

Case 9

On the Use of Multiple Class Test Assessments to Promote and Encourage Student Learning

Contributor	Séamus McLoone
Email	<code>seamus.mcloone@eeng.nuim.ie</code>
Telephone	+353-1-708-6201
Affiliation	Department of Electronic Engineering, National University of Ireland (NUI) Maynooth, Maynooth, Co. Kildare, Ireland.

9.1 Context

The use of multiple class test assessments is employed in two different modules taught at the undergraduate level in the Department of Electronic Engineering in the National University of Ireland, Maynooth, Co. Kildare. These modules are Digital Systems 1, a 2nd year module, and Control Systems Design, a final year module. These modules form part of an overall programme leading to an honours Bachelor of Engineering (B.E.) degree in Electronic, Computer or Telecommunications Engineering. The number of students enrolled in each module currently averages around 18.

Two different teaching strategies are employed. For Digital Systems, the content is delivered via a set of lectures and accompanying notes. In contrast, Control Systems Design is taught solely through a series of workshop-type tutorials. By providing the complete set of notes and problem sets at the start of the module, students are given the responsibility of self-learning. The tutorials provide a means for students to work through the notes and problem sets at their own pace, within reason, and a forum for having their questions answered.

9.2 Learning Outcomes being Assessed

At the end of the Digital Systems module, students should be able to:

- efficiently minimize logic using Karnaugh Maps;
- implement a logic circuit using NAND or NOR gates;
- design a basic counter; and
- convey a basic understanding of programmable logic devices.

In the case of the Control Systems Design module students should be able to:

- recognize the need for feedback control;
- carry out basic feedback design in both the time and frequency domains; and
- distinguish between linear and nonlinear systems.

9.3 Assessment Procedures/Details

Despite the different teaching approaches employed in the two modules, the basic assessment concept remains the same. Digital Systems has four key sections while Control Systems Design has five. A class test is used to examine each of these sections, thus, allowing each of the learning outcomes to be suitably assessed. All class tests are compulsory and all questions on each test have to be attempted. Generally, the class tests take place shortly after completion of the corresponding section of notes.

The class tests contain varying number of questions that range from straightforward, short-answers to more difficult, problem-solving. Generally, emphasis is placed on the method and not on the final answer. Furthermore, the tests tend to focus on the students' understanding of the notes and not simply on their ability to memorize them.

The class tests form a significant percentage of the overall mark—15% for Digital Systems and 25% for Control Systems Design. In addition to the class tests, assessment also includes either laboratories or assignments respectively and a final examination at the end of each module. This examination is based on the whole module, and not just sections of it, as is the case with the class tests. The class tests help the students to prepare for this final examination, which has the greatest percentage weighting of all the assessment elements. The structure and level of difficulty of the final examination has not been affected as a result of introducing the class tests into the respective modules.

9.4 Strengths and Limitations

9.4.1 Strengths

- Class tests serve as a great means of motivation. In general, the students learn the material for the class tests and, thus, are always up-to-date for the subsequent

sections of the course. Consequently, the students are able to follow the next sections of the course notes with more ease.

- The students tend to have less difficulty revising for the main examination at the end of the module, as they are not learning the material for the first time.
- While the students have to work harder throughout the module, they are under a lot less stress and pressure for the final examination. They also tend to develop a better attitude to and focus for work.
- As the students are no longer under the same pressure to learn everything at the last minute, they actually learn more of the course content.
- The class tests are very much a formative style of assessment. The students can find out what parts of the course they are struggling with and can always revisit these if required.

9.4.2 Limitations

- Studying for multiple class tests can be time consuming for the students. This can detract from their studies in other modules.
- From the lecturer's point of view, there is obviously a lot more work involved in having to correct multiple tests.

9.5 Contributor's Reflections on the Assessment

Lately, greater emphasis is being placed on learning outcomes, especially by the relevant professional bodies. It is now desired that these outcomes are suitably assessed by each module. However, the modules that rely primarily on a final examination to assess learning outcomes cannot always guarantee this. Since the students typically have a choice in the examination paper (a typical choice in Electronic Engineering is four out of six questions) the learning outcomes are not readily guaranteed. A possible solution is to make specific questions compulsory and to ensure that these target the learning outcomes. However, this can inadvertently add more pressure and stress to the students who leave studying until the last minute. An alternative solution, the one I adopted here, is to have multiple class tests throughout the course of the module, where each class test can easily target one or more of the learning outcomes. Alternative assessments to class tests could be used, but I find that these can sometimes present other difficulties, such as, ensuring that the assessments are individualised and/or properly supervised.

Another influencing factor behind the use of multiple class tests is that of student motivation. I have found that students are not easily motivated and only tend to study for tests. Without class tests, they do not really engage with the module until it is too late. The amount of valuable information that the students gain is also questionable. By employing class tests throughout the module, the students are encouraged to engage continually with the module. Furthermore, as the tests are of a formative nature, the

student learning experience is far more valuable and rewarding (Davis *et al.*, 2005). The class tests are of particular importance in the Control Systems Design module as they also act as a motivation for students to work through the notes and ensure that they maintain a reasonable pace of study.

The student feedback clearly shows that they are in favour of class tests, a sentiment also noted by Davis *et al.* (2005). Some of the students felt that it kept them focused throughout the module, maintained their interest in the course content and motivated them to study. Many of them commented on the fact that they felt it would be a lot easier to revise for the final examination for this module than for others that did not use class tests. It is interesting to note that a few suggested that the other modules should actually make more use of class tests.

From my point of view, the correcting of class tests can be time-consuming. This could prove problematic for large classes. Fortunately, to date, my average class size is approximately 18. For larger classes, there is the possibility of using multiple-choice class tests to ease the problem of correction, but I find that these cannot satisfactorily examine problems where the solution methodology is more important than the final answer.

Multiple class tests are clearly time-consuming for students and may also sometimes detract from the students' studies in other modules, a fact noted by some of the students themselves. While I feel that part of this is directly related to poor time management by some of the students, a lot of time is, nevertheless, spent in studying for the class tests. This assessment procedure would likely prove too stressful on the students if every module had four or five class tests, especially in final year where the course material is significantly more challenging.

Class tests allow for more detailed questions on each section of the notes. Furthermore, they act as a self-assessment for the students, allowing them to monitor their own progress. It also allows them to see how they are doing in relation to the rest of the class, as the average of each test is always available. Black *et al.* (2004) provide an interesting discussion on feedback through grading.

Finally, class tests also serve to provide the lecturer with a relatively accurate representation of the difficulties a student and, indeed, a class are having with relation to a particular section of the notes. These issues can easily be addressed before it is too late, i.e., after the final examination, thus allowing for an improved overall learning experience for the student.

9.6 Bibliography

- Black, P., Harrison, C., Lee, C., Marshall, B., and William, D. (2004) Working inside the black box: assessment for learning in the classroom. *Phi delta kappan*, 86(1):pp. 9–21.
- Davis, L. E., Harrison, M. C., Palipana, A. S., P., J., and Ward. (2005) Assessment-driven learning of mathematics for engineering students. *International journal of electrical engineering education*, 42(1):pp. 63–72.