Statistics in the Education Curriculum in West Germany

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1. Introduction

When students of education at (West) German universities are asked about their motivation for the compulsory courses on empirical social research and statistics, many of them respond negatively. This is the impression I formed while lecturing on these courses at two universities in Berlin for several years.

Looking over the scarce German literature on problems and concepts of courses on empirical or statistical methods, it seems that negative preconceptions frequently appear in students of other social sciences as well: Schulmeister (1982), for example, studies the fear of statistics; Leiser (1981) considers the possible origins of prejudices against quantitative methods; Hofmann (1986) states for sociology that only about two percent of the students have good qualifications in empirical methods and statistics. An increasing interest in the contents of methods courses has been recognised over the last few years in connection with the use of computers (Faulbaum, Haux and Jöckel, 1990).

Most research on the teaching of statistics - insofar as it is concerned with the social sciences at all - deals with psychology and sociology. In education, research on statistics as part of the curriculum is almost non-existent.

This paper deals with the attitudes which students bring with them into statistics courses and which influence the processes of teaching and learning.

2. Studying education in general

In (West) Germany the institutionalisation of statistics took place in the 1960s and courses on empirical research methods and statistics were established in the Education curriculum then (Hajek, Henning and Roeder, 1968). Previously, Education was dominated by the humanities following Schleiermacher (1768-1834) and Dilthey (1833-1911) who used an interpretive approach to education. This is in contrast to the causality approach of educational studies in the social sciences.

Teaching in quantitative methods and statistics became caught up in the tensions between the "interpretative" and "causality" approach. This has an impact not only on the schedule of the courses, but also on the students' attitudes. Students ask themselves why they should bother with methods of scientific research at all, when they have chosen to study pedagogy because they are interested in practical educational work. Other students argue against quantitative methods and statistics on the grounds of a humanities approach. For them the most important part of the educational process is the personalities of the individuals involved. This, they claim, could not be studied by objective methods like statistics. The students of a third group think they have quit mathematics in school, once and for all, so they are surprised to find it again on the agenda of their statistics courses.

3. The idea of the study

The subject of this study was the change in students' opinions, attitudes, and feelings about statistics and empirical research methods throughout a course given in the Department of Educational Science at the Free University of Berlin in 1988/89. The course lasted two semesters (three months each), and there were two-hour lectures twice a week. In addition, students could attend a tutorial. Students' knowledge was tested with take-home examinations.

Questionnaires were distributed at three stages: one at the beginning of the course, a second at the end of the first semester, and a third at the end of the second semester. The first questionnaire asked for the students' preconceptions of quantitative methods and statistics. The items about attitudes were adapted from a scale developed for students of psychology (Diehl, 1981; Diehl and Kohr, 1986). The second questionnaire was concerned with general aspects: degree of difficulty, the strain of students' studies, comprehensiveness, and so forth. For comparative reasons, parts of the first and the second questionnaire were repeated in the last one.

Altogether there were about 200 students in the course, and 179, i.e. about 90%, took part in at least one of the inquiries. However, if we look at those students who filled out at least one questionnaire, the sample decreases from 61% who filled out one questionnaire to 11% who filled out all of them. A comparison of the groups answering one, two, or three questionnaires showed no significant differences with respect to sex, age, or number of semesters at university.

4. Rating and change of attitudes to quantitative methods and statistics

The responses were analysed by means of a factor analysis. Three factors were concerned with attitudes and three with the rating of the course. The results are very similar to those of Diehl and Kohr (1986). The three attitude factors could be named as follows:

(i) adjustments to the essence and purpose of statistical methods;
(ii) degree of aversion to mathematical/statistical methods;
(iii) degree of enjoyment in dealing with statistical methods.

The three factors relating to the rating of the course are:

(i) rating of the degree of difficulty;
(ii) rating of schedule, structure and comprehensiveness of the course;
(iii) degree of work strain.

Corresponding to the results of the factor analysis we have set up six scales. To calculate the average scores on the scales all students available at the points of measurement were taken into account (cross-sectional analysis). Figure 1 shows means and standard deviations; high scores correspond to high ratings in the sense of the scale labels.

