Designing a Postgraduate Training Week

Abstract: This work discusses my experience in organizing and running a Training Week on PhD level for Students in Statistics, which was recently implemented as a new cornerstone of postgraduate training at the Department of Mathematical Sciences. It will be focused on the question of how to involve and motivate students, and give feedback to students, without formally assessing them. A pyramidal group work system is proposed and discussed.

Z0508571

1 Background

In October 2006, right after having taken up my new job as Lecturer at the Department of Mathematical Sciences at Durham University, I was asked to organize a Postgraduate "Training Week" for the Durham and Newcastle based Statistics PhD Students in May 2007. This would be part of a series of courses to be held alternately at Durham and Newcastle University, with one course in each academic year at each university. In total, six of such courses were to be developed, and after three years the cycle would continue with the first course again. So, “my” course was supposed to be the first of this series of courses, and I had to set up this course from the scratch. It was also the first course of this type ever held at the Mathematics Department. The training weeks were introduced because there was a broad agreement in the Statistics group that whoever obtains a PhD in Statistics should also have a solid knowledge about the state of the art in all major modern statistical fields – as many of the PhD students are nowadays subject changers or overseas students, which are very heterogeneous in their prior knowledge, the traditional postgraduate seminar series which used to be (and still is) running at our Department could not fulfil this challenging task alone anymore.

The planning stage involved thinking about the lecture material itself, the means of presentation, the composition of lectures/practicals/tutorials, rooms, software used for practicals, among other aspects. Given the complexity of the venture, it was clear from the beginning that I would not be able to organize this course alone. I would take the lead in course organization and delivery, but would be supported by two colleagues who would care for the catering and help with supervision in computer practicals.

At least, one important point was determined: The topic of the course. This was supposed to be “nonparametric smoothing” (see Fig. 1 for an illustrative example of what “smoothing” means from a statistical point of view) and the course should lead the students close to the forefront of current research activity. This was nice, as the course topic intersected with my own field of research. I considered this also as a chance and opportunity offered to me by the department: my field of research was essentially untaught and rather unknown at the Mathematics Department at that time, and this course was a wonderful chance to get people in touch with this, to my opinion, very important and very beautiful field of statistical science. Hence, I approached the preparation with a large amount of enthusiasm. Certainly, the fact that the course entered new grounds not only from a technical and organizational, but also subject-related viewpoint, made the preparation not easier. Books in the library still had to

be ordered (it turned out that the available planning period from October to May was exactly enough to have the books on time....), and no other kind of subject-related material (e.g., related lecture notes from other courses) was available in any form.

In this essay, I will not elaborate on all of the aspects of setting up and running this course, but will do this only as far as the following central issue is concerned: I had been told right at the beginning that there should be no assessment; one did not want to give the PhD students the impression that we "exam" them. I find this right and understandable, in particular PhD students in her last study years would not have liked, or not even accepted, a formal assessment. However, this generated for me the question how to motivate students, involve students, and give feedback to students, without formally assessing them. This question was my leitmotif during the entire planning stage and had substantial impact on how I designed this course in the end.

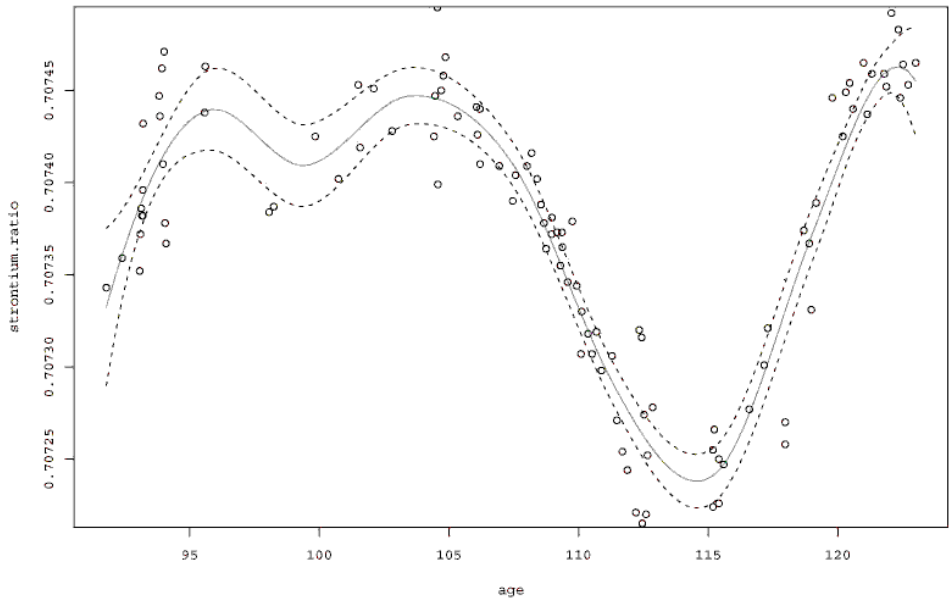

Fig. 1: Illustrative example for the course topic "Nonparametric Smoothing" – The plot shows the strontium content of fossils plotted against their age (circles), and a "smoothed" version of the data (solid curve) with confidence bands (dashed curves).

