Teaching Statistics in Psychology

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The demand for quantitative methods has been increasing steadily within the field of psychology, and it is commonly agreed that quantitative methods and statistics should be acknowledged as core requirements for a university degree in psychology. The Department of Psychology has recognized this development and first year students are now required to complete two semesters of Fundamental Statistics and later use their knowledge about statistics directly in the course on Cognitive Psychology in their third semester. We know that some students find quantitative methods very challenging but it also seems that some students simply lack the motivation to learn these skills.

In this project, we conducted an online survey for students in Statistics (first semester students) and Cognitive Psychology (third semester students) to examine if students' motivation for learning statistics can be increased by letting them work on data they have collected themself. In the Statistics course students primarily work on textbook data, whereas it has recently been implemented that students collect, analyse and present their own data in the course on Cognitive Psychology. Furthermore, the project aimed to investigate what motivates students for studying psychology and what they consider to be important methodological skills to be acquired in order to become a "real" psychologist.

Our results indicate that students' motivation for learning statistics increase when they get to work on their own data in Cognitive Psychology. We speculate that this may be because it allows students to see an immediate application of the methods in contrast to the more abstract application introduced in the Statistics course. The survey also revealed valuable information on the diversity of what motivates our students to study psychology. This can be used to construct interesting and germane examples to be employed in the Statistics course ensuring that the diversity of examples used in assignments and exercises reflects the diversity of the student body.

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Introduction

The demand for quantitative methods has been increasing steadily within the field of psychology, and it is commonly agreed that quantitative methods and statistics should be acknowledged as core requirements for a university degree in psychology (APA, 2013). The Department of Psychology has recognized this development and first year students are now required to complete two semesters of Fundamental Statistics and later use their knowledge about statistics directly in the course on Cognitive Psychology in their third semester. We know that some students find quantitative methods very challenging but it also seems that some students simply lack the motivation to learn these skills (cf. Student interviews, 2013), perhaps because they do not see this as a fundamental part of becoming a (clinical) psychologist, which is the aim of a majority of our students.

The public face of psychology is often represented by the therapist and on the surface, this occupation could not seem more removed from statistics. However, counter to what some students may think, intensive training in methodology, design, and statistics is actually especially important in clinical psychology given the range of questions that are addressed and the situations in which clinical researchers function (Kazdin in Aiken, West, Sechrest, & Reno, 1990). Even if students argue that they will not work as researchers, adequate statistical knowledge is central for becoming a good clinical psychologist; From the development of new therapeutic techniques to evaluating the effectiveness of the techniques upon implementation, statistical analyses provide the means by which conclusions can be drawn (Tessler, 2013). While *intrinsic motivation* for studying a subject may be the academic ideal (Biggs & Tang, 2011), not very many students actually approach statistics being intrinsically motivated. Rather, our typical student seems to be *extrinsically motivated* by the fact that he or she will have to pass the exam by the end of the second semester (cf. Student interviews, 2013).

Project aims

This project aims to investigate what motivates students for studying psychology and what they consider to be important methodological skills to be acquired in order to become a “real” psychologist. Moreover, we want to examine if students’ motivation for learning statistics can be increased by letting them work on data they have collected themself. In the Statistics course (first and second semesters) students primarily work on textbook data, whereas it has recently been implemented that students collect, analyse and present their own data in the course on Cognitive Psychology (third semester). In that sense, the use of statistics in Cognitive Psychology is an example of active, collaborative learning (Prince, 2004), which may help facilitate a deeper approach to learning and eventually higher quality outcomes and a more satisfying learning experience for the students (Ramsden, 2003). In contrast, the emphasis on textbook data and examples which the students may not readily relate to in the course on Statistics could lead to surface learning approaches and higher student dissatisfaction.

Method

We conducted an online survey for psychology students enrolled in Statistics (first semester students) and Cognitive Psychology (third semester students). Students were to answer the survey twice, at the beginning of the semester (T0) and at the end of the semester (T1). 191 students in Statistics and 157 students in Cognitive Psychology answered the survey at the beginning of the semester. At the end of the semester, 105 students in Statistics and 72 students in Cognitive Psychology answered the survey. The sample of students answering the survey at both time points comprised 77 students in Statistics and 59 students in Cognitive Psychology.

The online survey covered 18 questions (see Absalon for a printed version) divided into four categories:

- Why do you study psychology? (6 questions)
- What tools/methods are import for a psychologist? (5 questions)
- How do you feel about statistics? (5 questions)
- Do you consider psychology to be a natural science? (2 questions)

Questions were answered on a 5 point Likert-scale (“strongly disagree”=1, “disagree”=2, “neutral”=3, “agree”=4, and “strongly agree”=5). Further, it was possible to answer “Don’t know”.

