

The Scottish Computer Assisted Assessment Network

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Abstract

The Scottish Computer Assisted Assessment Network (SCAAN) [1] was set up in early 1999 to promote the use of online assessment in higher education institutions throughout Scotland. Funded by the Scottish Higher Education Funding Council under its Webtools initiative, SCAAN is a collaboration between three universities: Glasgow, Heriot-Watt and Strathclyde. Each of these establishments is implementing a particular computer-based assessment tool. Glasgow uses TRIADS, an Authorware-based multimedia assessment engine, built at the University of Derby. Heriot-Watt and Strathclyde have their own web-based assessment engines. It was decided that the dissemination and evaluation of three separate engines would be likely to result in generic deliverables, more useful to the higher education community than the promotion and analysis of a single engine.

This paper discusses the project in general and focuses in particular on the deliverables produced to date. These are:

- a requirements analysis of a generic (not engine-dependent) online assessment engine, specifying the required functions;
- a technical issues report which enables potential users to compare the engines and make informed decisions on the choice of engine;
- and a Document Type Definition (DTD) for a generic assessment containing core question types, taking into account the recent release of the Instructional Management Systems (IMS) specification for assessment, with the ultimate aim that all engines can be built in an extensible and interoperable manner.

Keywords

CAA, DTD, Miranda, TRIADS, WebTest

Introduction

The SCAAN Project brings together three electronic assessment systems, from three different institutions. The collaborators are as follows:

- Mr N Sclater and Ms K Howie from the University of Strathclyde are working with the institution's own web-based tool, Miranda, built under the Clyde Virtual University initiative. Miranda is a system which contains a variety of question types, easily implemented by academic staff with minimal technical knowledge [2].

- Dr R Sutcliffe and Dr L Leonard from the University of Glasgow are using TRIADS (created by the University of Derby), an inherently media rich assessment environment allowing complex and fine-grained interaction with the system. There are a large variety of interactive question types available for use in this system, including diagram labelling, sequencing and drag & drop format [3].
- Dr R Rist, Dr N Tomes and Ms M McAlpine from Heriot-Watt University, bring the institution's own web-based assessment system, WebTest, to the project, a flexible system allowing questions containing mathematical formulae and the randomisation of variable parameters within the question [4].

SCAAN also receives contributions and guidance from Dave Whittington, of the CAA Centre.

Each institution thus brings to the project a markedly different assessment tool. The varied skills and backgrounds of the SCAAN project members further increase the value of the collaboration between the three universities, with all parties contributing to the project reports.

The primary aims of the project are as follows:

- to evaluate the requirements of a web-based assessment system for differing types of user, both functionally and technically;
- to provide HEIs with the information they need to choose a particular assessment tool by delivering a framework for comparing the systems. This includes comparisons of the three tools brought to the SCAAN project;
- to transfer knowledge to interested parties through a series of ten staff development workshops held across the country;
- to design and evaluate new electronic assessment question types which meet users' needs;
- to support authoring and use of the three assessment systems.

The SCAAN Reports

The three reports produced by SCAAN are available on the project website [1]. A summary of each document follows.

The Requirements Analysis Report [5]

This document discusses some of the issues involved in using computer assisted assessment in HEIs. It discusses what would be required and expected from different users in an 'ideal' electronic assessment system and then proposes a method of measuring whether an assessment system is fulfilling its purpose effectively or not. This document is intended to contribute to discussion about the aims of electronic assessment, and how these differ from those of traditional assessment.

The first part of the document discusses the problem of academic staff who are skeptical about CAA. Many of them do not understand the potential of these systems, nor do they have the time to learn to use one. Those who do use CAA may use it purely for the ease of administration of an assessment; systems which automatically mark assessments for large classes have increasing appeal for time-pressed academics. Most lecturers still do not realise the potential of CAA for implementing thought-provoking questions whilst retaining the efficiency advantages of objective testing.

The second part of the document discusses the aims and requirements of an electronic assessment system. The system should be easily integrated with current (traditional) assessment methods. It should continue to provide efficient assessment for large classes and instantaneous feedback to staff and students, while being easily maintainable for technical staff.

