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Statistical advising as an element of teaching statistics in a university medical faculty

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Teaching statistics in a University medical faculty can involve many different activities and many different groups of students. Medical students may be taught statistics as part of a curriculum strand covering evidence-based medicine. Other students may undertake specialist training in the concepts and methods most frequently used in their field. However, many students on medicine- and health-related programmes may receive only a brief, general "introduction to statistics" course. While nowadays this may be supplemented by (or indeed consist entirely of) online learning materials and signposting to further resources, students could also benefit from one-to-one statistical advice when they undertake project work.

This talk will discuss the provision of statistical advising to support the learning and development of students. As well as receiving specialist input into their individual projects, students' learning may be reinforced or extended, and students may begin to consider how to effectively interact with a statistician. Statisticians may benefit from communication skills practice, prompts for self-learning and potential collaboration opportunities. Challenges may include how the provision of advice can be resourced, the risk of statisticians being regarded as service providers rather than educators and research collaborators, and a lack of training in advising skills for statisticians.

Transition to interactive online resources to enhance student learning of statistics - experience from the University of Plymouth.

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The number of students entering BMBS Medicine at Plymouth has recently increased. Limited extra resource and updated 'Outcomes for Graduates' presented the need to re-evaluate our teaching of statistics to undergraduate medical students.
The majority of statistics for medical students at Plymouth is embedded into Evidence Based Practice (EBP). Until recently, this programme was delivered via plenary lectures followed by small group contact sessions. However, plenary lectures were unable to identify students struggling with statistics and small group sessions are less feasible.
The new EBP programme incorporates a combination of approaches:

- More material online - interactive lessons and quizzes for students to complete before attending contact sessions
- Statistics 'clinics' - targeted to students unable to successfully complete quizzes
- Development of bite-sized 'vidcasts' as an additional resource
- Development of simulation programme to illustrate statistical concepts
- Large group contact sessions - applying understanding through group tasks and critical appraisal of evidence
- Revision plenaries – exam preparation and interactive quizzes

Our new programme is now in its second year. In this session, I'll describe and reflect on our experience so far, with particular emphasis on the e-lessons, simulation programme, and vidcasts.

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Teaching Statistical Significance: Time to look forward

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Having become the cornerstone of research, Null Hypothesis Significance Testing (NHST) underpins decision making. Because of misunderstanding and misuse the validity of inferences based on NHST are questionable. Consequently, in 2015 editors of a psychology journal took the radical decision to ban NHST, and ASA subsequently released a statement on its use and interpretation. Despite widespread discussion, little changed and journals continue to promote inference based on statistical significance. It is important that changes in practice continue to be advocated. This presentation will consider potential approaches including through education and the classroom. NHST is embedded in undergraduate courses and whilst some suggest it should not be taught, no magical alternative exists. It is suggested NHST is still taught, yet good practice encouraged. P-values provide useful information whilst NHST has practical applications in sample size calculations. Providing philosophical perspectives to research, and overviews of Fisher's and Neyman-Pearson's theories, permits the contrast of statistical with practical significance.

Using the Flipped Classroom to Teach Statistics (SPSS) Software Skills To Postgraduate Dental Students

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Traditionally, students attend classes or lectures and thereafter they synthesise, analyse and evaluate any content in order to understand it. In the flipped classroom, students engage with learning materials before the class and use classroom time to practice and apply concepts, often led or facilitated by the teacher (see, e.g.: www.heacademy.ac.uk/knowledge-hub/flipped-learning-0). More succinctly, flipped learning is defined in Flip your Classroom: Reach Every Student in Every Class Every Day by Bergmann & Sams (2012) as "that which is done in the class is now done at home, and that which as homework is now completed in class." In this presentation, I will describe how flipped learning has been implemented via Powerpoint slides and videos to teach statistics software skills (SPSS) in practical 2-hour computer workshop sessions as part of a larger Research Methods module for postgraduate dental students at Cardiff University. Student feedback indicates that these practical sessions have been well-received by the students, and online module resource monitoring show that students engage with the video content before (and after) class, as well as before their final SPSS exam. Finally, flipped learning has many advantages potentially for teaching statistics, although there are some pitfalls also.