2. Assessment and Feedback

The are two main reasons why assessment is performed in Higher Education: (i) To get an objective evaluation of the student's acquired knowledge, which can be used for example to decide on passing or failing a module or to assign grades (ii) To have some material available which enables the teacher to create *feedback*, which will help the student to position himself w.r.t. certain learning goals and which can serve as an important source of motivation.

Clearly (i) is not a problem in my context, as the students were not supposed to be graded and the course was not to be "passed" or "failed". However the importance of assessment goal (ii), generally known as *formative assessment*, cannot be ignored, as feedback has shown to occupy a central role in the student learning processes (Sadler, 1998).

Can a good course function without formative assessment? Firstly, let us note that there are certainly further sources of motivation like e.g. the task or subject matter in itself, or higher personal goals related to the subject matter (e.g. , arriving at better personal decision rules using the acquisited techniques (Troffaes, 2006)), or not necessarily related to the subject matter (e.g., finding a good job afterwards), among many others (Archer, 1994). However, assessment, in particular when it is carried out formatively, has the advantage that it actively gives feedback to the students whether he/she is on the right way to achieve (personally or externally set) learning goals, and gives the student the opportunity to modify or correct his/her current way of learning if certain intermediate goals have not been met so far. External Feedback, in turn, influences the way how students feel about themselves, and what and how they learn (Dweck, 1999), and their subsequent internal regularization processes will influence the degree to which the individual students are able to develop self-assessment tools, i.e. internal sets of personal tools which enable them to monitor their progress without requiring external teacher feedback (Nicol & Macfarlane-Dick, 2007) — the development of these tools is, of course, particularly important for PhD students. Summarizing, there is no way of giving a course without feedback. In other words, if there is to be a course without assessment, then feedback has to enter in another form.

One way out would have been to generate some informal pseudo-examination, based on which I could have given feedback to the students. However, I was soon sure that this was not the route that I wanted to go; I wanted a course that is closed in itself and not artificially cut into two pieces by an artificial assessment procedure. The question that I was considering is rather: Why does feedback need to be based on assessment? Indeed, over the last decades there has been a shift in the educational literature in the way that feedback is considered. [Admittedly, I was not aware of this literature when designing the course, but let me allow to put it into this context for the purposes of this essay!] Formerly, feedback used to be seen entirely in the responsibility of teachers, and was considered as a simple transmission process. These views have been recently questioned (e.g, Sadler, 1998), and made space for a more flexible view in which feedback is generated in an interactive manner. Interestingly, the person providing such feedback is not restricted to being the actual teacher. Nicol & Macfarlane-Dick (2007) mention explicitly the possibility of generating feedback by peers or students. These views go along with a revised view of the student learning processes; learning is nowadays “conceptualized as a process whereby students actively construct their own knowledge and skills”, e.g. by transforming the subject content and “discussing it with others” (Nicol & Macfarlane-Dick, 2007). One important side-effect of these techniques is that student learning becomes more *self-regulated*. Actually, everybody receives external and generates internal feedback all the time during their daily life – it is an important skill to understand how to use this permanent feedback information effectively.

For a course on PhD level, several students will already have learnt how to self-regulate their learning and will have developed efficient self- assessment procedures. However, this could not be assumed to hold for all of them. As already mentioned, students participating in the course were expected to have a quite heterogeneous background. There were some who could be assumed to have a quite solid education in Statistics; others may be subject changers but still have some experience in research or problem-solving which should imply to a certain extent the acquisition of self-assessment skills, while others (in particularly, some overseas students) may have neither of them. A course design which suits them all would need to be, in today’s terminology, “student-centered” (Lea et al, 2003). I developed therefore a technique which I call “pyramidal group work”. I will explain this technique in the following section.

