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Large Scale Implementation of Question Mark Perception (V2.5). Experiences at Loughborough University

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**LARGE SCALE
IMPLEMENTATION OF
QUESTION MARK PERCEPTION
(V2.5)**

**EXPERIENCES AT
LOUGHBOROUGH UNIVERSITY**

**Myles Danson, Bryan Dawson and
Tim Baseley**

Large Scale Implementation of Question Mark Perception (V2.5) – Experiences at Loughborough University

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Abstract

The paper outlines the experiences to date of two projects dealing with Question Mark Perception (V2.5) (<http://www.qmark.com/perception/index.html>). The first has been funded through the Teaching Quality Enhancement Fund (TQEF) and aims to implement a centrally supported web based CAA system to be offered to all staff at Loughborough University. This TQEF CAA project began in September 1999 and ends September 2002. The second project is funded by the Joint Information Systems Committee (JISC) Committee for Integrated Environments for Learners (JCIEL). This project aims to integrate the central web based assessment system with various management information systems (MIS) making a step towards the emergence of a Managed Learning Environment (MLE). This JISC CAA MLE project began October 2000 and ends September 2002. We outline the rationale, progress to date, issues arising, problems encountered and solved, and should be of interest to any institution considering a large scale roll out of Question Mark Perception. The deliverable of this JISC Project will be documentation detailing the experiences of the project and being generic in nature where possible. We will include the administrative, technical and pedagogical issues faced. Solutions and examples will be offered as appropriate. This document should be of use to any institution considering similar work. The final document will be available at the end of the project, September 2002, and will be disseminated by the JISC / JCIEL free to any UK HEI.

Introduction

Loughborough University is engaged in a large scale roll out of Question Mark Perception in order to achieve a centrally supported Web CAA System offered to all members of the Institution. Substantial TQEF funding was acquired to support this project for the duration. Further funding was acquired from the JISC JCIEL MLE Programme (<http://www.jisc.ac.uk/mle/>) to take the proposed CAA system further than was originally envisaged under the TQEF CAA project. Building on our current experience of screen delivered CAA we are taking integration with our main MIS further. The work is a first step towards a MLE at Loughborough University.

We report the impact of such an involved and extensive project on various roles within the University, the management issues arising from this, the technical and organisational issues encountered, and the planned project deliverables in terms of generic documentation to be made available free to UK HEI.

Overview of Perception

Briefly, Question Mark Perception Version 2.5 comprises three main elements. The Perception Server handles authentication, question, test and resource (eg. image files, multimedia and supplementary files) storage, test scheduling and delivery, results storage and web based reporting.

The questions are authored locally under a Windows only package called Question Manager (Browser Based Authoring is available but currently has limited functionality and is not discussed further in this paper). The questions are assembled into tests using a similar package called Session Manager. Session Manager allows tests and supplementary files to be published via ODBC to the Perception Server ready for delivery.