Results

Each survey item was analysed separately by conducting ANCOVAs with T1 (end of semester) as dependent variable, Group (Statistics vs. Cognitive psychology) as between subject variable, and T0 (start of semester) as covariate.

Results showed that students in Cognitive Psychology reported a significantly higher score on **”Statistics is an important tool”**, $F(1,129)=6.81$, $p<0.05$ (see Figure 1a), and on **”Will use my knowledge of stats during my education”**, $F(1,122)=4.37$, $p<0.05$ (see Figure 1b), than students in Statistics by the end of the semester. This suggests that the teaching of cognitive psychology in which students work on their own data enhances the students appreciation of statistics as a tool. This finding was further supported by students in Cognitive Psychology reporting a significantly (marginal) lower score on **”Statistics does not interest me”**, $F(1,131)=3.89$, $p=0.05$ (see Figure 1c), than students in Statistics by the end of semester.

In sum, these results show that students in Cognitive Psychology find quantitative methods more useful than their fellow first semester students in Statistics at the end of the semester. This is further supported by students in Cognitive Psychology reporting a significantly higher score on **”Psychological processes can be measured”**, $F(1,131)=15.31$, $p<0.001$, (see Figure 1d) than students in Statistics after the semester ended.

Data collected at semester start was furthermore analysed by conducting factor analyses to study underlying factors/student types in Statistics and Cognitive Psychology, respectively. The analysis revealed three underlying factors/student types in Statistics: students that are already very familiar with statistics, students that find statistics important to learn, and students that do not find statistics important to learn (see Figure 2a). A similar factor analysis for students in Cognitive Psychology revealed just two underlying factors/student types: students who find statistics important and students who do not find statistics important (see Figure 2b). Both analyses suggest some degree of diversity among students in both Statistics and Cognitive Psychology as to what they consider important to learn to become a psychologist and in their attitude toward statistics.

Discussion and perspectives

Our results indicate that students’ motivation for learning statistics increase when they get to work on their own data in Cognitive Psychology. We speculate that this may be because it allows students to see an immediate application of the methods in contrast to the more abstract application introduced in the Statistics course. According to Biggs and Tang (2011) intrinsic interest can be sparked by making a subject personally relevant and important. Hence, we suggest implementing more exercises based on “self-collected” data in the Statistics course as well. One way to achieve this would be letting students analyse data from the parallel courses in Social Psychology and Personality Psychology (currently in progress).

Furthermore, the results of the factor analyses have also provided us with valuable information on the diversity of what motivates our students to study psychology. This can be used to construct interesting and germane examples to be employed in the Statistics course ensuring that the diversity of examples used in assignments and exercises reflects the diversity of the student body. Specifically, the data suggest the more examples/cases from clinical psychology and studies relying on interviews, therapeutic conversations and observation of people should be used to intrinsically motivate the students who do not find statistics particularly interesting or important.

In sum, our results point to the necessity of introducing new initiatives related to the use of statistics in psychology to motivate students more. As part of this work, we suggest implementing a standard survey of attitudes toward statistics (e.g., the SATS survey; Schau et al., 1995) both at the beginning and at the end of the Statistics course in order to track changes instigated by alterations to the curriculum, examples or exercises and to provide students with data on their own attitudes toward statistics.

Aiken, L. S., et al. (1990). Graduate training in statistics, methodology, and measurement in psychology: A survey of PhD programs in North America. *American Psychologist*, *45*(6), 721.

APA, American Psychological Association. (2013). *APA guidelines for the undergraduate psychology major: Version 2.0.*

Biggs, J., & Tang, C. (2011). *Teaching for quality learning at university*. McGraw-Hill International.

Prince, M. (2004). Does active learning work? A review of the research. Journal of engineering education, 93(3), 223-231.

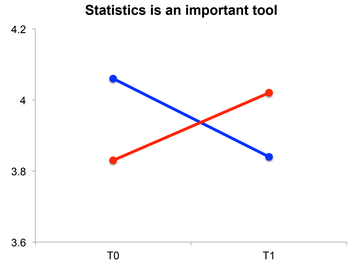
Ramsden, P. (2003). *Learning to teach in higher education* (2nd ed.). Routledge.

Schau, C., et al. (1995). The development and validation of the Survey of Attitudes Toward Statistics. *Educational and Psychological Measurement, 55,* 868-875.

Student interviews (Fall 2013). Four one hours interviews (two in Statistics, two in Cognitive Psychology). Transcripts on Absalon.

Tessler, J. (2013). *On the importance of learning statistics for psychology students*. Association for Psychological Science, Undergraduate Update.

