

## OVERCOMING CHALLENGES WITH SERVICE COURSES IN STATISTICS

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*Eight years have now passed since ICOTS8, when a novice educator shared her experience about teaching service courses in Statistics. Looking back, at the various challenges and opportunities raised within a decade of various changes which have affected the Statistics education, what is certain is that the educator ought to take responsibility towards statistical literacy. In this paper, by reflecting on our personal experience and the information conveyed by student data we aim to address some of the notable challenges and the undeniable benefits of a research-based education. Looking forward, we consider ways, including educational technologies, with which educators can facilitate the development of an inclusive learning community where specialist and particularly non-specialist students engage with Statistics and actively learn through dialogue and critical enquiry.*

### INTRODUCTION

Research in Statistics education in the last three decades has shed ample light on perceptions of both educators and students about quality of teaching and bespoke educational challenges in higher education. Degree programs on the whole and more specifically Probability and Statistics courses for specialist and non-specialist students have been reviewed and adjusted accordingly. Efforts on improving teaching have been made and learning has been affected respectively. In the process developments at national and international level have subsequently brought a new era of education reform aiming to improve the quality and diversity of educational opportunities. Research-based education and developments in digital education aspire to contribute further to fruitful pedagogical change and foster learner-centred experiences. Stepping back to reflect on academic teaching practice and listening carefully to students' voice for the last ten years we aim to see how educators and non-Statistics students' perceptions have evolved and core needs have changed.

### EDUCATORS' PERCEPTIONS

Three of the main areas that educators focus upon: (1) teaching and learning of Statistics as a discipline; (2) statistical literacy and communicating statistics; and (3) Statistics as a profession in the UK and other countries (Tishkovskaya, S. & Lancaster, G. A., 2017). Commonly accepted that Statistics is a multifaceted discipline, with clearly strong roots in Mathematics, Statistics is very important in its application in a wide range of fields. It is, therefore, fundamentally important to promote competent teaching of Statistics to all disciplines where problem definition, data collection, analysis and interpretation skills are essential to strengthen subject-specific knowledge (V. Isham, president of Royal Statistical Society, 2011-12).

The challenges raised are numerous and various scholars have spoken about these. Among others, increase in student numbers with subsequent lack of space, insufficient training of instructors, communication between departments and competition for student time but also the students' own not always positive feelings against the discipline are few of the issues that should not be ignored if to deliver successful service teaching (Allen, R. et al, 2010; Rassias, M. J., 2010).

To overcome the challenges, Garfield et al. (2008) encourage collaborative research amongst colleagues and students on the success of statistics courses in the classroom. According to A. Lefstein and J. Snell dialogic pedagogy is a term used by a growing number of scholars, practitioners and policy-makers to describe learning processes in which teacher and students critically interrogate the topic of study, express and listen to multiple voices and points of view and create respectful and equitable classroom relations. For us dialogic teaching and pedagogy as expressed via fruitful interaction with the students and our colleagues constitutes one of our top priorities. On one hand, the students via effective dialogue can gain important information about

the status of their learning process. On the other hand, the educators obtain information about their teaching practice and adjust it accordingly in order to achieve the intended learning outcomes.

### STUDENTS' PERCEPTIONS

Naturally the demographic and background information of students can differentiate their perception about quality of higher education. In fact, according to findings, factors such as the status of students for scholarship, extracurricular activities, parents' education, age, and university they study in have a significant influence on students' perception about quality of higher education (Akareem & Hossain, 2016). However, there are some norms that have proven important throughout the years. Arnon and Reichel (2007) with their study demonstrated that students perceive personal qualities and professional knowledge to be the most significant qualities needed to be an ideal teacher. The personal qualities include general personal qualities, kindness, leadership, and attitude toward profession; and professional qualities include knowledge of the subject matter and didactic knowledge.

Looking back at some of the comments we received from students studying towards an undergraduate degree in Psychology (University of Glasgow, 2009) we may retrieve information on what students believed to *make a difference to their learning process*.