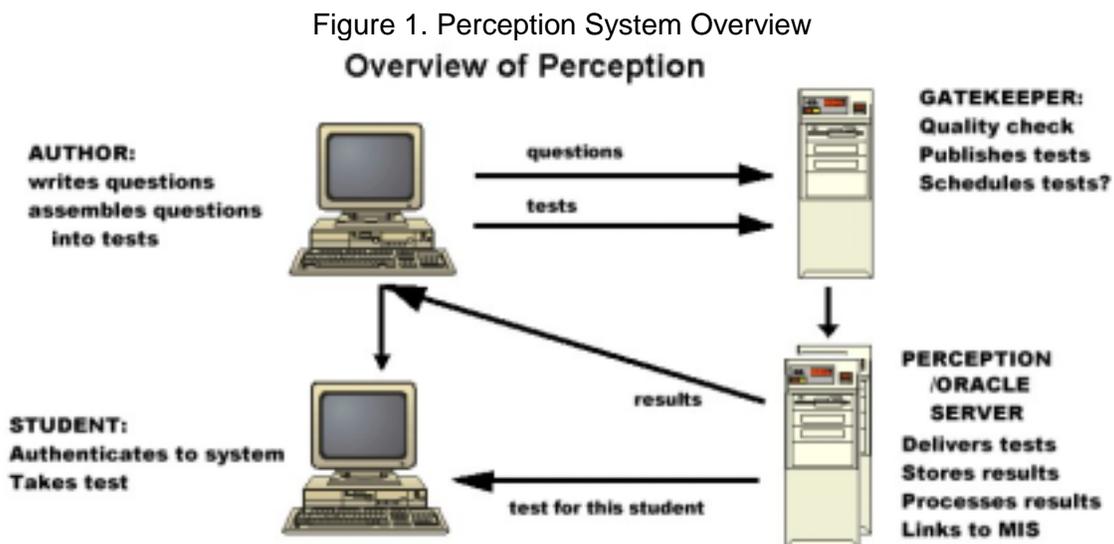
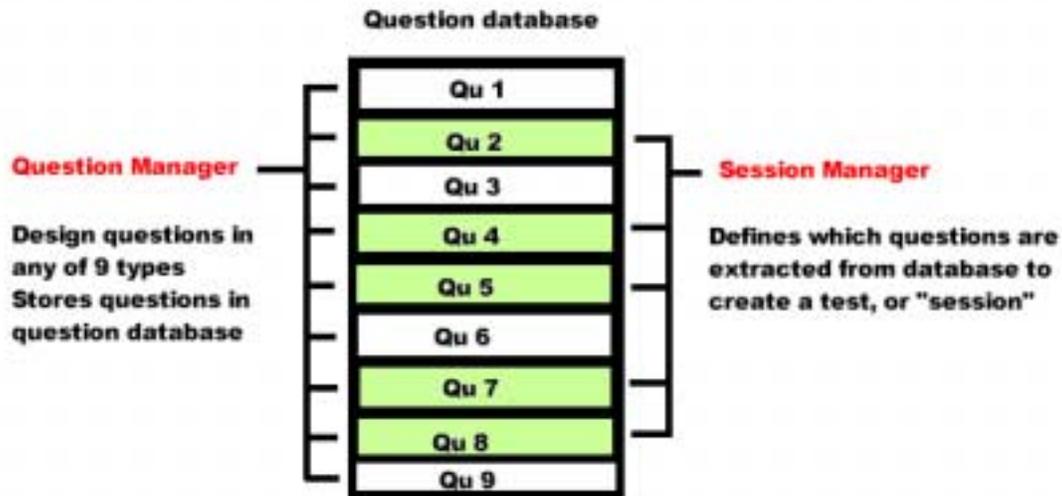


Figure 2: Question Manager and Session Manager



Why Loughborough

Loughborough University has a central unit that co-ordinates CAA across the university via a dedicated, full time CAA Officer. The CAA Officer has been in post for 4 years having built the CAA Unit to its present position and has overall responsibility for all centrally supported CAA activities at Loughborough. The services offered have delivered and marked over 105000 tests to date. Liaison with Computing Services and Central Administration is already well developed resulting in codes of good practice and established procedures agreed at the most senior level of the university.

Figure 3. Track Record at Loughborough



People

In order for such a project to be successful we have identified the principal stakeholders in the assessment process and involved them throughout. This is reflected in the project management structure:

Project Steering Group

Pro Vice Chancellor (Teaching) Loughborough (Chair)
Director, Staff Training and Development Loughborough
Director Computing Services Loughborough
Registrar Loughborough
Associate Dean (Teaching) Loughborough
External Member

Project Management Group

Chair and Project Manager and Director of Learning and Teaching Development
Project Officer and CAA Officer for the University
Computing Services Liaison and technical support
Corporate Information Systems liaison
Examinations Officer

Project Advisory Group

Science (Sci) Faculty academic representative
Engineering (Eng) Faculty academic representative
Social Science and Humanities (SSH) Faculty academic representative
SSH Faculty administrative representative
Eng Faculty administrative representative
Sci Faculty administrative representative
Faculty IT co-ordinators
Director of Staff Development
Director of the Quality Assessment Unit
Director of Audio Visual Services
Programme and Development Quality Team manager
Registrar
Assistant Director of Computing Services: Systems
Learning Technology Officer
Student Union Vice president for Education and Welfare
Director, Question Mark Computing Ltd
Specialist in intellectual property rights

The wider 'Advisory Group' are kept fully informed of the project so that they can elect to contribute at strategic points or are invited to provide specific information when required.

