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Split Information in PowerPoint Assisted Scholastic Settings

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Introduction

The use of multimedia presentations, and specifically PowerPoint slides in college classrooms is prevalent in modern colleges and universities. The clarity and consistency of visual content, ability to include complex animations and graphs, and ease with sharing in-class material online are considerable strengths. As a presentation method, the use of electronic slides are not without some cause for concern (Tufte, 2006; Liu et al., 2012), a partial list being: over density of information, going too fast through the material, and a reliance on slides for all aspects of a presentation even when other pedagogical tools (question and answer sessions, group discussion, etc.) would be more appropriate.

In addition to good practices for learning effectiveness with electronic slides in a classroom, there is also the issue of what information should be made available online.[1] For courses that do not use a textbook, or for course topics that are covered outside the scope of a textbook, there is a potential divergence between PowerPoint slides that work well in-class but then are not adequately descriptive once students leave the classroom. Yet, slides which are heavy in content (diagrams, equations, and lengthy text) runs afoul of the 'split-attention principle' which occurs "when learners are required to split their attention between and mentally integrate several sources of physically or temporally disparate information, where each source of in-

[1] The issue of whether lecture slides posted online are beneficial to student performance (Worthington et al., 2015) is a separate discussion.

formation is essential for understanding the material" (Ayres et al., 2005). A simple example shown in figure 6.1 is the teaching of trigonometry where equations are separate from graphs and there is essential accompanying text.

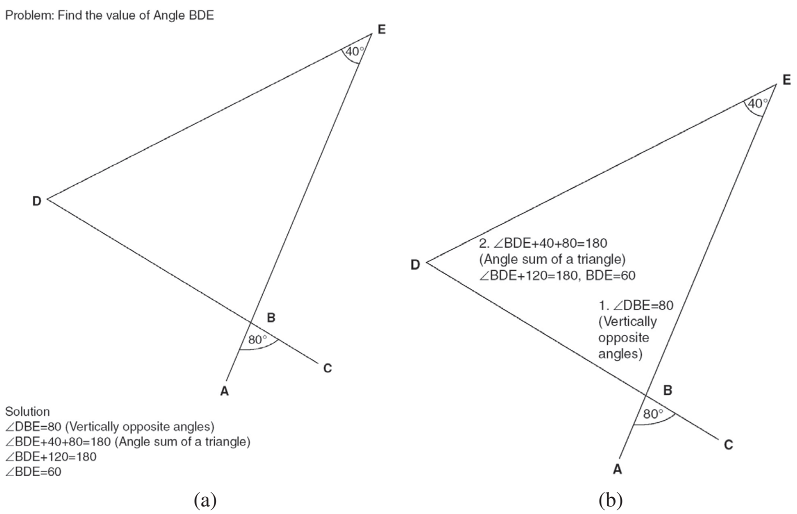

Fig. 6.1. Example from (Ayres et al., 2005) regarding the split-attention effect. In (a) the trigonometric equations and information are spatially disjoint from the illustrated triangle, where in (b) the information is integrated.

The split-attention principle builds on research by R. E. Mayer and colleagues highlighting that adding more information can overwhelm the cognitive load of the learner (Mayer et al., 2001), even in scenarios when the information is integrated, e.g. similar to figure 6.1b versus 6.1a. What is interesting in today's multimedia classroom environment is that even relevant details in PowerPoint slides are associated with a decrease in both a learners ability to retain knowledge as well as transfer knowledge to other analogous scenarios. Coupled with students having to listen to any lecture from teachers, it seems straightforward that the kind of information in slides that work well in a classroom is different than what may be most useful when students are out of the classroom.

In this project, I explore the appropriateness of including supplemental information in PowerPoint slides that are posted online that are extended versions of the in-class lecture slides.

Project Background

This project for having different in-class and online versions of PowerPoint lecture notes was motivated by the University of Copenhagen course Advanced Methods in Applied Statistics. It is a graduate level science course which covers topics that are not comprehensively covered in a single textbook, and relies on modern algorithms, statistical tools, and software development that are the trademarks of cutting edge data analysis in the physical sciences. In a 3-4 hour class session, there are normally 3 mini-lectures of 10-20 minutes followed by in-class exercises.

The primary focus of the course is to have practical examples and a working knowledge of various statistical methods as well as experience in developing proper data analysis software in a modern programming language (C++/C11, Matlab, R, Python, etc.). By not having a textbook, the course lecture slides and a few scholarly articles are the resource material. The concepts can often times seem understood and obvious by students while in the classroom where a teaching assistant and teacher are available, but due to the imperfection of human memory the same concepts can become ‘fuzzy’ while out of class. This is where explanatory lengthy text and explanations can be of significant utility, which brings about the divergence between what’s good for in-class slides (less text and more discussion) and out of class (more text).

While I have reduced the amount of text in the PowerPoint slides over the past 3 years of teaching the course, I have received feedback from students that they would enjoy having more material available for their own personal review. Hence, some of the previous PowerPoint slides had too much explanatory text to be well-suited for the in-class lecture portion, but too little when students had questions and were reviewing for the exam.