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Teaching Statistics to a Rare Breed of Medical Students

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UCL Great Ormond Street Institute of Child Health host an undergraduate intercalated programme for 20 medical students, wishing to take a break from their medical studies to broaden their horizon into research, paediatrics and child health. These aren't your typical medical students; they have opted to learn about statistics through a module titled 'Heath Research Methods' and carry out their own quantitative research project. Student feedback from this module in previous years has suggested a traditional lecture format is not engaging these self-motivated, independent learners as well as it could. In response, we transformed the module putting student-centred learning at its core. YouTube videos on topics such as research design, descriptive statistics, statistical inference and regression are sent out a week in advance of each session, with a short quiz to check their understanding. Weekly sessions are then spent discussing how these topics relate to their research projects, SPSS activities and group presentations. Preliminary feedback has been excellent, generating free text comments such as "I loved the recorded lecture format and found I got so much out of each and every session". Details of the module, feedback, and lessons learnt from this flipped-lecture approach will be presented in this talk.

Running research studies with medical students as participants – experience from the UEA.

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To bring research to life for three years of medical students we have run live "cohort" studies with students as participants. We aimed to give MBBS students experience of taking part in research and insight into data collection and analysis from the inside. Our cohort study aimed to assess the relationship between fluid intake and ability to concentrate (a vital skill for medical students and doctors!). This presentation will cover: the UEA MBBS medical research curriculum and where the student studies fitted in; the design of the studies; practical issues in their implementation; the results; student feedback and lessons we have learned.

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An R-based learning environment to teach statistics

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The R software is a free, open-source, powerful tool for statistical programming and graphics. The R environment is now increasingly used for reproducible research that seamlessly integrates data management, data analyses and report generation. We extended the flexibility of the R environment and adopted it for classroom teaching to deliver an R software-based statistics course. The environment includes both static and dynamic hypertext markup language (HTML) as well as produces course materials in portable document format (PDF) or e-book (EPUB) outputs. The searchable course material is clearly marked with sections and sub-sections for easy browsing. The in-built LaTeX contributes to the high-quality typesetting including presentation of complex mathematical formulae clearly hyperlinked with the text. The course content presents the narrative of statistical principles and theories intertwined with the R codes for implementation in the R software; thus students are encouraged to participate actively in the learning process. The course extensively uses both static and dynamic graphics to motivate and engage students. The course is also integrated with an interactive interface to learn complex statistical principles. The environment can also incorporate other objects, for example, audio and video, multiple choice questions and web links. Integrating with a wide range of teaching tools, this approach created a simple and effective learning environment to support, enhance and reinforce the learning experience in mathematics and statistics. Using a template of this environment, the talk will demonstrate many of these features.

Demonstration of an interactive simulation app for understanding diagnostic test accuracy.

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The majority of statistics teaching for medical students in Plymouth is embedded in the Evidence Based Practice programme. The course contains a large statistical element, which many students feel is neither native to their education nor to what they initially believe is necessary for a career in Medicine. We identified a need for additional online learning resources and have developed a series of 'vidcasts' that are supplementary to the course material. These have also motivated an opportunity to build a simulation app that vividly illustrates concepts hitherto difficult to demonstrate. Understanding diagnostic test accuracy statistics are essential for clinical decision making and evidence based practice yet many students struggle to achieve an intuitive understanding of them. Commonly reported sensitivity and specificity do not always easily translate into probability of disease, which is usually of primary interest. Our interactive app, developed using R Shiny, allows students to create and visualise different scenarios. For example, prevalence of disease may be varied and the results visualised and tabulated to show sensitivity, specificity, and predictive values.
In this session, I'll discuss and demonstrate our app. Delegates will also be invited to use the app themselves and provide valued feedback.

