

Verhoeven, P. S. (2009). *Quality in Statistics Education. Determinants of Course Outcomes in Methods & Statistics Education at Universities and Colleges (phd-thesis)*. The Hague: Boom Onderwijs.

Year: 2009

Author: Pieternella S. Verhoeven

Institution: University of Utrecht

Title: *Quality in Statistics Education. Determinants of Course Outcomes in Methods & Statistics Education at Universities and Colleges*

Supervisors: Joop Hox & Mart Jan de Jong

Although Statistics is not a very popular course according to most students, a majority of students still take it, as it is mandatory at most Social Science departments. Therefore, it takes special teaching skills to teach statistics. In order to do so it is essential for teachers to know what students' attitudes are toward statistics and what factors influence course outcomes. In this study an answer was sought to the question what the effect is of educational (organizational) and (individual) student factors on course outcomes with respect to introductory courses Statistics at Dutch and Flemish institutions of higher education. Theoretical focus lies on the Expectancy Value Model, by Eccles & Wigfield; it was adjusted for this study by following Schau's model closely and adding elements from Prosser & Trigwell. Additionally, the focus in this study was put on the analysis if pre- post-test change.

Besides a number of expert interviews, a large-scale survey was conducted where pre-test- and post-test attitude-data of 2,555 students were collected at 11 institutions in the Netherlands and Flanders. The data collection took place between January 2006 and May 2007, in three rounds. In order to measure attitudes toward statistics, the SATS©36, developed by Schau, was used. Besides measuring Affect, Cognitive Competency, Difficulty and Value, it measures Effort and Interest. Additionally, global attitudes were measured (such as math experience in high school and self confidence), individual (background) variables and institutional (course) variables were measured.

Besides uni-, bi- and multivariate analyses, confirmatory factor analyses were run to test the construct validity of the models. Additionally, intra-individual 'attitude-change' was analyzed and the effect this change has on student achievement. This was done by analyzing a series of latent growth models especially developed for this purpose. These Latent Change Method Effect models not only analyze intra-individual (attitude) change, but they can also uncover possible method effects that may occur as a result

of the set-up of the data-collection. Lastly, a hybrid approach was sought by testing a structural model with the most powerful indicators of student achievement present.

The results of the analyses show that individual factors have a more powerful effect on attitudes towards statistics and student-achievement than institutional factors. These factors are self confidence, mathematics experience, gender and age. This means that the higher one's self confidence, the more math experience a student has, the older he is, the better student achievement is. Gender holds a special position in this study. In a nutshell: females show (on average) lower attitudes toward statistics, they have lower self confidence and they put in more effort than males. However the effect of the attitude change on student achievement for females is positive and significant, whereas for males the effect of attitude change on student achievement is not significant.

The Latent Change Method Effect Models show a good way to analyze intra-individual change and the models revealed that in most cases a Method Effect was present. This was due to the set up of the study and the fact that the same instrument was used in both pre-test and post-test measurement. The scarcity of significant organizational influence was partly caused by the multilevel set up of the study. Being collected at different levels, individual and institutional factors are best analyzed using multilevel (hierarchical) tools. In this study it was chosen not to do so, because the institutional sample ($n=11$) was considered too small.

This thesis concludes with a number of recommendations for teachers to develop and organize their course and motivate their students. Lastly, future research should concentrate on 'teacher quality' a bit more, as this concept remained underexposed in this study. The most important message that I want to transmit is that highly motivated teachers can motivate their students, and as a result student achievement will be high irrespective of the topic.