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Y Sefydliad Mathemateg a Ffiseg | Institute of Maths and Physical Sciences

2003

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TYSTYSGRIF UWCHRADDDEDIG ADDYSGU MEWN ADDYSG UWCH

POSTGRADUATE CERTIFICATE IN TEACHING IN HIGHER EDUCATION

Cylch Dysgu 2 | Teaching Cycle 2

Different Teaching Styles

PRIFYSGOL
ABERYSTWYTH UNIVERSITY

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4.1.4 Further reflections and future practice

After due reflection, and some encouraging student questionnaire results, I have decided to adopt this teaching innovation as general practice. The cohort in the third group who took Linear Algebra have since studied MA30210 Norms and Differential Equations; I pointed out the correlation between good exam marks and submitting solutions at the start of the semester. Submission rates were pleasing; they are shown in the table below.

<table>
<thead>
<tr>
<th>Problem Sheet</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fraction Handed In</td>
<td>29/30</td>
<td>23/30</td>
<td>13/30</td>
<td>11/30</td>
</tr>
</tbody>
</table>

The exam was taken in January 2003; the correlation between submission rates and (raw) exam marks is tabulated below.

<table>
<thead>
<tr>
<th>Problem Sheets Attempted</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Students</td>
<td>0</td>
<td>5</td>
<td>10</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Average Exam</td>
<td>-</td>
<td>42</td>
<td>52</td>
<td>43</td>
<td>75</td>
</tr>
</tbody>
</table>

Overall the exam performance was satisfactory; scripts ranged from superb (112) to no questions attempted (0), with a mean mark of 55. One student withdrew (temporarily) from studies, which explains why 29, rather than 30, sat the paper. The correlation between handing in rates and exam score is not quite so striking as in previous examples, but is still marked.

4.2 Cycle 2 - Different Teaching Styles

Mathematics is by its nature a subject of accumulated knowledge; I dislike the term "linear" in this context, preferring "progressive" or "accumulative". Consequently lecturers need to cover an agreed minimum number of topics in their courses, so that colleagues can draw on this knowledge at later times (possibly after jogging the students' memories). This restricts possible teaching methods; the statement "you cannot discuss style without discussing substance" is certainly true of mathematics degree courses. However for the course MA12710 A Rough Guide to Mathematics and Statistics this constraint was not present to the same degree. This module is described in greater detail in section 6; at this juncture it suffices to say that the module was intended to be the equivalent of a mathematics course for Liberal Arts students in the U.S.A., aimed at developing the quantitative skills of students following degrees in Arts or "soft" Science subjects. This stand alone module represented an ideal opportunity to try a range of teaching techniques. The general theme of building a structure to solve a difficult problem by starting with simple cases was more important than covering a set amount of material.

4.2.1 Teaching Methods

As described in section 2, the formal lecture is a mainstay of mathematics degree teaching methods. However additional methods were utilised in the teaching of MA12710:

(i) The Mathlets computer package; this comprises a succession of problems where the student chooses between given alternatives, and is informed if their choice was correct before proceeding with the next question. There was a supervised session to enable students to test their background knowledge (and familiarise themselves with the package), with the opportunity to revisit problems in their own time.

(ii) A list of problems (starting at the elementary level and increasing in difficulty) to be done in class, with the students being encouraged to work in small groups, and the lecturer offering assistance as required. A big advantage here is that the lecturer can spend extra
time in small group or individual discussions with those who are struggling. A method much used by school mathematics teachers.

(iii) Topics studied via a series of examples, discussed by the group as a whole, the lecturer offering guidance.

4.2.2 Student feedback and personal reflection

The teaching for MA12710 was shared by myself and two other colleagues; one of these, Dr. John Lane, issued a detailed (electronic) questionnaire to students. Please find three responses (with names deleted) in Appendix D. Further student feedback can be found in the document *A Rough Guide to Mathematics and Statistics - MA12710: The First Year* in Appendix F. The former source provides the more useful feedback to judge the success of the innovation.

Question 11 asked "To what extent did you learn something new (either completely new material or improved understanding)?" Two responses were "Improved understanding of completing the square, I understand it slightly more than I did" and "My understanding of solving quadratic equations is much improved as I had never been taught completing the square before". These comments were gratifying, as I taught the method of solving quadratics by completing the square using methods (ii) and (iii), the theory being built up via carefully chosen examples. The responses were generally positive, which can be seen as a vindication of the teaching style. However use of the mathletics package is criticised in the third response - the complaint is that "this was not related to the rest of the course, and may have put some less experienced people off continuing the module." I consider this comment justified; there could have been better links with other parts of the course, and the experience seems to have worried rather than reassured most students.

The questionnaire results (and other evidence) were discussed by the lecturers involved and we resolved to drop the Mathletics package. However we were encouraged by the response to the other teaching methods.

4.3 Cycle 3 - Encouraging Problem Class Responses

I have already discussed the role of the problem class in mathematics in the description of Cycle 1 (and also in section 2). In summary, one demonstrates how to devise a plan to solve a given problem using knowledge that has been imparted in lectures (or from other sources), hoping the students will learn by analogy. The more the students become involved in this process, the more they gain. This is a form of teaching I have long enjoyed; lecturing standard material can become tedious, but thinking of strategies to solve challenging questions is always exciting, it being the essence of mathematics. The critical problem is always "how can I get the students to think?"

4.3.1 Norms and Differential Equations, Semester 1, 2002/3

The course MA30210 *Norms and Differential Equations* is one I have long wished to teach, it being the closest to my research interests of the modules the Mathematics Department currently offers. I lectured the module for the first time in Semester 1 of the 2002/3 session. One of the timetabled slots was an unpopular 17-10 to 18-00 on Tuesday, coming after two consecutive hours of lectures for the students. Given that this particular cohort are notorious for being taciturn, it was clear that generating satisfactory problem class responses was going to be a challenge. After a session where I felt the audience was particularly disengaged, I invited electronic comments about how problem classes could be improved. Please see Appendix D for two of the most useful responses. (Names and