The requirements analysis was completed with respect to four types of user: students, lecturers, central administration and system management. Each group of users has a different set of requirements.

Students

Students may use a computer-based assessment system for self-assessment or for examination purposes. In the latter case the system should collect the answers they submit and securely and reliably store them / mark them. These are also of course requirements of a traditional paper-based assessment system. There are other factors however, which relate to an electronic system. The system should require little training to use, testing the user's knowledge of the subject being assessed rather than the use of the system itself. It should be possible to allow students to examine their results and see where they went wrong. The system should provide appropriate feedback (particularly if the test is for self-assessment). Finally, the system should be accessible - physically, financially and to those with special needs.

Lecturers

Lecturers' interests will lie in the authoring and presentation of the questions they wish to set, together with the collation and analysis of class results. Their requirements are therefore different to that of the students. Ideally the questions lecturers wish to ask will fit the available electronic question types so that no compromise has to be made. A system which generates equivalent questions which vary slightly (i.e. different numbers in a mathematical question) may help to reduce plagiarism. It should require no more effort to build electronic tests than traditional paper based tests. Data on student progress and also class averages over a particular question should be available to the lecturer. It should also be possible to specify differing levels of feedback. Finally, the tests should be interoperable with other assessment systems and learning resources and so should be in an exportable format.

Central Administration

The central administration's priorities will be to ensure that results are stored reliably and are compatible with the central university computer system. Student performance information should be kept in a format which can be easily imported into central databases. Confidentiality and security are also important considerations.

System Management

System management has other requirements such as keeping the system easily maintainable and extendable. If the system complies with international standards (such as IMS) this will help to ensure interoperability between similar systems. The system should be reliable, scalable and should allow appropriate concurrency.

The final section of the report presents a possible list of questions which could be asked after the introduction of an electronic assessment engine into a department. Answering the list of questions provides a measure of how useful the system is to the department. Different assessment tools and uses of the tools can be compared using these questions.

Requirements will of course also vary depending on the proposed purpose of the assessment system. The Requirements Analysis Report discusses the functional requirements of the system in an idealised environment. The Technical Issues Report discusses some of the issues associated with real assessment systems as they are currently being implemented.

The Technical Issues Report [6]

This document discusses some of the technical issues arising from building and using an online assessment system. The issues are discussed with respect to the three assessment engines discussed earlier. The report starts by splitting an assessment tool into modules, grouped by facility. A possible model for a web-based assessment system is shown in Figure 1.

The registration system spans the entire assessment environment and deals with the security and access rights of the users. The question and test authoring systems allow a lecturer to build an assessment. The question display system presents the test to the user. Once the test is submitted the automatic marking system marks the test and reports back to the student through the feedback mechanism. With the result display system, students can look at the results for their tests or view the answers submitted, while a lecturer can examine results for the class as a whole or examine the test of a particular student.

Five sets of requirements are examined: student, lecturer, administration, system management and security.

Student

Student technical requirements reflect the fact that students use a wide variety of computers of different specifications and platforms and that each student should receive similar access to the assessment display system whatever machine they are using. If distance learning students are using the system, this is even more important as they do not have the benefit of university standards and computer support. They are also likely to have a slower connection to the system and may have to wait longer for materials to download.