- It makes a difference when a professor obviously cares that you understand & that you are interested.
- ...(lecturer's) personality and lecture style made the lectures much more interesting and easier to understand
- ... thoroughly cover topic so very easy to get a good understanding
- I enjoy stats when I understand it and when the lecturer is enthusiastic
- Enjoy least: lack of motivation
- Enjoy most: (i) learning about potential "traps" and misconceptions; (ii) breakthrough in thinking; (iii) the efficiency of problem solving and (iv) when I feel confident with a topic & can answer problems on it easily
- Some of the examples used were especially interesting. The lecturer was very engaging.
- I found these lectures are most engaging, as lots of questions were asked to us, which means you can't fall asleep & have actually to pay attention. I found revision of other subjects within the lectures very useful, as it linked topics together
- I liked the way you engaged with the students and didn't treat us like we were stupid.
- I do not enjoy stats in general but I really appreciated your way of interacting and making sure people would understand ☺

During the years 2010-2018 our practice has been informed further by being involved with an introductory course in Statistics for students from various disciplines (mainly Life Sciences, Medical Sciences, Chemistry, Arts and Sciences) in University College London. The module for some students is compulsory while others may select it as optional. Students are coming from very diverse backgrounds. Looking at the feedback we have obtained throughout these years, it is striking the unprompted repetition of specific key-words in the returned student comments.

In fact, some of the key-words which in our opinion corroborate what students traditionally perceive as competent and effective teaching practice are the following:

*For the lecturer/teaching:* accessible, approachable, attentive to students' needs, caring, committed, dedicated, enthusiastic about the discipline, friendly, helpful, inspires you to try harder, keen/willing to assist, patient, provide clear and thorough explanations, understanding, welcoming.

*For the course:* comfortable classroom environment, engaging, enjoyable, well-communicated expectations, well- designed / structured, opportunities for in-class and out of the class interaction

*Testimonials on what non-specialist students look for in an introductory course in Statistics:*

- the lecturer made the course a joy and much easier for me being someone that is not naturally talented at Mathematics; looked forward to lectures
- constantly trying to get the class involved in discussions by asking questions which were not too difficult yet not too easy
- appreciate teaching style: clear, thorough and interactive; available resources facilitate understanding of the content

- would recommend the course to anyone who is doing a science degree and not only as it gives the grounds of statistical analysis and the skills to apply it, which is of immense importance to any experimental work

## DISCUSSION

### *Characteristics for competent teaching practise in service courses in Statistics:*

- Be inclusive and make students feel engaged in class as this feeling will contribute to their engagement with the module outside of the classroom.
- Make the lectures interesting and interactive – for this use of educational technology (whenever available and if considered appropriate) proves to be extremely helpful (e.g. multiple-choice quizzes via online quiz platforms, Abourashchi et al., 2018).
- Competent delivery of the lecture – facilitate learning.
- The students ought to be challenged but also must be welcomed to challenge the instructor
- The lecturers' enthusiasm for the subject, helps drive home course material
- Clear description of the different theories – often in service courses instructors tend to think that students would not be interested for the underlying concepts or that these would be potentially confusing. We should not underestimate the potential of non-Statistics students. These are the future ambassadors of Statistics and they should be educated accordingly; for this balance between the theory and practice is important.

### *What to avoid...* (quoting what students have stated)

- Some lecturers could work on the delivery of their lecture. Many read from slides, don't interact with students and have a single tone. The subject itself may be boring but there are ways of making it more interesting.
- ...teaching level puts a strain on a useful course which otherwise has strong potential

### *Barriers and motivators for student engagement*

A motivating, class participative environment is not always easy to achieve. In fact, one of the barriers can be the level of expertise of the educators and furthermore their own professional goals and personal interests. Some academics are more teaching oriented than others and this is not stated here to demonise the different types of aspirations. On the contrary, under a research-based educational framework in higher education we strongly believe that the ideal type of a university educator is the one who is a successful researcher with a passion to communicate knowledge.

Based on evidence, as obtained by students' feedback in the years 2014-18, it is apparent that prompting interaction in class (1: "Not at all"; 5: "Very", Figure 1) is important and can subsequently have an impact to students' perceptions about the overall module assessment (1: "Very poor"; 5: "Very good", Figure 2) and Statistics in general. According to the data, the level of interaction is dependent on the level of expertise of the educators and on whether they are teaching or research oriented.

For our study we consider the professional title of an individual as an indicator of teaching or research orientation (e.g. a teaching fellow in the UK would be considered a teaching oriented educator, while a research fellow would be considered research oriented; note that in the UK system both have the opportunity to be involved with research and teaching respectively).

## CONCLUSION

Looking back to our experience, prompting interaction in class fosters student engagement which can be vital for their academic development. Furthermore, a motivating, class participative environment can constitute the basis for the development of honest communication among students and educators within and outside the classroom and therefore enhance the quality of modules and research-based education. Educational technologies (online platforms, forums etc.) can facilitate communication further.

