

INNOVATIONS IN STATISTICAL TRAINING: REFLECTIONS FROM THE UK Q-STEP INITIATIVE

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In a response to growing concern over the poor levels of statistical literacy among UK Social Science graduates, 'Q-Step' is a national initiative involving 16 Universities in the UK. The programme has funded experimentation and evaluation of a wide range of curriculum and pedagogic innovations all designed to improve the quality of quantitative training received on social science degree programmes. Five years on this paper reflects on the progress of one of these Q-Step Centres at the University of Manchester, highlighting the things that worked and focusing in particular on an initiative to incorporate work-based learning of statistics through paid summer internships. We draw out some of the lessons for both what we teach on the statistics curriculum and how we teach it.

BACKGROUND

The quantitative skills gap in UK universities' Social Sciences curricula is well documented (MacInnes, 2009), as is research councils' and teaching bodies' responses to this (British Academy, 2012). One outcome for the need for 'STEM skills in the social sciences', as described by a former higher education minister David Willetts, has been a national initiative named 'Q-Step', with 'Q' standing for 'Quantitative' and 'Step' for 'Step-change' in teaching quantitative methods to undergraduate social science and humanities students. The Q-Step programme is experimental and is currently in the process of being formally evaluated. Others have written about the pedagogic approaches underlying this and allied programmes, with a focus on the standard university undergraduate degree of 3 or 4 years in the UK (Nind et al., 2015). The end game is to have more quantitatively trained social science graduates enter the labour market in a world of increasing quantities of social data, and the need for the skills and training to research and analyse these.

This paper seeks to capture the learnings based on the experiences since 2013 of one of the Q-Step Centres, hosted at the University of Manchester. Half a decade after Q-Step began has seen the Q-Step team experimenting with teaching statistics to over 2,000 students on some five new course units across multiple degrees, and place over 200 of those in the workplace to practise these taught skills. In this paper we outline the approach we have taken and share the findings through three perspectives; the Q-Step lecturers, the students and the host work organisations in which the students are placed. An Action Learning Approach (Schon, 1987) provides the framework for the Manchester experiences, with 'learning by doing' underpinning our philosophy to develop ourselves as practitioners. Our students' knowledge and experience of applied statistics and data analysis is also being captured through survey tools, self-reflective pieces and interviews.

TEACHING STATISTICS AND DATA ANALYSIS TO SOCIAL SCIENCE UNDERGRADUATES

Following the six principles of GAISE for colleges (Carver et al., 2016) and over two decades-worth of experience of teaching statistics to social scientists at university level (Carter & Nicholson, 2016; Buckley et al., 2015) our pedagogic approach to teaching statistics to non-statisticians can be best described as 'doing statistics' (Hanson et al., 2014). After Hanson, we follow the steps of 'formulate questions, collect data, analyze data, and interpret results based on how statistics is taught at school level, whilst extending that to sit within the broader framework of the GAISE College guidelines. The four steps are appropriated for an undergraduate curriculum at a research university as follows:

- Formulate question becomes: Develop research question and hypothesis/es
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- Collect data becomes: Understand data collection and find secondary data to analyse

- Analyze data becomes: Analyze data using statistical software
- Interpret results becomes: Interpret results and reflect on these for future research

To this end we have introduced, as part of the Q-Step Centre, study units across the undergraduate curriculum based on these four steps. Students come to study not statistics but politics, or sociology, criminology or linguistics. Hence our teaching of statistics and data analysis is embedded in their substantive curriculum. For example, all first year politics and international relations students now study a compulsory course entitled Making Sense of Politics, whilst our second year sociology students study The Survey Method in Social Research and the criminologists Data Analysis for Criminologists. Each course will incorporate classroom-based teaching (in a lecture theatre) alongside practical experience in a lab. All teaching uses secondary data, such as large government surveys including the England and Wales Crime Survey, The British Social Attitudes Survey and British Electoral Study. As such our students are trained in how to undertake secondary data analysis, using a research question close to their study interests, and using software that can provide them with valuable skills in the workplace and for their final year undergraduate dissertation.

Approaching teaching in this way enables us to make the learning of statistics matter, substantively, and to break away from teaching the software independently of the research question. We do not claim to have completely solved the challenge of getting the number-phobic student to love statistics, but we do find their confidence grows as they build week by week on the practical skills as well as their theoretical understanding.

STUDENTS IN THE WORKPLACE

A second strand to the approach we take is through experiential learning, with a particular focus on learning by doing and the emotions of learning (Beard and Wilson, 2013). Each year since 2013 we have developed work-placed opportunities for students deemed eligible to apply. Eligibility is determined at two levels; first the student must be on a recognised Q-Step social science degree, and second they must have taken pre-requisite taught module in the first and/or second year. Students apply for and, if successfully shortlisted, are interviewed for an 8-week long, paid internship in a public, private or voluntary sector organisation. The host organisation must provide mentoring and support, a data-led, real-world, research based project and be in a position to host and help develop a student in the summer between the end of their second year and start of their final year. To date we have placed nearly 200 students in some sixty organisations across the UK, and more recently also overseas. The interns are paid for the duration of their work placement.