Analysis of the Assessment System

A full picture of the assessment process should be taken into account when considering how the new CAA System will impact on the University. The outcomes of our internal systems analysis regarding this are detailed in Appendix 1. The whole diagram, when put together, covered an entire wall of the CAA Unit!

System Features

Here we offer an example of some of the features of the system that have caused problems, and outline solutions.

Publishing route

The software is capable of publishing questions and sessions via ODBC. This requires an individual installation of the Oracle ODBC software on each client and is not a trivial installation.

Furthermore the ODBC Oracle account used for publishing requires access rights which pose a significant security risk. Anyone logged in to this account could damage the database. Furthermore the database design does not allow for multiple entries of question names, topic names and subtopic names.

Images and supplementary files are not held in the database but in a single directory. These are published to the server via a mapped network drive. This creates a major problem of files being overwritten by new files of the same name. This situation would rapidly get out of hand with large numbers of question authors.

For individual Topic, Resource and Session Names, the maximum number of characters is 50. The combination of Topic and Sub Topic Names cannot exceed 200 characters.

The workaround we have in place is a cumbersome file naming convention. Authors generate the questions and sessions locally according to the following convention:

In Question Manager

Question Database Name:

[Login Name_module code.question](#)

Topic Name:

Login Name_Module Code_Topic

Login Name_Module Code_Topic_Subtopic

Resource Name:

Login Name_Module Code_Topic_resource name.extension

Resource name in a subtopic:

Login Name_Module Code_Topic_Subtopic_resource name.extension

Example:

For 'admd' (question owner) to create a question database for module 'bsb210'

cmmd_bsb210.question

For 'admd' (question owner) to create a topic about 'cheques'

admd_bsb210_cheques

For 'admd' (question owner) to add a graphic of a signature to a question in the topic 'cheques':

admd_bsb210_cheques_signature.jpg

This question will be answered by students taking module bsb210

In Session Manager

Session Database Name:

Login Name_module code.session

Session Name:

Login Name_module code_session name

Where 'session name' is the subject matter

Example:

For 'admd' (session owner) to create a session database for module 'bsb210':

admd_bsb210.session

This database contains the session 'banking'

admd_bsb210_banking

To publish the material to the server the question author must use a file upload system. The relevant files are uploaded to a holding area on the server. A member of the project support staff must then check that the file naming convention has been followed before undertaking the publishing on behalf of the author. As more authors come on board this task will become non-trivial. Furthermore although individual questions and blocks of questions can be previewed locally, the finalised test as it would be seen by the students (including any feedback set), cannot be previewed on a single server system, unless published to that server. This is problematic for both the test author who wishes to try the test out, and the gatekeeper who needs to publish and schedule the sessions. The workaround may be to run two Perception servers, one of which is used for previewing.

Authoring Software Control

The two applications for authoring (Question Manager and Session Manager) are Windows only applications requiring a local installation. Furthermore a license file must be included. Ideally a single version of that software should be in use across the institution at any one time. At present authors request the software from a secure Members web site. They must complete various details about themselves and create an account before access is given to the installation files. This stores information about who has the authoring software and which version. As the project makes the transition from pilot to service we expect to firm up an alternative way of controlling this, perhaps by pushing out later versions to those clients who have already installed. We do not envisage pushing the software out to all client desktops at the University, but rather installing on demand. It is likely that in the future an 'InstallShield' type system will be used. However this requires negotiation with central Computing Services.

Automatic Candidate Authentication

A number of authentication options exist. The solution chosen will vary depending on institutional requirements. The options discussed below are automated. Note that self registration for authentication is possible under Perception by running Registration Manager and register.dll

Perception Security Database

Participants are authenticated on login using the data stored in Perceptions own security database. This database, which, in our case, is stored in Oracle tables, contains all the fields required to authenticate participants Login ID's and passwords. It also contains information about groups and which participant belongs to which group. Using this information, the participant is able to login and is then presented with the tests, which have either been assigned to that individual, or to the groups the individual belongs to.

