The relationship between learning approaches and students' achievements in an introductory statistics course in Finland

Kimmo Vehkalahti
University of Helsinki, Finland – kimmo.vehkalahti@helsinki.fi

Abstract

The aim of the study was to investigate the relationship between learning approaches and students’ achievements in an introductory course of statistics at the University of Helsinki, Finland. These topics have been studied extensively, but surprisingly there is not much published research related specifically to the statistics education, although statistics is needed and taught everywhere, especially as a minor subject. The current research was based on ASSIST measurement instrument and its condensed version that has been recently suggested for multinational studies in statistics education. This was the first study of the learning approaches in the history of this course. At this stage, the data were analysed by descriptive statistics and exploratory factor analysis that revealed a clear three-factor structure of the learning approaches. Preliminary results concerning the relationship between the learning approaches and students’ achievements were found by correlations between different scales and variables. This research is a part of a larger multinational study on learning approaches in statistics. It includes students from Italy, Australia, Argentina, Turkey, and Vietnam.

Keywords: learning approaches in statistics; ASSIST; students’ achievements; multinational study.

1. Introduction

The research related to students’ learning approaches has a long history (Entwistle & McCune, 2004). However, up to recent years, there have been almost no studies on learning approaches with a special focus on statistics (Chiesi et al., 2013), although it is obvious that statistics and statistical literacy are widely needed and taught everywhere in the world (e.g. Gal, 2003).

One of the most applied instruments for measuring the dimensions of learning approaches is called ASSIST: The Approaches and Study Skills Inventory for Students (Tait, Entwistle & McCune, 1998). In this study, we use a condensed version of ASSIST that has been suggested for multinational studies in statistics education by Chiesi et al. (2014). The psychometric properties of this version of ASSIST have been studied by Chiesi et al. (in process), based on comparisons of samples from five countries. In the current study, we apply this shortened ASSIST to a sample of university students in Finland and study the relationship between the students’ learning approaches and achievements in an introductory course of statistics organized by the Faculty of Social Sciences at the University of Helsinki.

A central construct both in ASSIST and all the other well known learning related inventories or questionnaires is Marton and Säljö’s (1976) original distinction between surface and deep approaches (Lonka, Olkinuora & Mäkinen, 2004, 303). The surface approach refers to memorizing without understanding, with a serious lack of personal engagement in the learning process, arising from an intention of getting forward with minimum trouble, whereas the deep approach is seen as an intention to maximize understanding, with a true commitment to learning, arising from a strong need to engage in the actual content of the task (Lonka et al, 2004, 302; Biggs, 2003, 14–17).
A third approach, called the *strategic approach*, differs from the previous ones, as it refers to the ways students organize their studying (Tait et al., 1998). Students adopting a strategic approach may apply any strategy that maximizes their chances of achieving the highest possible grades (Watkins, 2000, 163).

2. **Method**

2.1 **Measurement**

The ASSIST (Tait et al., 1998) consists of three sections: A, B, and C, where A (six items) measures conceptions of learning and C (eight items) measures preferences for different types of course and teaching. The central and most used section B measures the Deep, Surface, and Strategic learning approaches. The original version includes 52 items, but the condensed version (Chiesi et al., 2014) leaves out 20 and thus consists of 32 items. All items are measured with a five-point Likert scale (1 = disagree, 5 = agree). They are used to form eight subscales of four items each: Deep has three subscales called Seeking Meaning, Relating Ideas, and Use of Evidence; Surface has also three: Lack of Purpose, Unrelated Memorising, and Syllabus-boundness; Strategic has two subscales: Organized Studying and Time Management. In addition to ASSIST, students' attitudes towards statistics were measured by 10 brief statements.

The section B of the original ASSIST has been translated into Finnish in another study, using a certificated translator (Erkkilä, 2009, 102–103), and only a few fine-tunings of the wordings were done for the current study. The sections A and C as well as the ten attitude statements were translated into Finnish by the author with the help of a pedagogical expert.

2.2 **Procedure**

The data were collected in three phases during an introductory course of statistics at the University of Helsinki during the Fall term of 2014. The course consists of two parts. Part 1 focuses on statistical literacy, descriptive statistics and graphics, while Part 2 includes the basics of probability, statistical inference, hypothesis testing and linear regression.

Phase 0 was completed on the first lecture of the course using a two-page paper. The first page served as a cover letter describing the background, motivation, and the aims of the study, which were also verbally explained by the teacher. The second page included the actual questionnaire consisting only of the short sections A and C of ASSIST and the attitude statements as well as demographic and other background questions. The students were also asked for their student ID and a permission to use it for combining the data sets of the different phases and their grades of the course.

