

Livening Up the Introductory Statistics Course with Non-traditional Media Resources

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Abstract

The basic introductory statistics course is a course that is now required for most graduate as well as undergraduate degrees. However, it generally remains a course that most students do not look forward to taking usually due to anxiety fears and/or a general lack of interest in statistics which often leads to classroom boredom. We as professors of statistics are constantly looking for ways to “liven up” the topic for those who are not as enthusiastic about it as we are with the hopes of engaging the students throughout the entire class period. In this paper, I present my experience with incorporating non-traditional media resources, specifically the audience response device, into an introductory Biostatistics graduate level classroom that is cross-listed between both the graduate school and the college of public health.

Key Words: alternative media resources, teaching biostatistics, personal response device, innovative teaching, clickers, audience response device

1. Introduction

Although the use of audience response “clicker” device is commonly found in the teaching realm of other areas (e.g., continuing medical education), the discipline of statistics generally remains being taught by traditional means. Here I present my experience with incorporating a non-traditional media resource, specifically the audience response device, into our Biostatistics I graduate level course. Our institution is a medical and public health school; Biostatistics I is cross-listed between the Graduate School and the College of Public Health. It is a three credit-earning hour course that met during the summer session twice per week for three hours each. Although typically larger (e.g., 20-30 students), the class size was eleven students.

1.1 Objectives

The objective of this project was to test the feasibility and usefulness of incorporating the audience response device into the Biostatistics I course at our university with the following specific aims in mind:

- To keep the students engaged (“checked in”) throughout the entire 3 hour class period;
- To encourage classroom participation for those students who might not usually participate otherwise;
- To provide instant feedback to the student concerning their individual knowledge of the topic discussed;

- To provide instant feedback for the instructor concerning the students' understanding of a specific topic.

2. Audience Response Device and Classroom Implementation

The audience response “clicker” device is similar to what is seen on the television show “Who Wants to be a Millionaire” when the player chooses the option to poll the audience. At that time, each audience member has the opportunity to choose what they think the correct multiple choice answer to a specified question; the frequency distribution of the selected answers is then displayed. The audience response “clicker” devices supported by Turning Point Technologies were used for this project. Some features of these devices are as follows:

- It works in conjunction with Microsoft PowerPoint;
- The cost is \$10 fee per student (per semester) at our university;
- It has the ability to link each device with the name of the student using the device;
- It has the ability to display the frequency distribution of selected answers and fastest correct responder after a question;
- It has the ability to save the student response data after each session.

The clicker devices for this project are supported by Turning Point Technologies. After downloading the Turning Point software onto your computer it works in conjunction with Microsoft PowerPoint by providing an additional “Turning Point” tab within the PowerPoint software. Between five and eight Turning Point 4-choice multiple choice questions were incorporated throughout every lecture. For this project, each course topic was covered the traditional way (“by chalk”) along with an example and was then followed with two Turning Point question. For every topic, two Turning Point questions were introduced: one conceptual “big idea” question and one computational question. After each question was answered, the frequency distribution of the students' selected answers was displayed. The fastest two correct respondents were then displayed. The fastest respondent was given a small prize (i.e., miniature candy bar) after each question.

3. Student Feedback

At the end of the semester, a short anonymous survey was given to each student which was intended to gain a general understanding of the evaluation of the audience response device from the student's perspective. The survey included a series of questions as well as an optional open-ended comment section. The questions asked on the survey were as follows:

Questions/Answers (Agree, Disagree, Undecided)

1. I enjoyed using the device
2. Device was easy to use
3. It stimulated my thinking and interest
4. I value the instant feedback that it provided
5. It motivated me to continue learning
6. It helped my understanding of course concepts
7. I would rather NOT use the device

Questions/Answers (Excellent, Satisfactory, Poor, Undecided)

8. Overall evaluation of the device

The feedback from the students was mostly positive. There were 11 total students in the class; all students but one reported that they enjoyed using the device and that they would rather use the device in the classroom than not. Additionally, several students elaborated in the comments section on how much they enjoyed using the device and that it made the class “fun” and also liked the “treats given to the winners.” Some also said that they wished that others classes would use it. Only one student reported that they did not like using the device and the reason for the dislike was stated as “It puts unnecessary pressure on the students to work through the problems quickly.”

