Experiences with On-Line Examinations in an Introductory Applied Statistics Course

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1. Introduction

In the 1980s one of the authors began giving on-line examinations which used Minitab statistical software in his introductory applied statistics courses at Babson College, a small institution that grants undergraduate business degrees and MBAs. At that time his students used computers in one of the school's computer laboratories; today our students use laptops in a room, that is usually networked. Our initial reasons for giving examinations (and quizzes) in which the students have to use statistical software are the same reasons why we have continued to give such exams. Such exams allow students to demonstrate their ability to use statistical software and interpret the results. And, as a result of such use students learn important skills that they do not learn if these skills are not examined.

2. Examination Changes

How do our exams differ from ones in which statistical software is not employed? In recent years one of the authors has attempted to have one-third of his exam require the use of the software, one-third may require its use, and one-third does not require its use. For the software questions, students analyze data from three possible sources. First, they use files that contain the data. These files may be previously loaded on their computer or distributed during the class. Second, they enter small sets of data during the exam. Third, they generate data by using statistical software commands such as Minitab's Calc > Set Base and Calc > Random Data commands. Before the students analyze data, we always allow them to practice in class and through homework. We still require the students to write the majority of their answers on the hard-copy examination because it is easier for them to illustrate their work and for us to grade their work. For example, they may indicate the commands they used to generate their answers. In addition, one of the authors asks his students to submit a Minitab Project file that contains their exam computer work.

For such exams, we have found it useful to prepare for the worst-case scenario. Hence one of the authors had extra computers available in case of laboratory machine failure. Today we have back-up laptops available in case of a laptop failure. We also have multiple ways (such a disk with a file containing the data, a listing of the data, or Internet access to the data) in case a student cannot access a file. These precautions are similar to having transparencies for a PowerPoint presentation.

3. Academic Dishonesty

One major problem with allowing computers (and other technology) into examinations is the increased possibility of academic dishonesty during the examination. (In recent years there have

been more reports of cheating in the United States schools, even those with honor codes. This is especially true for business students, who acknowledge such behavior in anonymous surveys.) Easy communication between students is one example of such dishonesty. For example, most of today's laptops allow wireless communication. As another example, in 2002 some Columbia University students used the text messaging feature of their cell phones during an exam. Today, similar students might use the video messaging feature.

4. Precautions

There are four ways to reduce the possibility of such academic dishonesty. The first is providing explicit instructions on what is allowed during the exam (and referring to the institution's student handbook).

Another is paying attention to the physical administration of the exam. Students should be separated as much as possible. For example, Babson's networked classrooms allow dividers to be placed between students during exams. An instructor might consider assigned seats for the students to prevent possible collaboration between friends. He or she might number exams to identify what student sat next to what student. Finally, an instructor should roam around the examination room to observe what is being done by the students.

Not allowing communication is the third way. This means no sharing of calculators that can contain information. (If a student does not have a workable calculator, he or she may use the computer's built-in calculator.) This also means preventing access to e-mail, the school's intranet, or the Internet. Hence instructors need to check for cable wires or wireless boards. The institution may also purchase software to prevent such communication.

The fourth is the construction of the exam. With today's technology it is possible to construct more than one copy of an exam. (or the appearance of more than one copy by providing different cover pages or using different colored paper.) Identical questions (or portions of a question) can be presented in different order. Questions can be modified slightly. Here are three examples: negating or non-negating true/false questions for different students, asking for interval estimates with different levels of confidence, and requesting hypothesis test alternatives of less than, not equal to, or greater than. It is also quite easy to prepare similar exams with slightly different data. In addition, the data may be totally different by asking different students to analyze different columns of a data set or to analyze different sets of random data. The use of different questions often has pedagogical advantages, in addition to preventing academic dishonesty.

5. Concluding Remarks

Administrating on-line examinations in an introductory applied statistics courses provides the instructor with a more realistic assessment of a student's knowledge. But it has some disadvantages associated with it. First, some students may prefer not to use statistical software or just to examine its output. Second, there is extra work involved with such examinations for the instructor. For example, attempting to prevent academic dishonesty. Still, it is our belief that the advantages outweigh the disadvantages.

REFERENCE

Minitab, Inc. (1998), Student Edition of Minitab Based upon Minitab Release 12, Minitab, Inc., State College, Pennsylvania, USA

RESUMÉ

Cet article a décrit ce qui doit être accompli pour administrer les examens en ligne dans un premier cours d'appliquer des statistiques. Il explique comment des examens traditionnels doivent être changés (en particulier pour empêcher la malhonnêteté par des étudiants).