Chapter V

The Development of On-line Tests Based on Multiple Choice Questions

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ABSTRACT
This chapter is concerned with the use of Web-based technologies to deliver and manage on-line multiple choice tests for university teaching. The data defining the tests and the results of each student’s attempt is maintained in a server-side database. The test is delivered in a Web page that can be displayed by a standard Web browser. Students are thus able to access the required tests from the same location that they can access their course content, in large part, on the Web. Multiple choices tests have been shown to be an effective way of both supporting the learning experience and providing an objective assessment process. The basic elements of the required technology are described including some implementation issues that are necessary to achieve a viable and robust system. Some of the key issues include the use of server-side tools for database access and client-side components to deliver and manage the user interface.

INTRODUCTION
Assessment is an inherent part of all teaching activity and is subject to a wide range of approaches. In this chapter we will focus on a particular form of testing that has become available with the development of Web-based technologies and the wide availability of the Internet. In our school we have had the opportunity to build
curricula for a range of new professional Engineering degrees. We have been able to embrace a range of Web-based technologies right from the outset and to integrate these into our teaching processes.

As a part of these developments, we have chosen to implement a facility for providing a testing environment using multiple choice questions (MCQs) as a part of the Web-based delivery of curriculum content. This tool allows us to build, deliver and evaluate a number of MCQ tests. These can be inserted at appropriate places throughout an on-line teaching programme. Students are able to access the test from wherever they can access the Internet, while staff can monitor activity and test results, providing an integrated tool for assessment.

Naturally, there is a wide range of issues (and problems) associated with this approach, and these are discussed below. We also present an outline of how our system operates and describe some of the key architectural and design issues.

**ON-LINE MULTIPLE CHOICE TESTING**

**Background**

Assessment is a fundamental part of the educational process—it is seen to shape and drive student learning (Gibbs, 1995). Its underlying assumption is that it provides a representative sample of student behaviour in order to provide estimates of current status (Mogey & Watt, 1996). Assessment may perform one or more of the following roles:

- **In its diagnostic role,** it identifies strengths and weaknesses and may help in detecting misconceptions, as well as providing information on prior knowledge which helps identify the need to modify content to suit student requirements
- **Formative assessment** helps students discover what they have learned through appropriate and timely feedback in addition to supplying feedback to the teacher on teaching style as well as student progress. Formative assessment can motivate learning and encourage students to keep pace with the teaching
- **As a summative tool,** it estimates performance for the purpose of formal assessment.

Ideally, assessment is an integral part of a course with appropriate methods linked to learning objectives. Bloom’s taxonomy is commonly used when discussing various learning processes (Bloom, 1956). The learning objectives for each category are described below:

- **Knowledge**—learning objectives at this level include: knowing common terms, specific facts, methods and procedures, basic concepts, principles.
- **Comprehension**—learning objectives include: understanding facts and principles, interpreting verbal material, charts and graphs, translating material from one form to another (e.g., verbal to visual/mathematical), estimating future consequences implied in data, justifying methods and procedures.
- **Application**—learning objectives include: solving mathematical problems, constructing graphs and charts, demonstrating correct usage of a method or procedure.
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