4. Instructor Perspective

One of the primary goals of this project was to provide instant feedback for myself, as an instructor, so that it could be used to evaluate the students’ understanding of a specific topic. As an instructor, we generally tend to think that we have an idea of whether or not the students fully comprehend the topic that we are currently presenting by looking across the faces of various students in the audience throughout the lecture. I have remained confident in my ability to gage the students’ understanding throughout previous courses that I’ve taught but have been recently surprised during a few topics while incorporating the use of the “clicker” devices. One example is when the “One-way Analysis of Variance (ANOVA)” topic was introduced. The class had previously covered the various classic t-tests (e.g., one-sample and two-sample independent t-test, paired t-test) and the students seemed to have had a solid understanding of the methods and applications of them. Given the students’ previous knowledge of the t-test, I chose that to use the two-sample independent t-test as a foundational piece to teach the concept of the “One-way Analysis of Variance” topic. I introduced ANOVA as an extension of the two sample independent t-test where rather than comparing two groups to one another, we are now interested in comparing three or more groups to each other. We discussed a few examples, worked through the mathematics of partitioning the variance on the board, and finally worked through a few examples of application. As I scanned across the classroom looking at the student’s faces, I generally saw a classroom that fully understood the topic. I saw several nods and a general look of contentment on each of their faces. Next, I proceeded to review the ANOVA topic, as I had done with all of the previous topics, by presenting two audience response questions. The first question was conceptual and the second was computational. The conceptual question that was asked was:

“A One-way ANOVA is used when you are interested in:

1. Analyzing the difference between more than two population means
2. Analyzing the difference between two population variances
3. Analyzing the difference between two sample means

4. Analyzing the difference between more than two population variances.”

Overwhelmingly, the responses to this question were those involving population variances (i.e., 2. Analyzing the difference between two population variances; 4. Analyzing the difference between more than two population variances). I was quite surprised to get this response as I had visually seen a complete understanding of the topic across the students' faces. However, I took advantage of this information to correct the misunderstanding on the spot. I explained again the partitioning of the overall variance into components and hence the basis of the name of the method, Analysis of Variance. This was followed with stating that the goal of an ANOVA design, however, is to test the difference between three or more means, an extension of the two sample independent t-test. At this point the concept was clear and it allowed for the students to ask questions. The audience response device allows for an excellent teaching and learning opportunity such as this which is well received by both the instructor and the student. It allows for a misconception to be clarified instantaneously rather than allowing it to solidify incorrectly for a long period of time with the hopes that it will be corrected at a later date. This is especially important as it becomes more difficult to correct a misunderstanding the longer the period of time becomes that the misunderstanding was thought to be correct.

In this project, the “clicker” response data was completely anonymous to the class with the exception of including a slide reporting the names of the two fastest correct responders who were given directly following the frequency distribution of answers display. A response counter as well as a ten second timer was included on each “answer slide.” After the majority of the class had answered a question, the ten second timer was started to give the remaining students a chance to submit an answer. Although the information was anonymous, during the first month of class there was one student who consistently was not answering the questions. I first thought that one of the clickers may not be operating properly; however, there were a few rare questions that were answered by all students so I determined that this clearly was not the case. The Turning Point software allows one to save the answer data on an individual student level which can be linked up to the devices as I chose to do. Based on observing the clicker response data, I was able to determine which student was not answering the questions. She was a student who was struggling with the course and shortly thereafter ended up dropping the course.

The primary disadvantage that I found with using “clickers” within a mathematically oriented course is that both the questions and answers generally would not fit on the “answer” Turning Point slide. After experimenting with a few different options over the first few classes, I found the most effective way to rectify the issue was to display questions/answers on an overhead projector and the answers alone on the Turning Point slide.

Finally, I decided to reward the winner of each question by giving them a miniature candy bar. I had decided that with a 3-hour long class that the students would appreciate a mid-lecture sugar boost and I found that they really did! Originally before the course began, I had worries that the same one or two students would answer all of the questions correctly and that I might be giving the prize to the same person(s) throughout the entire semester. However, my experience was surprisingly on the contrary. Rarely did I have the same student perform as the “fastest responder” multiple times on a single day. Throughout a single class period with five to eight Turning Point questions, I sometimes would have at most two students that were the fastest responders on two questions or less; otherwise, there was a unique “fastest responder” to the other questions. Further, there seemed to generally be a unique set of “winners” from day to day.

5. Conclusions

Experience in using “clickers” (i.e., audience response device) in Biostatistics I was a generally extremely positive one from both a teaching perspective as well as a student perspective. The use of the device offers the following: 1) Engages the students throughout the course; 2) Encourages classroom participation for those students who might not usually participate otherwise; 3) Provides instant feedback to the student concerning their individual knowledge of the topic discussed; 4) Provides instant feedback for the instructor concerning the students’ understanding of a specific topic. The class average during the semester where clickers were incorporated was higher than has been over past semesters. The increased class average likely may be due to the incorporation of clickers into the course; however, there may have been other potential confounding factors that were involved. Nevertheless, the audience response device is an excellent teaching tool and thus will be adopted in all future Biostatistics I courses that I teach.

References

<http://www.turningtechnologies.com>