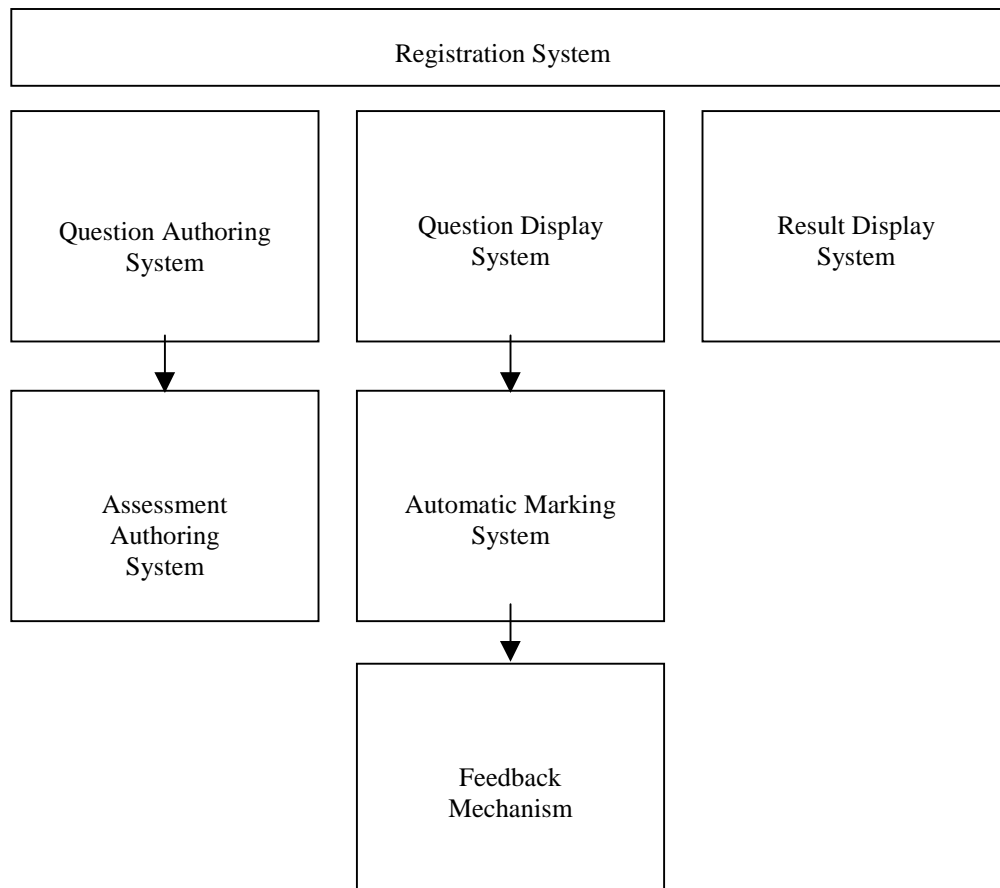


Figure 1
Model of a web-based assessment system

Lecturer

Technical requirements for lecturers who set questions will be different as ideally they will be able to build the assessments on their own machines. Thus both the assessment authoring system and the assessment display system should be cross-platform, and bandwidth usage should be kept to a minimum as lecturers often work from home. Lecturers may also require that new question types can be added to system by the system programmer fairly easily.

The kind of computers and software the lecturer and his/her class have access to will affect the choice of assessment system. The age and capabilities of the machines, the web browser installed and whether the machines are Mac, PC or UNIX are all factors which should be taken into account.

Administrator

It is necessary for administrators to be able to do a mass-registration of students for the assessment systems. Ideally this data will be easily transferable from existing records. It may be desirable for student usernames and passwords for completing assessments to be the same as those used for their central user accounts. Administrators would also find it useful if they could specify the format of reports which could be generated of user results.

System manager

The system manager has similar requirements to those specified already for other users but also has requirements to do with the server the system resides on. Issues such as portability of the assessment system (i.e. the type of server the system runs on) and ease of installation will be important to the system manager.

Security

Different user types should have different privileges within the system. Assessments and user submissions should be stored and marked securely on the server.

The document also compares the three engines, highlighting the advantages and disadvantages of each. This allows the reader to make an informed decision about which system would suit them best, depending on their requirements as a user.

The Document Type Definition Report [7]

The aim of this document was to provide a generic DTD for writing assessments in a manner which would allow any assessment engines which adhered to the DTD to be interoperable. However, the recently released IMS Test Interoperability Specification has now set international standards for online assessment. SCAAN has thus carried out a comparison between the DTD provided for WebTest, and a new DTD written for Version 2 of Miranda. These were compared in turn with the IMS Specification.