The organisations that we work with include national and local government departments, media organisations, data and research consultancies, think tanks, voluntary and charity organisations, research and planning teams in universities and polling companies. Some of our students have graduated and proceeded to work in their internship organisation. Others have gone on to undertake postgraduate study in social and quantitative research, and yet others have become alumni of the internship programme and are now supervising new cohorts of Q-Step interns.

All of our students are invited to a celebration event in the autumn, where they have the opportunity to showcase their work whilst on placement, in the form of a poster. These are made available on our Q-Step website under a section named 'student stories'. In recent years we have also awarded prizes, based on a panel of eminent external judges, to reward the most successful students for their research (criteria are clearly articulated and made available in advance).

Data analysis undertaken by the students ranges widely, from descriptive statistics and exploratory analysis through to sophisticated statistical modelling in government departments. Outputs whilst on the internship include blog posts, contributions to reports, and creation of slide decks, data-driven news articles, visualisations for external clients and in some cases academic papers. Some students have had the opportunity to contribute to high profile external reports too.

REFLECTIONS

Here we reflect on the innovations described, from three perspectives. Naturally these are indicative only and the subject of on-going research. References to work already published are included where this further illustrates our findings.

Instructors

The experiences and reflections of our Q-Step team, comprising lecturers in sociology, criminology, politics and international relations, English Language and Linguistics, and social statistics have not been published although the authors of this paper have presented widely and published in Statistical Education journals and books. Our collective reflections cohere around three main areas.

First, teaching applied statistics (the term we use for ‘doing statistics’) has a better chance of success if students are critically engaged with the substantive area of research. Second, we have all observed our students take giant leaps forward when they are given support and a real-world project that motivates them, both in the classroom and the workplace. We would contend that the experience in the workplace helps consolidate their classroom learning. And third, this is still a challenging space to occupy. Teaching quantitative research methods is hard, but it is a rewarding experience too. Following our students’ successes once they master how to undertake quantitative analysis is a gratifying experience. Our response to those who just ‘don’t get it’ is to further reflect on our curriculum and pedagogic approaches.

Finally, keeping in touch with our Q-Step alumni is opening our eyes, as educators, to the perceived value of statistical skills in the workplace. We have on-going research in better understanding the employers’ needs, which we hope to publish soon.

Students

Our students’ can be divided into two groups. The first have exposure to applied statistics teaching. The second advance this learning with practical application in the workplace through the paid internship programme described in this paper. To date we have not had opportunity to consider an experimental approach to evaluating our student groups, either by comparing those who do a placement with those who do not, or by testing the statistical understanding of students on social science degrees that are not taught statistics compared with the Q-Step cohort. That is to say, we have not established a control group against which we could test a hypothesis about the extent to which learning statistics in the Q-Step centre compares to learning it outside of the programme. This is an area we would like to undertake more research on. It is complicated by the nature of the embedding of statistics instruction across the curriculum, and delivery through multiple degrees and pathways. The experiences of the Cardiff Q-Step Centre (Williams et al., 2015) report a quasi-experiment, which we may try to emulate in future research, although their work proved inconclusive.

Nonetheless we have begun to publish on the student experience. This is based largely on student reflections, collected through a research project (at the end of the first cohort of those students who undertook an internship) (Carter, Brown and Simpson, 2016). Since 2014 we have collected reflective pieces from the students, which we are in the process of analysing. Other work is focussing on students’ attitudes to learning statistics before and after embedding this in the curriculum, and for a subset who do the work placements to develop reflections at the beginning, middle and end. We expect this to provide a rich resource of qualitative data for our next stage of research.

By way of illustrating the pipeline-to-research effect of the Q-Step programme, a student just this week shared the following. She is undertaking a Master’s in Social Research Methods and Statistics (SRMS), approaching the stage at which she is developing her research dissertation.

“Whilst I really enjoy my Master’s degree, it is very heavily focused on statistics rather than research. Had I started this degree without doing my Q-Step internship, I would have probably decided that it was way too difficult (having dropped maths at 16). However, my Q-Step internship encompassed ‘Social Statistics’ in every sense of the word. It was Applied Statistics. The numbers had meaning, because they were substantive. I could understand the social world around me. So Q-Step helped me by training me to look beyond the numbers, and not to feel overwhelmed by them.”

Host organisations

More work remains to be done here, and we have opened up a very rich seam for further research. We do have films and testimonials from our host organisations, which we use in our promotional material and to incentivise students to consider undertaking a paid internship. Nonetheless we wish to understand better the value of our training, classroom and work-placed, to our host organisations as potential future employees of our graduates. A proxy measure for success is the proportion who come back to us year on year, requesting further interns. It is becoming clear that our students are an asset to these organisations, and a mechanism for bringing in much-needed statistical capacity. Our challenge now is to develop a business model that shares the costs of this between the university and the business world

CONCLUSION

The University of Manchester Q-Step Centre is positioning us to undertake valuable research in statistical training for non-statisticians. Our work over the past five years is assisting us to further develop the *practice of statistics*, and the value of *experiential learning*. We hope to continue to develop this model, including with overseas partners who are faced with the challenge of teaching statistical literacy for 21st century research and careers.

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