
Teaching Subject Teaching in Higher Education - A Case for Statistics

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Both the Institute for Learning and Teaching in Higher Education (ILTHE) and the Learning and Teaching Support Networks (LTSNs) are committed to discipline-based educational training for academic staff. However, many Higher Education (HE) staff development and induction programmes only cover *generic* aspects of teaching. A few do include a guest presentation or two from subject experts, but, in general, we have found relatively little input concerned with the particular issues and problems that face teachers of specific subjects and topics in HE. Yet there are many compelling reasons for much greater input of subject-based material in *all* programmes for teachers of HE subjects. For example such input:

- helps to build bridges between the generic teaching and the perceived needs and subject problems of new staff;
- can deal specifically with the relevant characteristics of the subject and its students;
- acknowledges that for many subjects there is a large body of research and evidence associated with their teaching;
- builds support for the development of Continuing Professional Development (CPD) in the subject teaching across the university.

In mathematics, statistics and OR (MSOR), until relatively recently, there was little evidence of *subject-specific* input to induction programmes. The one-day induction course for new teachers of mathematics in UKHE, held annually in September at the University of Birmingham and run by the LTSN Maths, Stats & OR Network, is one of the first of its kind. It has been received with much acclaim, and has become firmly established within the UK HE mathematics community.

Discipline Based Induction and CPD

Elsewhere, in those HE induction programmes where a discipline is introduced, it is often done by practical work in personal teaching and/or by the observation of others teaching the subject. We do not believe that the bridge between generic- and discipline-based work is well made by such practice. It is, in effect, left to the individual to see and make the links and there is no necessary linking to the scholarship that exists in the education of that subject.

One barrier to introducing more discipline-based study is the way staff development units are structured and funded within, for example, universities. The units' expertise is invariably in *generic* education, and, although subject specialist staff are sometimes seconded into such units, effectively they become additional generic staff. The funding of the units is based on the assumption of generic delivery and it is seen as too expensive to provide developed discipline-based induction and CPD courses covering all the many subjects taught.

Also there are barriers that relate to the loud message from subject departments, however supportive in principle, that what *really* matters is research publication. Since generic coverage must reasonably precede discipline-based coverage the discipline will often appear as an optional extra.

In the light of these considerations we believe that a strong case can be made for the inclusion of discipline-based content in induction and CPD courses, and for this to be embedded in the requirements and standards currently being developed.

We present the following pervasive arguments in relation to statistics, but they can be equally applied to other subjects in HE.

1 *Tradition in School Teaching*

All schoolteachers who have BEd or PGCE qualifications will have *had* to study both generic- and discipline-based education. If studying both, and in particular the subject-based material, is appropriate for schoolteachers then it must surely be needed for HE teachers, where teaching and learning is predominantly discipline-based.

2 *Discipline-Based Research and Knowledge*

The Royal Statistical Society (RSS) Centre for Statistical Education (CSE) has been developing subject-based aspects of statistics teaching since 1995, building on the work of the former CSE, which was established in 1983. Since 2001, using funding from HEFCE, it has built on this experience to create HE Teaching Statistics material (see *Teaching Statistics Teaching* below). Other areas, such as mathematics education, have a major body of research-based knowledge going back far longer and, indeed, in most disciplines there are research and practitioner journals for teachers of the subjects. We believe that this body of teaching knowledge should be brought into induction and staff development courses, and it needs to be delivered using the expertise of relevant subject specialists.

3 *Discipline Characteristics*

The teaching of each discipline has its own distinctive characteristics. The following four are cited in relation to statistics, but could apply to other subjects as well.

- a) *Statistics*, as it currently exists, could not be taught without reliance on sophisticated software, which gives distinctive characteristics to the nature of the teaching.
- b) The teaching methods used within disciplines differ in their nature and balance. For example, within *statistics* there is a need for a broad portfolio of activity-based teaching methods, ranging from individual case studies to community projects.
- c) The nature of the concepts required within disciplines differs between them. In *statistics* these can range from the entirely philosophical to the deeply mathematical. This variation, and the varying balance for different courses, must be reflected in the teaching methods and styles used.
- d) A consequence of observing sharp differences in what, and how, material is taught, is that approaches to, and balances within, assessment vary between disciplines. In *statistics*, it may involve anything from testing simple calculation skills all the way through to the ability to carry out complex surveys, perform statistical modelling,

draw inferences and come to important evidence-based decisions.

Many of the above characteristics result in different requirements from the specialist skills and expertise of the teachers for the different disciplines

4 *Student Characteristics*

Some disciplines are taught to a fairly homogeneous student group. Others have to make allowances for very heterogeneous types of students. In *statistics*, for example, the subject has to be taught to students of mathematics, social science, science and business and, sometimes, even a mixture of all these in the same class. The approaches to the teaching and the problems faced by the teacher are quite distinct between these situations.