1a



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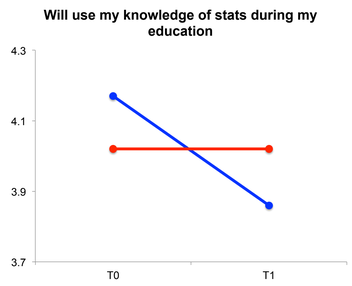

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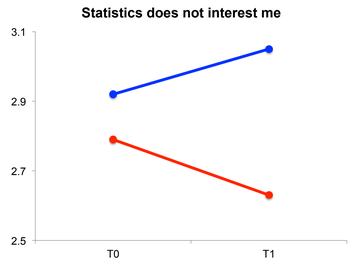

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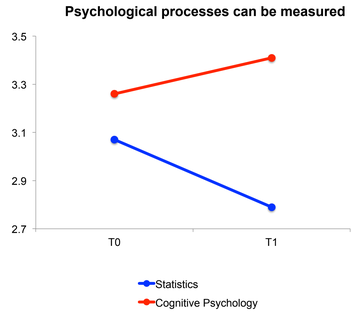
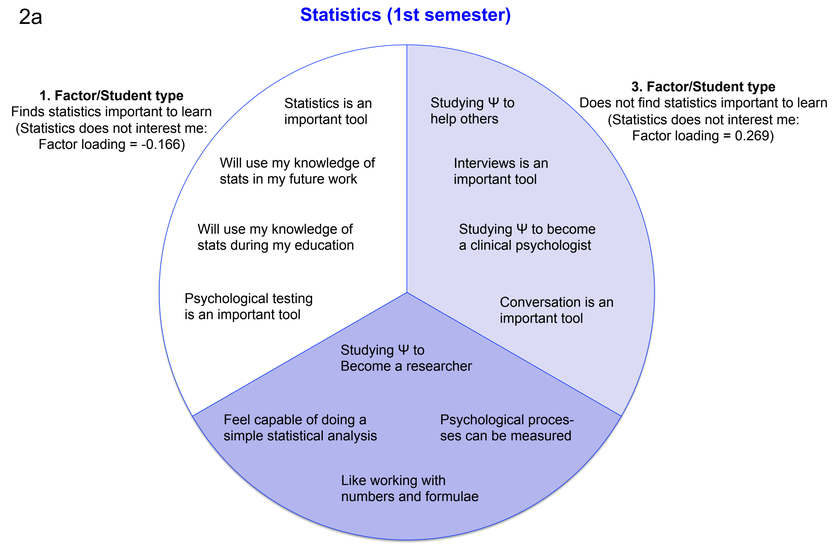


Figure 1: Results of selected survey items

Data from survey items in which we found a significant difference between Statistics and Cognitive Psychology at T1 (end of semester) using T0 (start of semester) as a covariate.

2a



2b

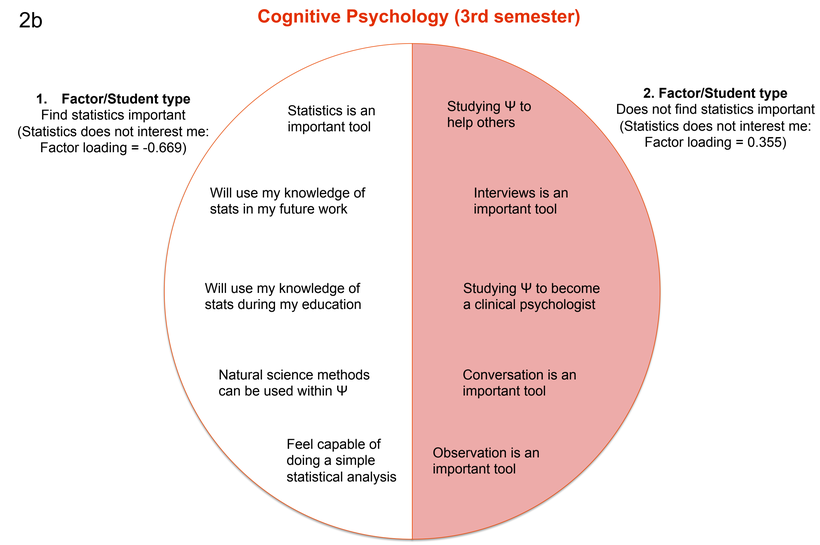


Figure 2: Results of factor analyses on data collected at semester start (T0)

Pie charts show the underlying factors/student types (three in the first semester Statistics course and two in the third semester Cognitive Psychology course) and the survey items correlating most with each factor (Note Ψ = psychology).