A longitudinal study of the development of attitudes and beliefs towards Physics

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Overview

Student success in a Physics degree has been shown to depend on more than just performance in course assessment; important additional factors include student attitudes and beliefs about their subject. We have used an instrument (CLASS) [1] that measures how student epistemologies evolve over the course of their undergraduate degrees.

Our previous work has sampled a cross-section of students across the Physics undergraduate programme at Edinburgh in a given academic year, and found that student attitudes and beliefs remain essentially static. Here, we present fully longitudinal data collected over the past three years, where we track the evolution of attitudes and beliefs of one group of students. We find broadly similar results: attitudes and beliefs remain surprisingly consistent over time. This suggests that a 'cross-sectional' or 'pseudo-longitudinal' study (collecting snapshot data in one year) is a valid methodology, rather than necessarily having to wait several years to accumulate fully longitudinal data.

Educational Context

The Scottish degree system usually requires four years of undergraduate study for a Bachelors degree with an optional fifth year available to some students, resulting in an Integrated Masters degree.

Neither of the first two years of the undergraduate degree count towards the final degree classification, with students typically studying two thirds physics and mathematics and the final third a free choice elective. This results in first year classes being made up of approximately 50% majors and 50% non majors (although the nature of this study means that all data reported here is for physics majors only).

Typical first year class sizes in Physics at Edinburgh are 200-300 students (typically half of which are non-majors), while the average graduating class has around 70 students.

Methodology

The CLASS survey [1] was used to survey students on entry to the undergraduate degree programme at the beginning of the 2008-09 academic year. The students were surveyed before any teaching had taken place. The same cohort of students have been surveyed at the end of their sophomore year and again at the end of junior year.

Only students who have filled in all three surveys are represented here (N=35). It is not possible for non-majors to enrol in the 3rd year physics classes; as a result only physics majors are represented in this study.

We have previous presented data collected using a 'cross-sectional' or 'pseudo-longitudinal' method, where all data is collected in the same academic year and inter year comparisons are drawn [2]. The fully longitudinal data has been compared to that collected through the cross-sectional method to establish any differences between the two methods.

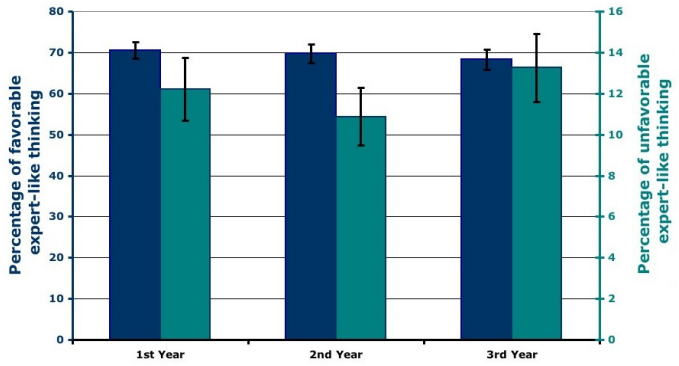

Figure 1 Favorable (left hand axis) and unfavorable (right hand axis) CLASS scores for the first three years of an undergraduate degree. N=35, error bars represent the standard error.

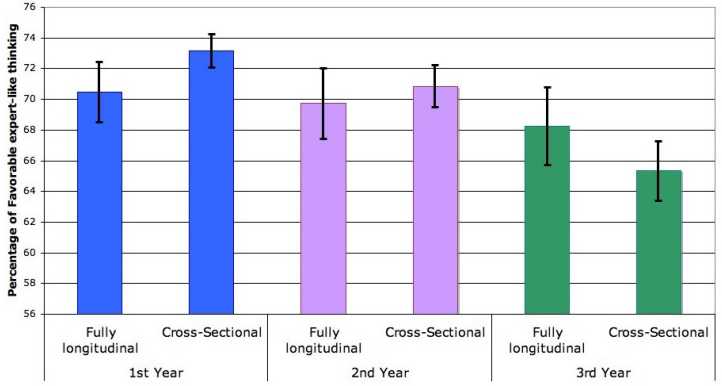

Figure 2 Comparison of data collected using fully longitudinal and cross-sectional methods. N=35 for fully longitudinal data. Cross-sectional data N=127, N=105 and N=61 respectively.

Results

Figure 1 shows the overall favorable and unfavorable CLASS scores as collected over three years (note that the unfavorable scores are plotted against a second axis). The overall scores are remarkably constant with statistical tests (ANOVA) showing no differences in the scores between first, second and third year.

In Figure 2, two methods of carrying out a longitudinal study are compared. The fully-longitudinal data (as shown in Figure 1) is compared to previously collected cross-sectional data, for the first three years of the undergraduate degree.

The sample sizes are larger for the cross-sectional study due to the fact no data needs to be discarded as the data is not matched to track the progress of individual students.

No statistical differences are found between data collected by either method for the first three years of the degree programme.

Conclusions

We have collected CLASS survey data for the same group of undergraduate physics majors for three of the four years of a Bachelors degree.

We find relatively unchanged levels of expert-like thinking for the first three years of the degree program, consistent with other work in this area [3].

In addition, the data collected through a fully longitudinal method of data collection appears to support that collected through a cross-sectional method, suggesting that the cross-sectional methodology is valid.

In Spring 2012 the final data collection of our fully longitudinal study will take place, coinciding with the graduation of the majority of the students in this study. Analysis will be carried out of the final grades of the students and their intended career destinations to look for correlations with levels of expert-like thinking.

References

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