Looking forward we would therefore suggest to policy-makers, departments and universities to: (a) pay even more attention to service courses in Statistics as it has been indicated by scholarly evidence; (b) look more thoroughly in the assignment of teaching responsibilities; (c) invest in educational technologies; (d) provide support and opportunities for further development to educators at all levels and (e) promote effective and efficient dialogue between educators and students for quality assurance of modules and degree programmes.

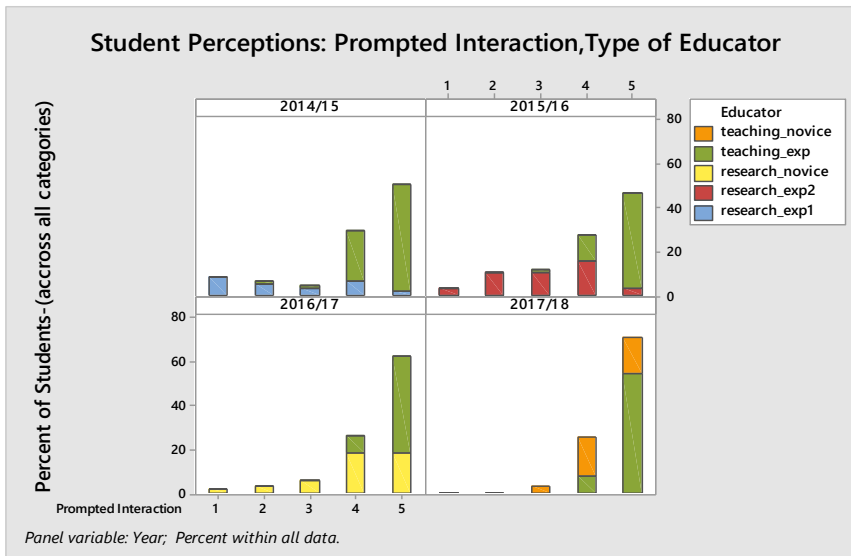


Figure 1: Student perceptions about level of interaction for an introductory module in Statistics for different groups of non-specialist students

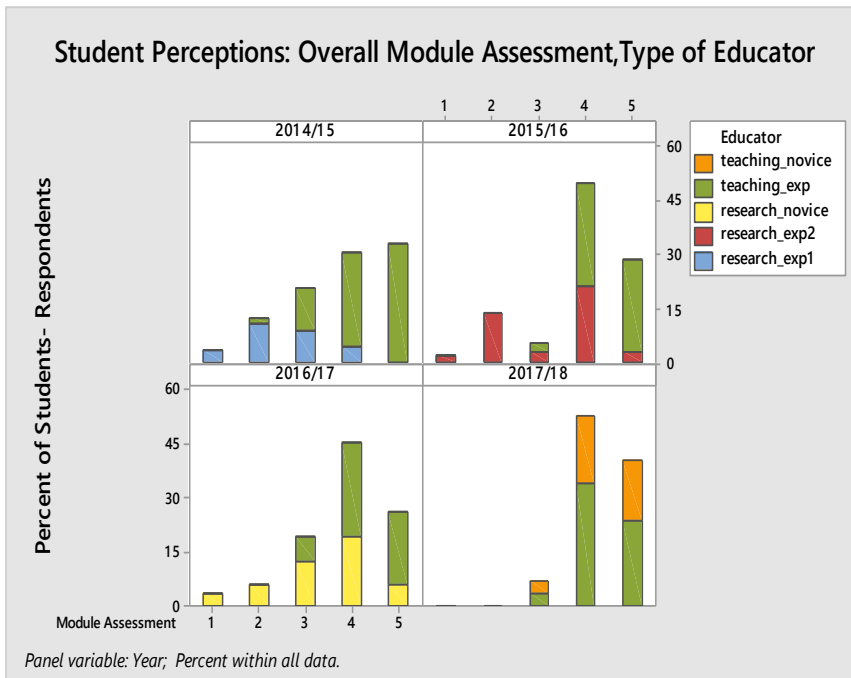


Figure 2: Student perceptions about overall assessment for an introductory module in Statistics for different groups of non-specialist students

Note: 1. teaching oriented educators (teaching\_novice: involved with the module for the first time; teaching\_exp: involved with the module for more than three years)  
 2. research oriented individuals (research\_novice: member of staff involved with teaching for the first time in the UK; research\_exp1/2: two different academics with years of research experience in Statistical Science and former experience in teaching modules in the UK)

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