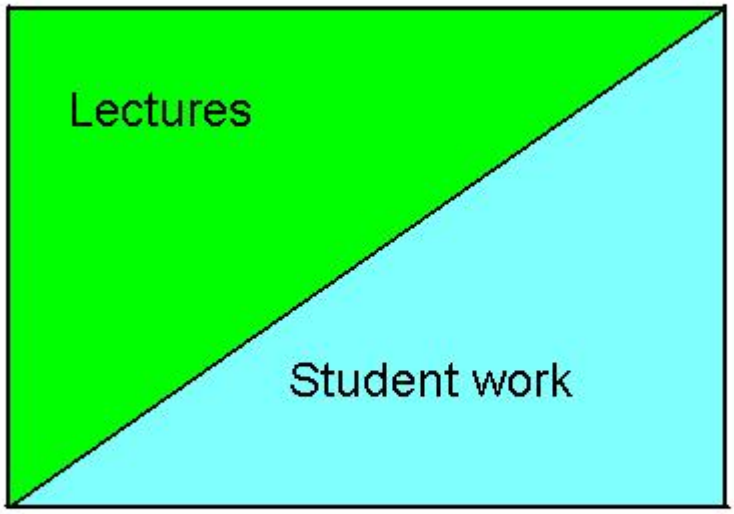

Fig. 2: Schematic illustration of proportion of lectures/ practicals during the Training Week. Left: Monday; right: Friday.

3 Pyramidal group work

First, some words on the general course design. Certainly, it never goes without lecturing... Given the nature of the material (lots of graphics needed), a computer presentation was the only reasonable way to deliver the material. I did not use powerpoint, as it is quite cumbersome to create mathematical formulas and expressions with powerpoint, but opted for LaTeX-generated PDF slides instead. During the week, the amount of lecturing was gradually reduced, and the amount of practical work increased, as illustrated schematically in Fig. 2. Note that this figure corresponds nicely to Fig. 8.1 in the "Handbook of Teaching and Learning in Higher Education" (Fry, Ketteridge, & Marshall, 2003), which represents the supervisor-supervisee relationship over time.

The practical work started on Tuesday, and was carried out nearly exclusively using a computer. Hence, I will use the terms "practical" and "computer lab" synonymously in this essay. Throughout, two members of staff were available during the practicals to help if there were questions. The "pyramidal group work" scheme started with the first practical, and proceeded in three stages:

Stage A:

The students worked independently (i.e., each student using one computer) on some relatively simple toy data examples, to get some familiarity with the software and the material. This stage comprised of roughly 2.5 hours.

Stage B:

Each two students formed a mini-group, which had to analyze two real-world data problems, which were different and more complex than those in Stage A, but related in methodology. To solve them, the students had to reflect together on their skills achieved during Stage A and apply them on the more challenging problem at hand. This stage comprised of roughly 3 hours.

Stage C:

Each two mini-groups joined now into groups of four. Within each group, each mini-group had to give a 5-minute presentation of their Stage B results to the new group members. The group had then to discuss the results together, and each mini-group had to justify their results, or give advice to the other mini-group how to arrive at them, depending on the agreement or discrepancy between the results in the two mini-groups. After this discussion the group should have arrived at a coherent and complete image about the collective results relating these two data sets. Secondly, the group had to decide for one of the two data sets, with which they would carry on with further analyses. Hence, while the link between Stage A and Stage B was the methodology, the link between Stage B and Stage C were the data. After having finalized their analysis of the chosen data set, each group had to prepare and give a 15-minute presentation on their results, which was attended by all course participants. The time span available for stage C was about 5 hours.

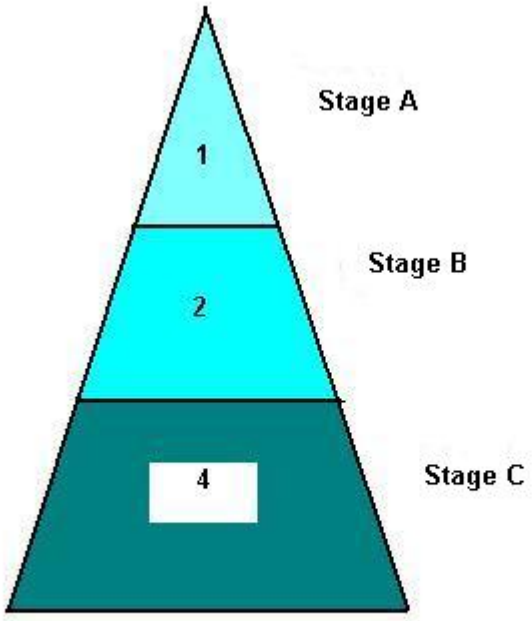

Fig. 3. Schematic diagram of "pyramidal group work". The numbers indicate the group sizes and the time axis originates in the top of the pyramid.

