Computer aided assessment with eGrade

Chris Sangwin
The University of Birmingham

c.j.sangwin@bham.ac.uk

More supplier info at:

http://jws-edcv.wiley.com/college/egrade

What is eGrade?...eGrade is an internet based computer aided assessment system, designed with good support for mathematics, and in this review we concentrate on eGrade's *mathematical* features. As an 'off the peg' commercial computer aided assessment system, eGrade is comprehensive and well-developed.

Within eGrade, individual *questions*, that is to say tasks, problems etc. are arranged into *question banks*. These banks help the instructor to organize the material, and select questions into *assignments*. The course *instructor* is in overall control of the course but may have a number of *proctors* (perhaps graduate teaching assistants) who have more limited access to the staff functions.

The eGrade system provides the following tools.

- **Assignment editor:** create assignments, set policies, etc.
- **Question bank editor:** edit and create question banks, select questions from question banks provided by a book publisher, tailor feedback to students, etc.
- **Gradebook:** class handling features, including import of class lists, viewing individual and class results, exporting results to an external application.
- **Website editor:** upload and organize reference files onto the class website.
- **System tools:** change instructor passwords, manage proctors, lock access for students, etc.

Student interaction

Users need a web browser that supports Java and Javascript. Internet Explorer 5.5 or better and Netscape 4.7 are recommended. Before students can register for the system they are required to accept a lengthy licence agreement. Users are given the option of downloading and installing the "Math Package", about 823K. This is to reduce the connection time for students with a dial-up or other slow connection. The reviewer downloaded, but did not install this.

Students gain access to the system via a web page, designed by the instructor. This lists materials, notices and assignments for the student to complete. Once students select an assignment they are prompted for their username and password. Students may return to partially completed assignments etc. Questions are presented one per internet page, and there are sensible navigation options between pages.

Students may enter mathematical answers using either a *text mode* single line entry or *symbol mode*, which requires a plug-in component. Students may preview their formula prior to marking, using a pop-up Java window, to check the computer has interpreted the formula as the student intended. This worked well, and experience with other systems shows students value such a feature.

The eGrade system is well designed and easy to navigate. One persistent problem occurred with the 'back button' provided on the page itself (not on the browser). This regularly gave a 'page expired' error, even when used within seconds of arriving on a given page.

The web pages contain a lot of material, particularly small images. These

images contained toolbars, and even parts of the text as .gif images (without alt text) making the pages impossible to enlarge for partially sighted students. Furthermore, this was often slow, (up to 15 seconds per page) even with a good university based LAN link, and might take an inordinate amount of time over a dial-up connection.

Staff interaction

Each course or class is given a home page, through which administrative functions are performed. Mostly this worked well, there were only the inevitable problems one encounters learning any new system.

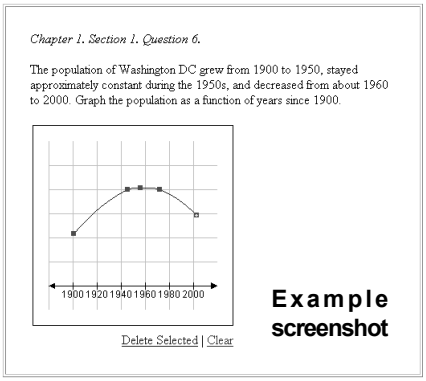
The rules and policies for each assignment are determined by the instructor, from a useful selection of options. For example, the instructor has the ability to control assignment access, grading parameters, and recording of grades to eGrade's gradebook. The menus and summaries are well laid out. eGrade claims to be able to export data to course management systems, WebCT and Blackboard are explicitly mentioned. This was not attempted by the reviewer, but is clearly a useful feature.

Extensive online help is included for the instructor with the system which was very helpful. Also provided is email and phone support. The reviewer did send a number of email queries, which generated an acknowledgement, but unfortunately no reply.

Question banks

eGrade uses *question banks* which contain, and are used to manage, individual questions. Assignments are built from these questions.

One intention is that publishers will provide the problems from paper based books as eGrade question banks. The instructor would then be able to select, and possibly modify these, for use with their group. Linking the problems in the text book with those on the internet site has great educational merit. Furthermore, duplication of effort in creating computer aided assessment content is reduced. The availability of problem sets for eGrade with automatic marking, feedback etc. may even affect the instructor's choice of course text. This is one of the strengths of eGrade. Close collaboration with the publisher Wiley has resulted in a number of texts available [5].



