A QUANTITATIVE HISTORICAL PERSPECTIVE ON THE EFFECTIVENESS OF VARIOUS INSTRUCTIONAL METHODS IN TEACHING STATISTICS AT THE POST-SECONDARY LEVEL OF EDUCATION

Shawn Fitzgerald
Kent State University, United States
smfitzge@kent.edu

The purpose of this quantitative review of studies was to determine the overall effectiveness of various instructional strategies employed in the statistics classroom at the university level. When compared to the traditional lecture approach, “innovative” instructional strategies were associated with greater student achievement (d = 0.3389). However, several study characteristics moderated the relationship between the instructional strategies and statistics achievement. Findings suggest that a publication bias exists in this literature as the average effect for studies which were published (d = 0.4235) was significantly greater than presentations (d = 0.1515) and dissertations or theses (d = 0.1761). It was also observed that for studies which used random assignment produced larger average effects (d = 0.3615) than those which used intact groups (d = 0.2624). The significance of these results will be discussed relative to the historical effectiveness of these strategies employed in the statistics classroom.

THEORETICAL PERSPECTIVE AND PURPOSE

In 1967, the Joint Committee of the American Statistical Association and the National Council of Teachers of Mathematics on the Curriculum in Statistics and Probability was formed to plan and coordinate improvements in the science and teaching of statistics and probability at all levels of education. Since this time the research on and innovations related to the teaching of statistics at the university level has advanced rapidly. As a result of the advances in this field, many mathematics education journals, such as the Mathematics Teacher, Educational Studies in Mathematics, and The College Mathematics Journal, have regularly published articles on the teaching of statistics at this level. Furthermore, journals such as Teaching Statistics and Journal of Statistics Education have evolved and are devoted specifically to publishing research on statistics education. A search of several on-line research databases revealed over 500 articles and papers related to the teaching of statistics at the university level from 1967 to 2005. Among the literature focusing on statistics instruction, it appears that there is growing support among those teaching statistics and those conducting research on the teaching of statistics for the increased use of innovative methods of instruction in the statistics classroom.

The innovative methods which have been incorporated into the statistics classroom over the years include personalized systems of instruction, programmed instruction, the use of small groups in cooperative learning environments, as well as the use of computers as both a tool for delivering instruction and as a teaching aid. In addition, statistics laboratories have been used to supplement instruction in order to give students experience with analyzing data using various statistical packages and conducting other hands-on activities related to data analysis and interpretation. Other teaching aids which have been “experimented” within the class have included the use of writing assignments, the use of humor, the use of analogies and metaphors, and the use of exercises and assignments that are oriented toward the students’ field of interest. While this description is not inclusive of all the various instructional methods and teaching aids which have been explored in the statistics classroom, it does indicate the diverse nature of what has been explored in an attempt to improve statistics instruction and education since the 1960’s.

In general, the rationale for incorporating these innovative methods into the statistics classroom is that students will likely understand statistical concepts more easily; will be able to deal with more complex data; and will be more motivated to learn and ultimately be able to attain a higher level of achievement in a statistics course than they would had they been exposed to the traditional lecture method of instruction. Unfortunately, among the studies which have focused on the effectiveness of these innovative instructional methods of teaching statistics, few have produced consistent results when compared to the traditional lecture approach. This finding is evident even when considering those studies focusing on the same method of instruction.