The perception security database has to be updated by direct user input, or by using an automated scripting method, which takes data from another system and inserts it into the database.

This is the solution currently running at Loughborough. Automatic population of the Perception Security database by Perl scripts drawing on source information in the University MIS. This allows the import of student ID number, Email address, as well as module membership. We currently update nightly over 17000 participant registration details and over 3500 module registration details. This allows full use of the Perception administration tools. We can schedule a test to a module of students down to the year, month, day and minute.

Problems uncovered with this solution include the fact that Perception does not use standard encryption. Participant passwords are unencrypted! This is totally non-standard and means that it is impossible to copy across and use Novell passwords which are one way encrypted. The only work around we have found is to authenticate by the password issued at the time a user first registered with the University. This is clearly not ideal.

A further problem is another design issue within Perception. The facility to limit the number of attempts an individual can make on a particular assessment is supported. However, when applied to groups (in our case over 3500 module registrations), the attempt allowed is assigned to the group. If a single attempt is set, then the first group member to call that test takes the allocation. No other member of the group may take the test.

The work around to this problem is to schedule each session to individual members of the group. There is a feature that automates this process. However on a large scale implementation such as this we would expect to see an enormous number of schedules (4 sessions per module, 100 students per module, 3500 modules would result in 1.4 million schedules in the database!)

Perception Integration Protocol (PIP)

Perception Integration Protocol (PIP) is a tool provided to call Perception tests directly from another system. The Perception security database is bypassed. Another system, such as a VLE, passes PIP information to the Perception server, which then runs the test. The actual test run depends on the information sent.

All security authentication of the participant and the selection of the required test is performed by the 'calling' application. This application sends enough information to the Perception server to enable full updates of the reporting database. However the Perception administrative tools offered in security manager are lost and these powerful features are essential under the model being pursued at Loughborough.

Lightweight Directory Access Protocol (LDAP)

The Lightweight Directory Access Protocol is used by Perception to authenticate participants against an LDAP server database of user objects. Like PIP, the test is run from a 'calling' application, but instead of authenticating users against the calling application's security database, the LDAP server database is used. Perception's security database is again bypassed, and again the Perception administrative tools offered in security manager are lost.

Open.dll

This is a program contained within Perception which effectively 'cuts out' participant authentication. The participant must enter their login ID and group, but no password, to see the list of tests they can take. The security database is used to hold the group membership records and the participant ID's.

The Template Design Process

The decision was taken early on in the project to utilise Perception's template feature, and to impose a set of common question templates on all questions to be delivered by the system. This gives all questions the same look and feel, and guarantees that they meet minimum standards of usability e.g. at different screen resolutions. The chief reasons for this decision were:

- Experience with the Question Mark for Windows system had already shown that Quality Assurance checks on tutor-authored tests were very time-consuming. Imposition of a common template reduces the number of checks that need to be made before the Gatekeeper can publish a test session.
- Many of the authors who use the system are tutors engaged in service teaching. Their students are thus not from the tutor's own department, and if departmental templates were to be used, students would be exposed to 'foreign' templates and standards when taking tests. This imposes an extra, avoidable burden on the student.
- One of the major advantages of the question-banking in Perception is the ability to share questions. In other words, a tutor may set a test containing questions from a number of sources (e.g. an engineer may want to incorporate some mathematics questions in a test). If all question authors are using a common template, many of the problems involved with the mixing of questions simply go away.

The authoring tools are delivered to the tutor/authors in a packaged executable with a Windows installer, so the templates are incorporated in the package and installed along with the authoring tools. The templates have been designed with the advice of the Human Sciences & Advanced Technology Research Institute

(HUSAT) <http://info.lboro.ac.uk/research/husat/index.html>. Established in 1970, HUSAT is the largest centre in Europe for research into human factors and information technology. It provides research, training and consultancy from its human sciences base on any human aspect of the design, manufacture, implementation and use of advanced technology. The University Disabilities and Additional Needs Service were engaged in the design process to advise primarily on accessibility issues.

How many templates?