Proposal

To better align the in-class and out-of-class learning styles and resources for students, it may be appropriate to have two different versions of the same lecture slides. In this fashion, there would be a version that is optimized for presenting in front of an audience and another as review material. From the students' perspective this approach is intended to avoid overwhelming their working memory (Baddeley, 2010) while they listen to the teacher discuss the material and understand the visual information presented (either in the form of graphs, equations, animations, or scientific sketches).

Execution and Challenges

On a limited scale I implemented having different slides from what is shown in class to what is posted online. This was for the Advanced Methods in Applied Statistics course, which has approximately 30-35 students split between studying for their M.Sc. or Ph.D. degrees. While the course is listed as an elective for physics degrees, approximately 30% of the students were non-physicists, and of that group only a few were not following a physical science specialization (e.g. economics). As such, the response from students at either the undergraduate level or in other subject areas may differ from what I experienced.

For the slides that were different between the in-class and online versions, the online versions themselves had two different additions:

- Transition slides that covered what was discussed verbally in class about the statistics topic, such as Boosted Decision Trees and how the number of nodes, number of variables, and depth of the tree can influence the outcome. These were sometimes listed as 'comments' on the titles of the slides, and were reminders of best-use practices, see Appendix A for an example.
- There was also the addition of material that was not covered in-depth in the lecture portion of the course, but constituted more review material for any interested students. For example, the mathematics for weighting a data sample in Adaptive Boosting.

Because each lecture centers on understanding and solving around 3 in-class exercises, each example exercise is specifically worded and was left the same between the in-class and online version. For 3 of the lectures in the Advanced Methods class, as well as two guest lectures in the Applied Statistics:From Data to Results, I used more streamlined lecture slides for the in-class portion versus what was posted online.

Since only 30-50 minutes of each 3-4 hour lecture session is actually lecture, there is a substantial amount of time to interact with the students. Initially some of the students were concerned that the version of the lecture slides they saw online and were following during lecture were not the same as what was being shown on the projector. This was mostly fixed by one of two interventions: including the slides in the actual lecture but only flashing through them quickly while explicitly telling the class "This is what we just got done discussing and is only included as a reminder" or by saying that the online lecture slides have *additional* text, and that all the core information was present in both versions.

Besides the oversight regarding stating that online version has more explicit text- and readingbased slides, the students did not appear to consciously notice that there was a difference between those lectures which had the extra material in the slides, and the other lectures which did not include any extra transition slides. Where there was an impact was regarding class participation and questions asked during the lecture portion of the class. For lectures where the slides were the same online and in-class, there were fewer questions and comments during the lecture portion with the whole class; an average of <1 per 10-20 minute mini-lecture. When there were different versions, students appeared to follow the in-class lecture more intently and there were correspondingly 1-2 questions or comments for each mini-lecture. In both scenarios, the amount of questions and discussion during the exercise portion each of class was the same.

One challenge in having two different versions of the slides is gauging what impact it has for the students. While the number of questions asked during the lecture portion of a course can be a proxy for student participation, it might also be that having less material produces less understanding and the increase in a questions are not a reflection of student participation, but of a worse learning outcome. In the future it would be interesting to compare exam scores from problems associated with lectures that had in-class and online optimized versions, versus lectures where there is only one set of slides.

Besides gauging the impact of split versions of slides, it should be noted that it takes a non-negligible amount of additional time to produce additional material for the same lecture. Students can get a sense that whatever appears as explicit text during in slides carries more importance than what is discussed during the lecture. This is especially true when there is no textbook to serve as the absolute authority. Students which understood the concepts during the lecture and exercise portion of a class, were sometimes confused by any divergence between what is contained in the additional material and what was covered in class.

Discussion and Conclusion

Having an in-class optimized set of slides was helpful in keeping the students moving at a similar pace through the lecture content. When there is less text and less material, whatever is being shown or discussed becomes the obvious focal point. Students do not have to decide between listening to the instructor, understanding the equation or graphs, while simultaneously reading lengthy passages of explanatory text. Even when text is shown in a bullet-format and only after a discussion has occurred, many students can feel rushed. Having the additional material in an online version also helps those students who would not focus on the text during the lecture portion, but benefit from clarification and additional information when it comes to doing the written homework and exam.

While there is an additional burden on a teacher to create two (slightly or significantly) different versions of any PowerPoint slides, there appears to be a benefit to the students and their in-class concentration. Being explicit about the differences, explaining why there are two versions, and being conscious about the extra material that is included in any online versions are important aspects to consider when taking this approach.

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A Transition slide for material that was dicussed in-class but was included explicitly in the online version of the lecture slides

BDT Comments

- It is common to throw an absurd number of variables into a BDT and have it signify the variables of importance. The more variables used in any supervised learning algorithm, the more difficult it is to debug when something goes wrong, e.g. user error.
- The number of nodes, variables, events, and depth of each tree can influence the classification outcome. Because BDTs are generally fast to train, play around with the settings/options to see the effects.
- Ensure that the variables used in training match the distribution shapes in data. Poor variable agreement will bias the BDT, and if the BDT uses many variables it can be hard to notice that a problem exists.

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