was reading it), I have fallen into the trap in believing some of these urban legends. It's good to know that there isn't evidence that support these ideas. As an example, in Statistics we work a lot with the R programming language and one of its popular graphical user interfaces, RStudio. A lot of times the students can't even find how to do basic things while in RStudio like importing a data set and set the working directory even though there are two sections on the top (i.e. titled File and Session) that include these commands (titled Import a data set and set a working directory). In general, I have seen an unwillingness to explore things that they don't feel confident at. Several students have written down a command in RStudio and didn't want to press the Enter button before speaking to me first and asking if they had written the command correctly. This shows me that they are not as comfortable as we think they are. Most importantly though, I think that this a direct result of us not challenging them enough and making them learn from their failures. Finally, Kirschner et al. (2013) say that the preferred way of learning, however, does not need to be the most productive way of learning. Specifically: "Let us make a comparison with food. Suppose that we ask children what food they prefer. Some children might prefer fruit and milk, but the majority will prefer candy and soft drinks. Would this be a justified reason to give these children the food they prefer? We think not, simply because the preferred food will have a negative effect on their health." I will probably "steal" the candy and soft drinks statement next time a student tells me that they prefer the lecture to be done a different way.

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