It was quickly established that a suite of templates was required. Perception has two modes of delivering questions:

1. Deliver the questions all-at-once on one web page, with a vertical scrollbar to move between questions. Submit the answers to all questions with a button at the foot of the page.
2. Deliver the questions one-at-a-time, with navigation buttons to move between them. Again, the answers are not submitted as they are answered, but only when the Submit button is pressed.

Whilst the one-at-a-time option is preferred for most uses of the system, it was felt that in some cases the ability to scroll back to an earlier question was useful, particularly where a test is structured in such a way that questions get progressively harder, and later questions test concepts which were established in earlier questions.

Features of the templates

Screen shots of the two template designs are shown in Appendix 2. It should be noted that the java script used by Question Mark in the one-at-a-time template is only supported by java enable Microsoft Internet Explorer.

The university has a standard web browser (a customised version of Microsoft Internet Explorer 5, with Java enabled and a set of plug-ins). Two screen resolutions are in common use: 800x600 and 1024x768. Both are accommodated by the templates, which use only standard fonts, and colours from the Internet Explorer palette.

- The test title is defined by the tutor who creates the test session. It must unambiguously identify this particular test because students may sit several tests during the course of a module.
- The candidate identifier is the student's registration number (also known as their library number). It is the standard way of identifying a student on a Loughborough exam paper.
- Tests are scheduled to groups which correspond to the students taking a particular module, so the unique module identifier is displayed on the test

header. A special module ("everyone") is defined for allowing universal access to a test session.

- On-line help is available to describe how to operate the system. The control for this will scroll off the page if using the all-at-once delivery template, which is why one-at-a-time delivery is preferred.
- Only standard fonts and text sizes/styles are used, for maximum browser compatibility.
- We have tried to maintain a clean, functional appearance with a minimum of distractions.
- Space for corporate identity is provided.
- The attributes of the screen area available for the questions is fixed, so authors know what shape, size and colour their "canvas" is. This allows the template to be modified without having to re-distribute new templates to every author after each change. It is the version of the template on the server which is used, not the version on the authoring client.