Interactive R-shiny applications demonstrating normal distribution, hypothesis testing and statistical power calculation

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The normal distribution is ubiquitous; it is the most common continuous probability distribution that students in a Medical Statistics course would encounter. A proper understanding of different aspects of the normal distribution as well as mapping these concepts to different application areas and its interpretation is essential. Using shiny-based tools in the R software environment, we created three simple, interactive and user-friendly applications to capture properties of the normal distribution, concepts of hypothesis testing and features of the statistical power calculation. The first application creates the probability density function and cumulative distribution function and presents the cumulative probability for lower, upper or both tails and the corresponding quantiles interactively based on values provided by the user. The second application extends the concept to one sample known variance hypothesis testing using the z-test. The application relates to the hypothesis testing in the context of type 1 error, one or two-tailed test and quantiles. The third application visually captures the statistical power and sample size calculation in a one-sample one-tailed setting. The application reinforces the concepts of statistical power and sample size calculation in relation to mean difference, variance, type 1 and type 2 errors. The interactive, user-friendly and graphical features of these applications allow the users to comprehend and learn complex statistical concepts with active participation, hence complementing with the theoretical underpinnings of these concepts. These applications can also be easily configured and extended to other statistical distributions. The talk will capture the use of these applications in a classroom scenario.

Professional development and recognition for medical statisticians – initial results of a Royal Statistical Society (RSS) survey

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Delegates to 'Burwalls 2017' in Nottingham raised several issues in a useful session encouraging awareness and planning for professional and career development by medical statisticians. Many felt obstructed or confused about their career paths. This and other issues relating to professional recognition were subsequently discussed by the Medical Section committee of the Royal Statistical Society (RSS), the professional organisation for statisticians and those who work with data. The RSS commissioned the Section to develop a survey to ascertain the extent and nature of such obstacles to professional satisfaction. The survey was run in early-2019: members of the RSS with interests in medicine were invited to respond. Later any other loosely defined 'medical statisticians' working in public institutions could complete the survey via the free sharing of a link to the questionnaire via professional and informal networks. Results from the 335 respondents are currently being analysed. Most were based in UK (87%), 74% were working in academia, and 15% in the NHS. Median working experience was 10 years. In my talk I will report some initial results, focussing on access to conference attendance, obstacles to career development and the advice of respondents to their peers in 'finding a way through'.

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Taking medical statistics to schools – The King, the cream and the RCT

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The king is suffering from a nasty rash and wants to try a new wonder cream. But his pageboy is concerned. The cream is not yet proven to work and with 1,000 others in the Kingdom also suffering from the rash, the potential for harm is huge. If the king uses the cream, everyone else is likely to follow suit. What is to be done? Luckily the pageboy studied medical statistics at university…
Outreach is an important component of our work as educators. Early exposure to statistics may help children overcome their fears of mathematical subjects and encourage them to consider careers in the area. This session is a demonstration of an outreach activity that could be used with children in school years 5-8 (approx. ages 9-12) to help explain what a RCT is and the basic computations required for analysis of the results. I will need some volunteers to participate (and it could get competitive!). The "content" of the session is very light (you won't learn any stats!), but a fairly novel format will be used which hopefully you will find entertaining.

Professional Development for Statisticians: A Personal Experience of Teaching, Game Changers, and Endgames

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Professional development is essential and actively encouraged in academia. The development as a professional is a continuous one and involves the growth in skills, knowledge, and experiences. It may have many benefits, besides the obvious of being intellectually stimulating. It can enhance the student experience, benefit the wider community through the research process, advance careers and lead to promotion. However, the opportunities for professional development for statisticians can vary tremendously within, and between institutions. Those in teaching are often limited. In this presentation I will give a personal experience of the opportunities that have arisen through teaching; in particular game-changes that came about through involvement and enterprise in writing "Statistical Endgames", a weekly series for the *BMJ*. Such opportunities have depended on good fortune, unexpected opportunities, and moreover enterprise. Nonetheless, they have not been without challenges.