Then, why did this approach address the issues raised in the previous section, and in how far does it provide or substitute external feedback in any form? Well, firstly, and trivially, the supervisors gave feedback to students while answering questions or looking at the student results during the computer labs. Secondly, student group work automatically implies a certain amount of external feedback by peers, as the students discuss their work with each other. But thirdly, and importantly, it was the subsequent joining of groups which contributed the main effect. Every time when a group merged into a larger group, the two constituting components had to explain their previous results to their new partner, and the latter was then supposed to give feedback and provide help, if necessary. When the groups merged for the

second time, this effect was certainly more pronounced, as the results were now at a more elaborated stage. Furthermore, if you have to decide on "throwing half of your previous work away", you have to reflect and discuss carefully what you have achieved so far. Indeed, I realized that the individual groups took these internal discussions quite seriously. They analyzed the chosen data set and prepared the final presentations with much joy, enthusiasm, and dedication, what was reflected in a high quality and diversity of the presentations. The depth of their results (one group managed to confute some published research results on the same data) sincerely impressed me, given the relatively short time that the final groups of four worked together as a unit. All in all, it were mainly these presentations which reassured me that the chosen approach was successful in the end.

From a theoretical point of view, one might see a link to threshold concepts (e.g., Meyer and Land, 2003, Cousin, 2006) here. If some student or group had failed to get to the learning target in the past stage then their new partner group should give them sufficient feedback to "pass the threshold", which would imply here that there were two thresholds to pass. Though the latter is roughly true [The first threshold would correspond to mastery of the "smoothing" techniques themselves, and the second threshold to the ability of applying them adequately in the context of a new and complex real world problem], I guess that this conclusion would still be slightly idealized. In any case, a flavour of a "curriculum design perspective that aims for a research-minded approach to mastery in which there is always space for questioning the concept itself", which was identified by Cousin (2006) as one of five key characteristics of threshold concepts, is certainly there.

4 Conclusion

In summary, feedback was provided to students via

- teachers during practicals,
- peers in successive group discussions,
- teacher and peers after group presentations.

Self-assessment was encouraged through

- the necessity to explain the work done so far to others,
- the necessity to decide within a group,
- the group presentations themselves (if you have to present something, you have to reflect on it).

I got feedback on the student progress through

- observation and communication with groups during stages A, B, and C,
- the group presentations at the end.

I got feedback on the course design itself through

- the progress of the groups through all stages,
- the quality of the presentations,
- personal communication and student-emails (which were very positive).

I want to finish this essay with some considerations about aspects which are yet unclear to me (but will be relevant again as I will give the same course again in May 2010). Firstly, though the idea is that the stronger students will help and guide the weaker students within the groups, there is the risk that some individuals fall behind within a group. This danger is particularly high when the groups do not divide the presentation among them but choose one

representative to give the entire presentation. Further, I was left wondering whether I was too liberal with the composition of the groups. I let students do their choices essentially on their own which resulted in three types of groups in the end: Newcastle students, Durham students, and groups consisting of Arabs from both universities. The latter groups gave rise to another problem when it came to the group presentations on Friday afternoon which coincided with their prayer time (however, all Arab students participated at the presentation session in the end). There are several other aspects to think about, also how to strengthen the momentarily rather vague link to the threshold concept, but generally I am convinced that the concept of "pyramidal group work" is worthwhile; and should be considered whenever students have to be involved without formally assessing them. This holds not only, but in particular, for courses on PhD level.

References

Archer, J. (1994). Achievement goals as a measure of motivation in university students, *Contemporary Educational Psychology **19** (4),* 430—448.

Cousin, G. (2006). An introduction to threshold concepts. *Planet **17***, 4—5.

Dweck, C. (1999). *Self-theories: their role in motivation, personality, and development.* Psychology Press, Philadelphia.

Frey, H., Ketteridge, S. and Marshall, S. (2003). *A Handbook of Teaching & Learning in Higher Education.* RoutledgeFalmer, London / New York.

Lea, S.J., Stephenson, D. & Troy, J. (2003). Higher education students' attitudes to student-centred learning: beyond education 'bulimina'. *Studies in Higher Education **28** (3),* 321—334.

Meyer, J.H.F. and Land, R. (2003). Threshold concepts and troublesome knowledge (I): Linkages to ways of thinking and practising within the disciplines. In Rust, C. (ed) *Improving student learning –ten years on.* OCSLD, Oxford.

Nicol, D.J. and Macfarlane-Dick, D. (2006). Formative assessment and sellf-regulated learning: a model seven principles of good feedback practice. *Studies in Higher Education **31** (2*), 199—218.

Sadler, D.R. (1998). Formative assessment: Revisiting the territory*. Assessment in Education **54***, 60-79.

Troffaes, M.C.M. (2006). Teaching as Student Creativity. Unpublished Manuscript, Department of Mathematical Sciences, Durham University.