Example screenshot

Instructors may also author their own material and build question banks. This allows instructors to adopt an "off the peg solution" and rapidly set internet based tests, or to develop their own schemes of work according to their need and taste.

Types of questions

eGrade provides facilities for the usual 'objective test' questions: multiple choice, true/false etc. There are also short answer and essay questions. Point-and-click, graph sketching and other questions are also possible.

In addition there is a "Formula" question type which accepts a single formula as answer. That is, an expression constructed of numbers, variable names, the standard arithmetic operators and functions. This is graded *"by comparing it with the correct answer"*, although the exact mechanism by which this takes place is not clear. Some computer algebra may be involved, but not at the level on some other systems [4]. I suspect one mechanism involves substituting in values as the documentation states that *"If the student response and the correct answer are numerically equivalent then the response is graded as correct…"*. There are extensions of the eGrade system that allow access to Maple 8 to perform grading, produce plots etc. This gives more functionality, allowing answers to be manipulated mathematically. The reviewer did not have access to these features. Either method allows great flexibility and works in a reasonably robust way if questions are authored with care.

There are various subsidiary question types. Restricted formula mode restricts functions to those commonly found on a non-scientific calculator. This allows one to choose to penalize an expression such as cos(p), rather than -1 in an answer. Equation mode allows expressions including an equality to be evaluated. The "Formula Mod C" mode accepts answers that differ by a constant (eg indefinite integration). Mechanisms exist for tuples as answers. There are plain numerical, dimensioned numerical and dimensioned formula types. It is possible to control the acceptable margin of error with such numerical answers.

Four methods for authoring questions are available, with more specific information on each to be found at [1]. Each produces a question bank file that can be imported into the question bank editor. Firstly questions may be authored online using the question bank editor itself. Not all questions, particularly the more complex mathematical questions,

may be authored in this way. Secondly, questions may be authored using the free standing proprietary software Diploma from Brownstone Publishing [2].

Questions may be authored as text files using an HTML-like script syntax and uploaded for processing. This is necessary for the more complex mathematics questions, or those using Java etc. This scripting allows randomization within questions. A question 'template' into which random values may be inserted can be authored using such a script. These random values are used to generate the answer, and feedback etc.

Finally, it is possible to convert LaTeX question documents into eGrade's internal question format. This uses LaTeX macros obtained from a password protected web site. For an example of such a question, see [3].

Conclusion

Overall, the eGrade system is extensive, well though out and works well. The pages are Javascript heavy, and contain lots of images, which may cause problems with other browsers and dial up internet connections.

Mathematics is very well supported. The display, answer entry and preview features are well thought out and worked. Randomization and mathematical comparison of answers, possibly using Maple, allows sophistication. Good feedback is possible based on Students' answers. The scripting language for question authoring gives an excellent level of control and flexibility to the instructor. Availability of text book exercise sets provide an efficient off the peg solution for those who prefer not to author their own material. This is a particular strength.

References

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Monthly series on Computer-Aided Assessment in Maths, http://ltsn.mathstore.ac.uk/articles/maths-caa-series
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March 2003: Coping with diversity in recruitment. Can CAA help?
Contributed by Kevin Golden, University of the West of England.

Many Engineering awards recruit students from diverse academic backgrounds that include A-level, BTEC qualifications, Foundation Years and overseas qualifications. In addition to this there will be mature students returning to education after an absence of more than five years. One of the main areas of weakness possessed by this diverse population is mathematics and many of the students require a considerable level of support if they are to progress beyond the first year of their award. CAA appears to offer certain advantages for this type of course. Students receive instant feedback on their progress, and they can easily repeat the assessment, potentially linking the assessment directly to learning. This exercise can be carried out efficiently for large numbers of students and where tutor support is required, it is being given to a student already informed, to a certain extent, on where their weaknesses lie. In this article the use of CAA on a module with the above student profile is discussed and its effectiveness considered by tracking the performance of a group of students on first and second level mathematics modules. The results are mixed, as may be expected for this group. However, when viewed over the longer term, the majority of students from each of these different cohorts did make significant progress in the subject.

February 2003: e-Grade: A Computer Assisted Assessment System
Contributed by Douglas Quinney, Keele University.

This article briefly describes eGrade, a web-based system that can process a wide range of math-based assessment, while supporting content across all academic disciplines, that has been developed by Professor John Orr at the University of Nebraska-Lincoln. In particular, the process of creating questions, maintaining question banks, setting assignments and maintaining a course will be described.