Module 3 DESIGNING A CURRICULUM

We assume that, as suggested in the guidelines for Module 1, the first module assigned to you is an advanced course with a small audience of say 5 -- 20 students (an MSc or year-4 MMath course) and that the second is aimed at a larger audience of say at least 50 students (a year 2, or popular year 3 module). For a new lecturer with little previous teaching experience, such an allocation of initial lecturing duties would offer a sensible graduation from a more intimate teaching experience to a more formal one. (Of course, this order could be reversed for a participant with the appropriate previous experience.)

In this module’s title, Designing a Curriculum, the word ‘curriculum’ suggests the content and structure of a whole degree programme. It is certainly important for a new lecturer to have an overview of the curricula of the taught programmes in the Department, to think critically about them, and to explore in broad terms what a mathematics degree is trying to do and how it is structured. However, it is also important for her to focus on the syllabuses of the modules she is currently teaching and on how they fit into the broader scheme of things. In what follows we will concentrate on ‘designing a module’, and this will be particularly appropriate if the first module you teach is a new research-driven module of the kind described above.

Module Activities

Here are your Designing a Curriculum activities for the modules you have been assigned to teach:

1. If the module is new, decide on its content and structure in consultation with your module mentor, taking into account how it fits in with other parts of the mathematics degree programmes.

2. Before the module is taught, prepare a detailed syllabus including
   - A broad outline with headings for the main topics
   - A rationale for the treatment chosen
   - Details of each topic with an estimate of how many lectures will be devoted to it
   - A summary of assumed knowledge and skills justified by the content of prerequisite courses and, if relevant, the Mathematics A-Level.

   If the module has been taught before, the existing syllabus may be adopted or modified; any significant changes should be approved by the Department’s Teaching Committee in case they have implications for other parts of the degree course.

3. Prepare a student handout for the first lecture describing the aims, objectives, and assessment regime for the module.

4. Soon after the teaching of the module is over, write a short report on how it lived up to the expectations of you and your students, reflecting on any lessons to be learnt, especially on the time taken to cover the material in the syllabus. This should be combined with the more detailed post mortem written immediately after marking the module’s final exam.

5. Over the years we become set in our ways; new members of staff, many from other traditions, should be encouraged to question our habits and bring in fresh ideas. As part of Designing a Curriculum, you are expected to undertake a small project related to some aspect of the undergraduate programme as a whole. You are encouraged to suggest your own themes, investigations or critical analyses; they should be close to your own interests and concerns, and, if possible, useful in some way to the Department. To give you a flavour of what is envisaged, here are some possible topics:
   - How the existing module sequences support the development of one of the main subject areas such as Algebra, Analysis, Geometry/Topology, Applied
   - The role of computing in the undergraduate programme
The methods and quantity of assessment used by the Department
The structure of one of the joint degrees
The Department's 'quality control' procedures
How the Department meets the very varied aspirations and abilities of its undergraduates
(For participants teaching MSc modules or supervising MSc students only.) The coherence of the MSc course and how it serves the needs of its takers.
A very thorough and detailed analysis of the pedagogy for a small and very focused piece of mathematics, specifically looking at
  o various ways to teach it,
  o how students will learn it, and
  o how you can assess a student’s understanding and ability to use the knowledge creatively
(Examples of such a ‘learning object’ might be the Mean Value Theorem, Commutative Diagrams, or what it means to “solve an equation”). In other words, to try to formulate the beginnings of a theory of learning by looking very closely at a concrete example.

The next set of activities relate to being a tutor:

6. Read the Tutors’ Guide.

7. Design outlines for 2 separate tutorials aimed at first-year students, one of them incorporating some of the online tutorial material created by David Mond at
   http://www.warwick.ac.uk/MathStuff/Tutorial/

8. Answer the questions on a A-Level Mathematics paper, commenting on their relation to the A-Level syllabus and on the difficulties likely to be met by students in the transition to university mathematics, especially the Warwick curriculum.

9. Create a list of teaching and learning resources on the Web suitable for first-year students.

10. Write appropriate responses that a tutor could make to a list of typical emergency situations their tutees might present -- a kind of tutor’s driving test. The list could be a set of descriptions of various emergency scenarios. The Departments might be prepared to cooperate in the production of a video showing a variety of tutorials in action. This video might contain clips showing a range of student crises that call for a tutorial response

**Portfolio Items for Designing a Curriculum**

1. A copy of the student handout stating the module’s aims, objectives, assessment regime, and expected learning outcomes.

2. Your evaluation of the design of your first two mathematics modules. In particular, this report should include the following:
   
   • A summary of any changes you made to the way the module had previously been given and your reasons for them.
   
   • Suggestions for further modifications in your two modules’ designs in the light of your experience teaching them. These should be supported by justification for the proposed changes and an indication of how they might be evaluated.
   
   • A list of any departmental or external factors that affected the module design (for instance, institutional procedures and policies, Quality Assurance Agency, professional needs, accreditation).
You might wish to support your arguments for change by citing the knowledge of students you have gained through tutorial contact.

3. A report on the project described in paragraph 5 above. (Any important issues you raise in your report will, with your permission, be passed to the Department’s Teaching Committee by the WMTC coordinator.)