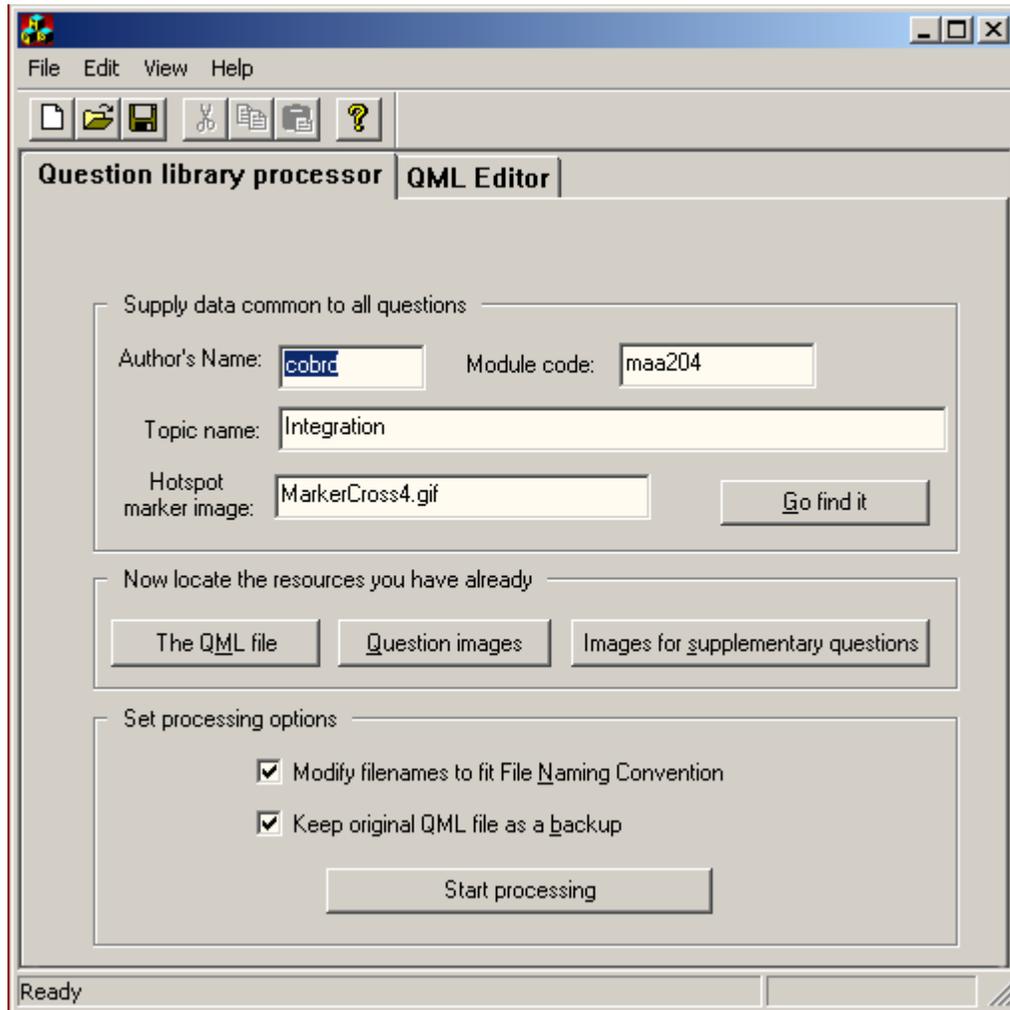
Conversion of existing CAA material

The existing Question Mark for Windows (QMWS) system has generated large numbers of tests which require conversion to Perception format. The two systems will run in parallel for at least one academic year whilst the conversion takes place.

The limitations of the Exporter software are well documented (http://www.qmark.com/uk/perception/manuals/authoring_manual/10%20qml%20windows%20exporter.html)

and an extra step in the export process has been introduced to work around some of the problems, and to allow our file naming convention to be applied systematically to all the components of a test. The tool, written in C++, is essentially a filter which generates a revised QML file based upon the output of Exporter and information added by the tutor.

Fig 4: The QML file post-processor



Technical Details

The hardware for the project was based on the Compaq 'Proliant' server platform. It was decided that this server would provide the most reliable and cost effective solution as it is 'industry standard' and contains many fault tolerant elements.

The server, which is rack mounted into a Compaq Rack system, is powered from an appropriate UPS power protection system and is located in an environmentally controlled room.

In summary, the hardware comprises:

Compaq Proliant ML370 - 1 x Pentium III-667MHz- 256KB L2 Cache.
3 x 18.2GB hard drives (10,000rpm) in a RAID 5 configuration (36GB usable)
384MB EEC memory
Compaq ROC 'on-board' RAID controller
100MB/s Full-Duplex Ethernet Network interface
Compaq Rack
APC 700VA UPS

There are two servers, one is used as the primary Perception server and the other as the secondary, development Perception server and data backup server containing a 35/70GB DLT tape drive.

The project has full documentation of the technical requirements and these will be made available as part of the project deliverables.

Automated Score Upload and Ratification Feature

The next stage of the project involves the design of a system to provide for the uploading of test scores to a holding area of the central student records database. In tandem with this feature we will provide an appropriate mechanism for ratifying these scores prior to automatically uploading to each student's record into the database

Project Deliverables

The project is committed to producing documentation outlining the process of embedding a central web CAA Service based on Question Mark Perception software and tied in to appropriate MIS to provide the assessment part of an emerging MLE. Where possible the approach taken will be generic in nature and aims to be of direct use to any institution considering similar work. The documentation will encompass the administrative, technical and pedagogical issues faced. Solutions and examples will be offered as appropriate. The final document will be available at the end of the project, September 2002, and will be disseminated by the JISC / JCIEL free to any UK HEI.

The Immediate Future

The project is funded until September 2002. We aim to bring on line a mass staff development programme once the system has been finalised. This should begin January 2002. In tandem with that, the Authoring Software roll out mechanism should be enacted by January 2002. The rest of that year will be spent recruiting staff, refining the system, preparing the documentation, and evaluating the project.

