Chapter 22
Experiences From an Introductory Statistics Course Based on an Applet-Based Technology

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ABSTRACT

After the unexpected spread of the global pandemic, all the universities around the world have implemented online learning procedures. This necessity forced the mathematics and statistics instructors to use more technological means than ever. The method used in this chapter involves an intense use of applet-based education tools for a two-course sequence of introductory statistics. Forty-five applets were used during the courses. At the end of the semester for each course, a short questionnaire was given to the students to evaluate the method applied. The feedback from the students about the applet-based instruction was largely positive. Possible future works are suggested in the conclusion.

INTRODUCTION

The theme of technology is particularly important for statistics education because of the role of technology in changing views of statistical knowledge, pedagogy and learning (Schuyten and Thas, 2007). Indeed, using technology in teaching statistics subjects has seemed to be a good option over the past three decades. Several types of technological tools were used in statistics instruction, such as statistical software packages, spreadsheets, virtual manipulatives, multimedia materials and graphing calculators. These tools helped instructors to facilitate teaching by calculating statistical operations, analyzing data, or explaining the concepts and the big ideas of statistics. They also simplified the students' information retention processes and the comprehension of difficult subjects. However, with the rapid spread of global pandemic, online education and technology usage have become a necessity, rather than an option. Thus,

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digital learning materials have become more important for distance learners than ever (Osmanoglu et al, 2020).

Turkey confirmed the first case of Covid-19 on March 11, 2020. One week after that date, all the universities in Turkey issued a learning policy at home and implemented online learning through some learning management systems (LMSs). The LMS used in the researcher's university offered a synchronous learning environment which is structured in the sense that students attend live lectures, there are real-time interactions between educators and learners, and there is a possibility of instant feedback. However, math lecturers are used to the flexibility of chalk and, most of them, among the others, are probably the least willing to use the tools of online learning systems, which generally offer limitations in writing mathematical symbols. Besides, students cannot follow slides as good as blackboard because the lecture speed in slide-based lectures is higher than blackboard-based teaching method. So it is not easy to keep the students' interests alive in online mathematics or statistics courses. On the other hand, the pandemic could bring a unique opportunity in changing the technology component of the courses performed only in occasional trips to the lab beforehand. It could be moved away from the standard lecture format to an active and innovative learning environment in which students could instantly work with the data, perform calculations, make simulations, visualize mathematical and statistical concepts, and do their homework with their own computers. This could be a fascinating experience.

The author thought that the main component of the technology that was proposed to apply would be virtual and dynamic objects which are generally called "applet" or "virtual manipulative". Then, it was decided to apply an intensive applet-based technology to the two-course sequence of "Introductory Statistics". The first course, which deals with the tabular and graphical displays, descriptive methods, basics of probability theory and special probability distributions, was taught in the Spring 2020. The second course, which is given in Fall 2020, covers the techniques and theory of sampling, the two phases of statistical inference which are confidence intervals and hypothesis testing, goodness of fit and independence tests, correlation, simple linear regression, and analysis of variance. Both courses were taught at Istanbul University, Faculty of Political Science. Commonly, the technological component in statistics courses is a software package such as SPSS or Minitab, which offers a wide range of possibilities. In contrast to a general software package, however, an advantage of using applets for teaching statistical topics is that they are often very specific. Applet interactions can be designed to enable focused investigations of the desired content objectives. They can be used to run simulations without having to understand or to modify computer code; with the appropriate applet, changing the parameters of a simulation can be a matter of adjusting a slider or clicking a button.

The initial interest level of students in the first of the two-course sequence is usually moderate before the pandemic. Many of the students in the course are intimidated a little bit by the course "Mathematics" in the Fall 2019. Implementing user-friendly applets to the courses for simulation, visualizing concepts or performing calculations with this audience has the potential to increase both interest in and understanding of the material. In line with this possible expectation, when the students were asked to evaluate the method applied at the end of the semester, student reactions demonstrated, indeed, that interactive applet-based tutorials integrated into introductory statistics courses can be accepted by students as useful supplements, or even replacements for, traditional statistics assignments.

The aim of this chapter is to share all these experiences mentioned above. The remainder of this chapter is organized as follows. The difficulties encountered in teaching and learning statistics are pointed out, applet-based education tools are introduced as a way to reduce these difficulties, then the details of the applets used, the reactions of the students and the suggestions for the possible future works are given.