4. Written evidence of at least two of the following:
   - One of the outline tutorials described in para 7 above
   - Your evaluation of the A-Level Mathematics paper described in para 8 above
   - Your list of Web resources for first-year students described in para 9 above
   - Your reference to a prospective employer
   - Your responses to the Tutor’s emergency checklist described in para 11 above

**Assessment of the Module Designing a Curriculum**

1. This module will not be assessed until the final portfolio is submitted. The completed portfolio containing your work for all four modules should be submitted to the CAP Secretary by the deadline you have agreed with the WTC(M) Coordinator; but you are strongly encouraged to submit a draft of your work to your CAP advisor for comment and feedback well before then.

2. For each WTC module, generic or subject-based, there is a specified set of qualities and achievements (its ‘learning outcomes’) in which a successful candidate must demonstrate proficiency. Below we list (in bold type) the formal WTC learning outcomes followed by an exemplary gloss (in italic type) setting them in the context of the departmental variant.

**QUALITIES AND ACHIEVEMENTS FOR DESIGNING A CURRICULUM**

A. Learning and Teaching

   - **Understands the relevance of learning theory, including adult learning, to curriculum design**
     
     Some students learn visually and gain mathematical insight from pictures; other find pictures confusing and prefer an abstract symbolic presentation. How do students grasp the full significance of a powerful idea encompassed in a new definition (Lara Alcock, formerly of Warwick has studied this question in the context of teaching the first-year Analysis modules.) Should the many modes of learning mathematics affect the way we teach it?

   - **Able to identify factors relating to learners’ past and present background and experience that may be accommodated within a learning programme**
     
     David Ausubel’s belief that “The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly.” applies as much to the teaching of mathematics as to any other discipline.

   - **Understands issues relating to independence in learning**
     
     It is particularly true of mathematics that much of the learning takes place outside the lecture and the tutorial, in private study or work with other students. How can one best motivate this and encourage students to develop the right habits of study?

   - **Able to determine the appropriate role and tasks of the teacher and learner in respect of the programme**
     
     Make it clear where your responsibility as a teacher ends and the student’s as
a learner begins.

- **Understands the influence of different cultures on learning and teaching**
  
  How universal is the language of mathematics? The incorporation of a historical perspective in your teaching will make students aware of the significant contributions to mathematics made by a great variety of cultural traditions in the past four millennia.

- **Understands why learners from different cultural backgrounds perform in a given way**
  
  Students’ cultural backgrounds may influence their attitudes to such things as the authority of the teacher and their willingness to challenge it, plagiarism, group work, and so on.

B. Curriculum Context

- **Understands the rationale for and uses of a range of curriculum models**
  
  How should we determine what mathematics we cover in our degree programmes? For instance, is it acceptable that we have no module on mathematical logic in our core (our students can take an optional course on symbolic logic offered by the Philosophy Department). Should we be worried that we offer so little main-stream number theory?

- **Understands institutional, national and international context of curriculum design**
  
  Most of us are aware of the differences in levels and approaches in the mathematics degrees (a) between different universities in the United Kingdom and (b) between different countries (eg. USA and France). These differences usually have their roots in the way mathematics is taught in the secondary educational sector. Are we at Warwick confident that we have got it right?

C. Curriculum Planning

- **Understands curriculum planning techniques**
  
  This should not present any problems if you are a well-organized person and use common sense.

- **Understands the major features of a range of teaching and learning methods**
  
  A wider range of teaching and learning methods are used in the Mathematics Department than you might imagine. While ‘chalk and talk’ is the most common, you will also find small group learning with peer support (first-term 'Analysis'), self-study with work-books (second-year 'Number Theory'), project based modules (second-year 'Modelling Nature’s Non-Linearity'), public presentations and peer assessment (fourth-year 'Maths-in-Action Projects'), lab work (first-year 'Experimental Mathematics'), investigation and problem solving (second-year "Mathematical Excursions").

- **Understands the major features of a range of media used in teaching and learning**
  
  Whether you use the blackboard or data projection, it is important to know the best techniques and to avoid the pitfalls of the media you use for teaching. The Centre for Academic Practice lays on a variety of courses and
workshops on all aspects of teaching, and some of these may help you in developing an effective presentation style. The CAP programme can be found at http://www2.warwick.ac.uk/services/cap/events/

- **Understands significance of a range of assessment strategies and tools in relation to curriculum design**
  An integral part of designing your module is deciding how you will assess it.

- **Understands how Equal Opportunities issues relate to curriculum planning**
  For instance, if your module involves a high level of computer interactivity, have you made provision for the occasional person who has a condition that makes it very difficult for them to read computer screens?

**D. Evaluation**

- **Understands how own values and assumptions can relate to curriculum in own academic discipline**
  Know your own preferences and prejudices and be wary of letting them dominate your teaching.

- **Able to evaluate critically own and others’ curricula**
  Your portfolio work will surely indicate how thoughtful you are about your teaching.

**E. Implementation**

- **Able to design and implement a series of sessions, including assessment strategies, appropriate to learner, subject, context and level**
  I suppose this means: “Did your module actually take place and go according to plan?” It emphasizes the need to assess your performance teaching your first two modules critically and to suggest changes for next time.