5 *Lecturers' Perceptions*

Teachers in HE usually see themselves as *subject* specialists, who also have to teach - subject expertise is regarded as paramount. Thus, purely generic induction and CPD courses can be seen as alien to their interests, or as just not relevant! In *statistics* we have much anecdotal evidence from visiting HE departments of mathematics and talking to many statistics colleagues, that generic induction courses do not satisfy their subject-specific needs. To overcome this hurdle the bridge between generic teaching ideas and the practice of subject teaching needs to be clear and firm.

We have received wide support from mathematics and statistics colleagues for our plan to introduce statistics teaching material into induction and CPD courses in HE. As we have already pointed out, there are several problems that have to be solved before such courses can be introduced on a wide scale. To overcome these, there needs to be pressure at both national and local level, and from within the statistics community. In the next section we describe distance-learning material on teaching statistics in HE that we have developed for use in the induction of new staff and in CPD.

Teaching Statistics Teaching

In many UK HE mathematics/statistics departments there may be one or two new lectures in mathematics and/or statistics appointed every few years. Similarly, other departments that might award, for example, science-, economics- or engineering-type degrees, may have their own new and/or established teachers of statistics who may, or may not be subject specialists in that field. Nevertheless, all these teachers of statistics need to think very deeply about *how* to teach the subject. The material we describe in this article is designed for such teachers and, we hope, will help to build the bridge

between generic induction courses for new staff and add to a portfolio of CPD. We hope it will help to solve some of the problems faced by new, and established staff that need to teach statistics.

The statistics team of the LTSN Maths, Stats & OR Network has been considering these issues for the last two years and have developed an approach, which we offer as a pilot case study. In 2001 the team started delivering regional one-day workshops on teaching, learning and assessing statistics in HE, for new staff as induction, and for experienced staff as CPD. See, for example, the Nov 2001 issue of *MSOR Connections* at <http://ltsn.mathstore.ac.uk/newsletter/nov2001/pdf/staffdevprojet.pdf>. From these workshops the team developed a set of distance-learning materials on the teaching of statistics in HE. The material comprises six sections.

I. An Overview of Statistics in HE

This section helps a new teacher to view statistics in the national and, where appropriate, international context, and to become aware of the variety of support mechanisms that exist.

II. Learning Statistics

This section develops those elements of learning theory that have an immediate impact on the teaching of statistics, and contains many illustrations.

III. Teaching Statistics – General

This section studies a broad range of issues faced by the statistics teacher.

IV. Teaching Statistics – Specific

This section opens up the opportunity for teachers to look at their own selection of topics that they do, or may teach, and examines the contexts in which the teaching can occur.

V. Feedback and Assessment in Statistics

This section provides a study of specific methods appropriate to the formation and assessment of students' understanding and skills in statistics.

VI. Computer Supported Statistics Teaching

This section is web-based and explores both the use of statistical software and of the Internet in the teaching of statistics. This includes issues on the teaching of the many uses of the computer in statistics and also the use of the computer as a teaching tool.

Sections I - V are provided in hard-copy format and section VI is Internet-based. The sections are supported by resource packs of illustrative material, a Reader and a web site, written in the virtual learning environment

Blackboard. This web site allows for group email, conferencing etc., and enables new staff at different universities to feel less isolated, by being part of a national cohort.

The material is seen as having several uses. It may be used just as background material for support of individual study. It may be used as a single optional unit within a PGCert or Diploma in Learning and Teaching. With this in mind the material has a built-in assignment and can carry approximately 20 M-level credits. It is up to the university whether it would provide tutorial support and/or assessment, but both can be provided externally if needed.

Another use is through taking it as an external *Certificate in Teaching Statistics in HE*. At the time of writing, the RSS was obtaining independent professional advice, on behalf of its Professional Affairs Committee (PAC), about the material. The PAC will consider this advice with a view to accrediting the Certificate. It may also be promoted as part of the Society's professional development programme. Discussions are underway for the Certificate to also lead to Associate Membership of the ILTHE. The Certificate route provides the opportunity for the material to be used as CPD as well, and might be particularly useful for part-time and temporary staff who are looking to improve their CVs.

The material is currently in its final stage of development and will be piloted this academic year at a number of universities. Vic Barnett (vic.barnett@ntu.ac.uk) is course leader and would be pleased to talk to departments and/or colleagues interested in taking part in the pilot. Other information can be found on the current activities part of the RSSCSE website at <http://science.ntu.ac.uk/rsscse/activities/distanceLearning.htm>

Conclusions

In this article we have presented a case for material in *Teaching Statistics in HE* to be adopted within the UK either as an accredited Certificate in its own right, or as an integral part of courses for new staff induction and for CPD.

We also have argued that, more generally, such courses in other disciplines could help with the enhancement and development of subject-specific teaching and learning, especially for new staff induction and for CPD for experienced staff.

We would be very happy to discuss in detail our approach to the development of the materials with colleagues in other LTSN Subject Centres.