CHAPTER 1

INTRODUCTION

The need of quantitative comparisons between institutions gave rise to the development of performance indicators. As Goldstein and Spiegelhalter (1996) argued, '... a performance indicator is a summary statistical measurement on an institution, or system, which is intended to be related to the 'quality' of its functioning'. Education, health and social services are the areas where these indicators are widely used in the last decade. We are primarily interested in the performance indicators in the area of education.

According to Goldstein and Spiegelhalter (1996) there are three kinds of indicators (measures): (a) 'input' indicators, such as the pupil/teacher ratio, which are used to estimate the resources available to institutions, (b) 'process' measures, such as average teaching time per pupil, which reflect organizational structure and (c) 'outcome' measures, such as school examination results, which are used to judge institutional effectiveness.

In this thesis we concentrate on outcome indicators in the area of education. More specifically, the aim is to assess the effectiveness of Greek Lyceums, to detect potential differences in the performance of Lyceums according to the type of Lyceums (public, private), the gender of the students and the scientific orientation that students have chosen. The data examined refer to examination results for two adjacent years, 1990 and 1991. Thus, we want to explore those factors that affect students' achievement in the National Entrance Exams for the Greek Universities and the Technical Institutions.

A basic characteristic of the data, that will be analyzed, is their hierarchical structure. A hierarchy consists of units grouped at different levels

(Goldstein, (1995)). In the area of education the most trivial example of hierarchical data consist of the grouping of students in classrooms and of classrooms in schools. In the data we analyze in this dissertation the following structure holds: there are prefectures, schools nested in prefectures and students nested in schools. Consequently, there is the need for taking into account the fact that the units of one level are subject to the influences of their grouping in the units of higher levels. For this reason, when one wants to analyze a set of data with hierarchical structure one cannot just ignore this hierarchy and use traditional statistical analysis techniques. The analysis that is required, in such cases, is the multilevel modeling. Furthermore, another subject that needs to be treated cautiously is the need of making adjustments for the existing achievements of the students. In the opposite case, the results produced by an unadjusted analysis would be insufficient and misleading for the inferences about school differences.

The analysis of the data showed that there are differences between prefectures and between schools in the performance of students in the National Entrance Exam in Greece. The factor that affect students' performance in the National Entrance Exam is the gender of the students, the type of schools and the scientific orientation that students have chosen. To be more accurate, it is concluded that boys do better than girls, the public schools do much better than the private ones, while the scientific orientation differences are statistically significant but not very pronounced. Finally, the students who took the Exam in 1990 did better than those who took the Exam in 1991. It is important to stress at this point that these results must be treated as suggestive rather than definitive.

Chapter 2 of the dissertation presents some introductory theory about the Variance Component Models and the Hierarchical Linear Models, whose common feature is the existence of random effects at each sampling level. This allows them to 'handle' data with hierarchical structure and thus these models comprise the basis of the structure of multilevel modeling. Also, some

important applications of these models in educational research are reviewed. In the third chapter, the theory of multilevel models is expanded and applications of these models in educational research are discussed. In the fourth chapter, the Greek data and the variables of interest are presented, followed by their analysis. Finally, in the last chapter an overall picture of the results is presented and the conclusions derived by this statistical analysis are summarized.