Introductory Statistics Courses for Non-statistics Majors at Colleges and Universities

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1. Introduction

Programs of statistical education for non-statistics majors at colleges and universities are intended to serve one of the following three purposes:

a. Statistical literacy education for the future citizens who are to become the "consumers" of statistics, expected to read statistical data intelligently and think statistically in the information society.

b. Training elementary and secondary schools' "teachers of statistics". Most of elementary school teachers are trained to teach all subjects, and some elements of mathematics together with statistics should be included in their training programs at colleges and universities. As for statistics, statistical literacy education of a. may suffice if it is a good one. At secondary schools, statistics is taught by teachers of mathematics so that colleges and universities may be expected to provide future teachers of mathematics with good mathematics programs at the undergraduate and master's levels which include at least one introductory statistics course for non-statistics majors.

c. Teaching statistics and statistical methods for the future "users" of statistical methods in their respective fields of application: sciences, technology, industry, medicine, business, government, and others.

Current introductory statistics courses for non-statistics majors at colleges and universities are one of the following three types:

(1) Traditional basic statistics, which consists of elements of descriptive statistics, frequentist theory of probability, and a hybrid of Fisherian and Neyman-Pearson theories of inference.

(2) Basic practice of statistics, which consists of data production, data analysis and inference in the freuentist and data-oriented approach, with stress on statistical thinking, concepts and real data, but less mathematics and recipes.

(3) Elementary Bayesian statistics, based on subjective probability, as a critical tool of science, stressing on the shortcomings of the frequentist inference and reinterpreting results of frequentist inference from Bayesian viewpoint, however with less mathematics and with real data.

In the present paper the author will show that the reasons why introductory courses of type (1) be replaced by those of type (2) or (3).

2. Traditional basic statistics

A course of this type is mathematically oriented, with stress on derivation of formulae but with

only a few realistic, not real, data sets as examples. [Hoel(1971), Miller(1983), University of Tokyo (ed.)(1991), etc.] It tends to be a mathematical theory of probability dealing with statistics. Due to the fact that high school graduates entering colleges and universities are less equipped with necessary mathematical preparations than in the past, it is almost imperative to change courses of type (1) to those of type (2) or (3).

3. Basic practice of statistics

Moore(1998) gives a more compelling reason why a course of type (2) is preferable to that of type (1) under the circumstances where an introductory course is the one and only one formal exposure of statistics to most college graduates, stressing that it must provide them with statistical thinking, not statistical methods derived from mathematics of statistics. Ito(2001) stresses the importance of statistical thinking in an introductory statistics course. One good textbook for this type is Moore(1995). If students are interested in applying statistical methods in their respective fields, they are advised to continue to take one or more method-oriented courses designed to serve particular disciplines so that they may understand what the informed application of statistical methods is.

4. Elementary Bayesian statistics

While an introductory course of type (2) is useful for the future "consumers" of statistics and future "users" of statistical methods, a course of type (3) may be suitable for the philosophy-oriented liberal arts students. One good textbook for this is Berry(1996). However, applications of Bayesian statistics to practical problems should be avoided at this introductory level.

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FRENCH RESUME

On compare trois types de cours d' initiation à la statistique pour les étudiants des universités et des instituts universitaires non spécialisés dans cette matière :
(1) Eléments de la statistique traditionnelle, (2) Exercices de base de statistique,
(3) Eléments de la statistique Bayesian. On propose que les cours du type (1) soient remplacés par ceux des types (2) ou (3).