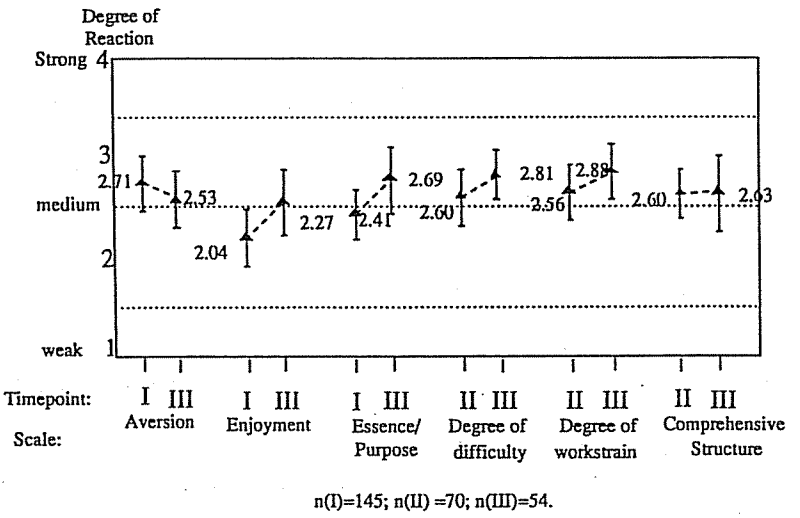

FIGURE 1
Means and standard deviations for the six scales

At the beginning of the course both the "Enjoyment" and "Aversion" scales have the widest deviation towards the negative; seen from an assumed central - or undecided - point on the scale (at 2.5) they deviate at timepoint I by 0.46 and 0.21 points. On the other hand, the ratings of "Essence and Purpose" tend to the undecided range. Thus, it seems that a somewhat neutral rating of the abstract essence of quantitative methods prevails at the beginning of the course. But this is juxtaposed with an expected discontent as regards concrete work with those methods; real enjoyment in working with statistics seems inconceivable to the students.

At this time female students show more aversion to mathematics and statistics (mean for female students 2.78; mean for male students 2.52; $t = 2.02$, $p = 0.04$). For example, female students admit sooner than male students that mathematics has never been their strong point, or that they feel stress when working with figures, and so forth. One can guess that school experience in mathematics strongly influences the attitudes towards statistics at university.

The attitudes found in the results of the first inquiry correspond to the ratings at the end of the course. It can be confirmed that those students with great aversion to statistics also have higher scores on the "Degree of Difficulty" scale than others (Pearson's Correlation between "Aversion" and "Degree of Difficulty" : 0.71; $p < 0.001$). These students also have higher ratings on the "Degree of Work Strain" scale (Pearson's Correlation : 0.46; $p < 0.001$). The scores for the scale "Comprehensive Structure" are independent of the preadjustments.

At last there is an overall positive answer to the most important question of whether attitudes have changed in the course of the programme. When we compare the means of the three attitude scales at the beginning of the course with those at the end there are no major differences, but there is a clear tendency to a positive change in attitudes. The "Essence and Purpose" scale has the greatest increase. At the end of the course quantitative methods are judged to be more important than at the beginning.

Looked at more closely, this positive change depends on the female students. While for the male students the mean on the scale "Essence and Purpose" of the first inquiry does not differ from the second (first : 2.36; second : 2.33), it increases for the female students (first : 2.42; second : 2.87). Also, the "Aversion" scale shows a greater change for the female students than for the male students.

Unlike gender the heterogeneous age structure of the participants has little impact on the different scales. Finally, it should be noted that many students had jobs during the semester (27%). However, it is of interest that there was no connection between time spent on these and changes in the ratings.

5. Conclusions

The main finding of this study is that the course in quantitative methods and statistics - as it was during the time period of the study - helped to modify students' attitudes in a positive way. For the lecturers and tutors this is, for sure, a satisfactory result. It cannot be said, though, whether or not a different form of course presentation would cause greater changes. But the finding does show that reasoning about methods of empirical social research and statistics can help to change the negative attitudes and prejudices of many students. Women, especially, who showed a greater aversion to mathematical methods, got the impression during the course that it makes sense to handle these methods. It seems that students' sceptical attitudes to quantitative methods could be changed to an informed critique. From this there is hope that the sceptical view towards empirical/statistical approaches which can be found in education overall, will be followed by a more productive discourse on methods.

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