The idea of the three-phase data collection was to maximize the response rate while minimizing the work load of the data entry. Therefore, the Phase 0 questionnaire was made very short and easy to answer in a few minutes in the end of the lecture. In the cover letter it was stated that filling the subsequent questionnaires carefully would give two extra points in Part 1 and three extra points in Part 2.

Phase 1 was completed in the end of Part 1 using an e-form that included the section B of ASSIST with the attitude statements and background questions. Finally, Phase 2 was completed in the end of Part 2 using an e-form that included all the sections A, B, and C of ASSIST with the attitude statements and background questions.
2.3 Participants
The course is compulsory for almost all students of the Faculty of Social Sciences, but there are also students from other faculties of the university. During the last years, the number of students in Part 1 has steadily increased from about 300 up to 600. Part 2 is not compulsory for all students of the Faculty, so the number of students is a bit smaller, typically about 250. The course under study was the first one under the new name Introduction to Social Statistics, which better reflects the contents and focus of the course since a complete renovation that took place some years earlier (Vehkalahti, 2014). As a result of the name change, the number of students from other faculties decreased, increasing the proportion of Social Science students from ca. 65% to 80%.

The students participated in the study on a voluntary basis. The cover letter informed that participating would be related to the topics of the course and it was hence strongly recommended.

2.4 Data
The combined data set from Phases 0, 1, and 2 enables different research settings. The present study is based on the Phase 2 data. The students’ achievements were measured by their points in the exam of Part 2 and the number of exam failures. The maximum score in an exam (one in the end of Part 2, at most four after the course) was 33 points. The minimum score for passing was 12 points. (These include the three extra points obtained from participating in the study.)

The final Phase 2 data set consisted of 183 students (67% female, mean age of 25.6 years, SD = 7.7). Due to life-long learning, the age distribution was skewed, as the median age was 22. The proportion of Social Science students in Part 2 was 77.6% (69% female, mean age of 25.2 years, SD = 7.4). The other participants came from the Faculty of Science (14.2%) or other faculties, such as Agriculture, Behavioural Sciences, and Arts (less than 3% each). Therefore, these data best represent the conceptions of the students of Social Sciences.

2.5 Software
The data were analysed and visualized using Survo R (Sund, Vehkalahti & Mustonen, 2012), the newest generation of Survo (Mustonen, 1992), implemented as an R package.

3. Results
The number of missing values was extremely small, because the instruction was to fill the questionnaires carefully in order to obtain the extra points. The few missing values in the Phase 2 data occurred completely at random, and they were imputed primarily using the data sets from Phase 0 or Phase 1. Only five missing values remained and they were replaced simply by values of 3 (the middle value of the scales).

3.1 Learning approaches
Following the theory of three learning approaches and earlier results by Chiesi et al (2014), a three-factor model was estimated using a maximum-likelihood factor analysis, conducted with the eight subscales. A clear and simple structure was obtained using the Oblimin rotation, but as the correlations of the factors were fairly low (largest one -0.38 between the Deep and Surface factors, others about 0.10), a similar result was obtained also using the orthogonal Varimax rotation (see Table 1).

An interesting finding was that the three-factor structure could be obtained also with the 32 items. They loaded clearly on their expected factors, thus supporting the condensed version of ASSIST.
3.2 Achievements

The combined distribution of the points in the exams of Part 2 is shown in Figure 1. The points represent the best achievement so far. There have been three exams after the course, and two more will be organized during the summer of 2015, before the next course starts in September.

![Figure 1: Distribution of the points in exams of Part 2.](image)

The correlation between the points and the Strategic approach was 0.20, but it was uncorrelated with the Deep and Surface approaches. The points also correlated with a general positive attitude towards statistics (0.34) as well as with a confidence to statistical (0.39) and mathematical (0.36) skills. Attitudes (like value and interest in statistics) were positively related to Deep approach and negatively to Surface approach. The points and the exam failures correlated negatively (-0.77).
4. Conclusions
Based on the factor analysis and the correlations between various scales and variables of the data, it seems that the condensed version of ASSIST works well with the Finnish sample of Social Science students, and that the results are both promising and in line with earlier findings. Structural equation models will be used for further analysis of the data.

Acknowledgements
The author is grateful for PhD Liisa Myyry, the senior lecturer in university pedagogy at the Faculty of Social Sciences at University of Helsinki, for her useful comments and suggestions, especially with the Finnish translations of the ASSIST items. The author also wants to thank the lovely speakers of the Special Topic Session STS030 in the 59th WSC of ISI in Hong Kong, for their open-mindedness for my humble suggestion of adding a "northern dimension" to their multinational research project. Thank you! It is fantastic to be a part of the group!

References


