INTRODUCTORY STATS, THERE'S AN APP FOR THAT

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Overview – Elementary statistics is a final math course for many students. Traditional classes use either calculators or tables in books that the students will not have after the completion of the course. This sends the message that statistics is only for math class. We used free cell phone apps for the course encouraging use after the class concluded.

Section 1: Overview of introductory statistics courses

At many schools there are several first courses in statistics. An introduction to mathematical statistics typically has a calculus prerequisite. Elementary statistics typically has a prerequisite of college algebra. Within elementary statistics we can further divide the courses into those preparing for research methods and those satisfying a quantitative literacy requirement. The courses that are preparing for research methods are placed in the curriculum with the expectation that the students will take a follow up course where the statistics will be applied in a particular discipline. Quantitative literacy requirement courses are typically the final math course of a student's career. As a rule of thumb, the preparation for research methods courses prepare students to be producers of statistics. The quantitative literacy courses prepare students to be consumers of statistics,

Traditionally, students use a variety of technologies in an elementary statistics class. Many classes use books and tables, graphing calculators, special pedagogical software, and production software for doing statistics. Different approaches are called for depending on the objectives of the course and how it fits into a larger curriculum.

For a course that prepares producers of statistics it makes sense to use the production software that the client disciplines will use in research methods. At the author's institution a strong case can be made for Excel (business), SPSS (political science and psychology), JMP or SAS (public health), or R (biology). For these courses we want the method of finding statistics to be consistent enough so that the sophomores who took the class last year tell the freshmen in the course this year hat they need to learn this because they will see it again. There is an appropriate place for demonstration or and pedagogical software (websites and Fathom) because of the power of good visualizations in the learning process. One might even use tables to check conceptual understanding and for

exceedingly simple problems. I would argue against graphing calculators. I find that students see problems done on a calculator as different enough to be disconnected from problems done on production software.

For a course that prepares students to be simply consumers of statistics, for a quantitative literacy course, the considerations are quite different. There is no follow up course where the techniques will be used again on questions that the students find more interesting. These courses face the dynamic where students are often math phobic, do not see the value of the course, and are trained that math courses have no connection to anything other than math courses. Teaching software skills is an investment in skills that the students probably will not retain and are not central to the purpose of the course. I would argue that any "last math course" should be constructed to emphasize the connections of the content of the course to what students will do outside the course. I would argue that the appropriate statistical software should be free software available of a cellphone or tablet.

Section 2: The argument for the use of apps

A major challenge for a last math course is the perception from the students that they will never use this material again. At the introductory level students are quite bad at transferring and applying knowledge in a new domain. Unfortunately this means if with do statistics with tools the students will only have while in the course, we will give the message that we do not expect them to use the techniques outside of the course. In the introductory statistics classes I have taught, all of the students plan to get rid of their books when the class if finished. Those with graphing calculators only plan to keep the calculators for classes that require them. The students will lose access to the publisher website with special software when the term on their license expires. Most or not going to install specialty software on their computers, even if it is free. However almost all of my students have smartphones, and between tablets and computers, all have access to internet connected devices.

The approach shifts form teaching specific uses of specified and provided software to asking the student to go to the appropriate app store or to use Google (or their favorite search engine) to find a tool for the tack in the class. This does mean that students in the same class will be using different software for the same task. It also means that they need to be retrained to use web searches and cell phones for academic tasks. (Most of my students have been trained by many years of schooling that the cell phones they are never without, are not to be used for academic tasks.

Section 3: Tasks and apps

Using the internet for an introductory statistics class means that we need to start with a list of tasks to be performed. In a standard course these fall into several categories. We ask students to produce descriptive statistics for a sample of a single variable. We ask

students to look up critical values form a chart. We ask them to do simple computations with z, p, and t. We ask them to work with data for a chi-squared or F distribution.

There are a couple of basic approaches for using the internet instead of tables for basic statistics. You can have the students use free general purpose math applications. You can have the students use free specialty apps designed for specific statistical tasks. You can have the students use the full range of websites.

For general purpose math apps, my favorites are Wolfram|Alpha and GeoGebra. A sizable percentage of the students will have already heard about Alpha. It will do almost any computation. There is a free version. The phone version is $1.99. On the downside, students sometimes have trouble with its syntax. GeoGebra is designed as pedagogical software so it may be easier to use. Neither is as user friendly for specific questions as the specialty apps.

For free specialty apps I looked at the iOS store and found Simple Stat, Std. Dev., Calc Pro, LeanStatFree, StatCalcLite, StatViz, F-Graph, StaTableLite, Bell Curves, and Stats Pad LE. A disadvantage of the app route is that students will need several apps for the range of tasks they need to perform.

In either case all of my students were able to find something to use with the advanced instructions of “have an app that handles the following tasks”.

Section 4: Pedagogical issues

The biggest practical issue with allowing internet connected devices in class is that you need to allow them on tests if you want their use to be considered a significant part of the course. That brings up issues of academic honesty. I partially addressed the issue by having tests in two parts, a paper part looking at definitions and conceptual understanding and a potion that allowed the internet where computations needed to be done. I would argue that the content of the pedagogical content of the course should be more important than what makes for easy testing in designing a course.

It is worth noting that some class time needs to go into finding app and online resources. I found it useful to have students work in groups when they were looking for online material.