The comparison between the three DTDs reveals a few minor differences. The IMS specification covers assessments in greater detail while the engine specific DTDs cover more specific question types in use at Strathclyde and Heriot-Watt. The two engine specific DTDs break down the assessments repeatedly to the HTML level while the IMS specification builds the DTD from scratch without the use of HTML as a base.

None of the DTDs discusses presentation issues such as the display of text (font size and style). All of them allow questions to be grouped within containers of some sort. They all discuss a variety of question types.

It was decided that, due to the evolving nature of the IMS specification, the best design of a DTD which would allow WebTest and Miranda to interoperate would be one which suited the particular assessment engine in question but which could be easily altered to fit the IMS specification (Figure 2). If each assessment engine could export assessments/questions etc in an IMS compliant form and could also import other IMS compliant assessment items then not only would WebTest and Miranda be interoperable but also there would be compatibility with any other IMS compliant system such as QuestionMark.

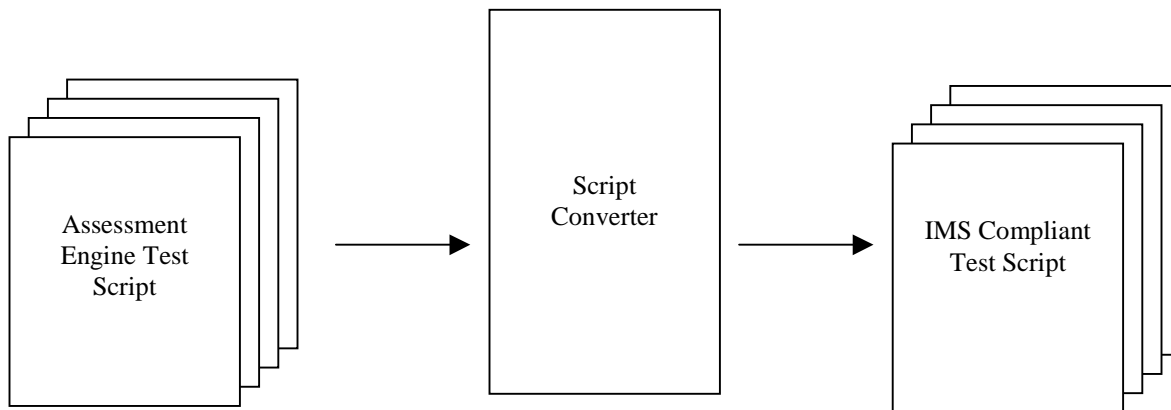


Figure 2

Tests which can be exported as IMS compliant will allow the assessment engines to continue to use their own question and test specifications

Plans for the remainder of the SCAAN project

The SCAAN project is funded until January 2001 and will disseminate these documents and run computer-aided assessment workshops throughout 2000. These workshops will include discussions of issues surrounding CAA, presentations of the SCAAN documents, demonstrations of the three assessment engines and finally a chance for attendees to receive hands-on tutorials in the use of the assessment engines. All three institutions will continue to support staff at Scottish HEIs who wish to implement the CAA tools.

Project Achievements

The SCAAN project has achieved its initial aims and is now in its dissemination phase. The main achievements can be summarised as follows:

- a) The requirements of an assessment system have been drawn up for a variety of users with different backgrounds, skills, training and with different purposes for the system in mind.

- b) An examination has been carried out of the feasibility of making some of the existing CAA systems compliant with the current IMS standard and in the future allowing importing and exporting of any other IMS compliant assessment information.
- c) CAA has been promoted to and is being used by a wide variety of departments in Scottish universities. It is hoped that the forthcoming dissemination events will show interested academics from non-technical fields the benefits of CAA and encourage further implementations of the three systems.

References

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- [4] <http://flex-learn.ma.hw.ac.uk/>
- [5] SCAAN Requirements Analysis Report:
http://www.scaan.ac.uk/public_docs/academic-requirements.doc
- [6] SCAAN Technical Issues Report
http://www.scaan.ac.uk/public_docs/technical_issues.doc
- [7] SCAAN DTD Comparison
- all relevant documents can be found at:
http://www.scaan.ac.uk/public_docs/doc.html