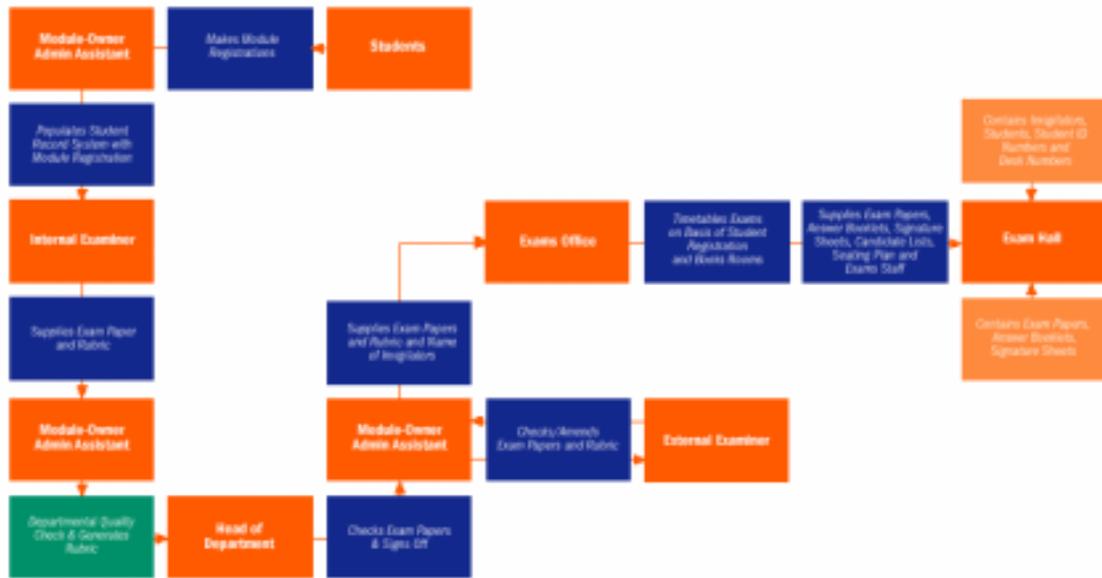
As is often the case with 'project funded' projects, we will begin lobbying for continuation funds.

Appendix 1 - Diagrammatical representation of the assessment process at Loughborough University

Coursework



Pre-Exam



Post-Exam



Appendix 2 - The standard one-at-a-time template

The screenshot shows a web assessment interface with a blue header bar containing the text "Web assessments at LU" and a logo. Below the header, a yellow navigation bar contains a "HELP" icon, the candidate's name "Candidate: Bryan", the assessment title "Assessment:", and the module name "Module: Editing".

The main content area displays "Question 6 of 7 questions in this part of the test. (There are 1 part(s) to this test)". The question text is: "With this sort of question, you answer it by typing words in the blank spaces: The [red box] and the pussycat went to [red box] in a beautiful pea-[green box] boat". A red arrow points to the question number "6" in the left-hand column of question indicators.

Below the question text, it states "This question is worth 3 mark(s)". A yellow highlight covers the text: "This is the current Question-by-Question (QbQ) template for Perception. The yellow area's share of the screen will remain fixed, so the white area is the canvas on which the questions will be delivered." A green line points from this text to the yellow header bar.

Below the yellow highlight, there are four explanatory paragraphs:

- "There is one question button per question, allowing random access to any question in this block. The Buttons may be highlighted in red. Highlighting is for use as an indicator only. With > 10 questions per block, a scrollbar is used to view question buttons which won't fit into the top section of the left hand column." A green line points from this text to the question indicator buttons.
- "The candidate may amend their answers up to the point when the Submit button is clicked. Then all of the answers for this block are send to the server in one go - keep blocks to < 13 questions so the candidate is less vulnerable to network or computer crashes." A green line points from this text to the "Submit" button.
- "The header section contains a help button explaining what the screen objects do (but not how to answer the different types of question) and also a note of the test name, their name, and their module. This is to allow candidates and invigilators to see that the right candidate is taking the right test." A green line points from this text to the yellow header bar.
- "Rubric items are in grey. The value of the question (in marks) is shown, as it normally is on paper exams. The current layout can only show where the candidate is in THIS BLOCK of the test, along with a note of how many blocks there are. Ideally, we should want an indication of progress through the entire test, not just this block of questions." A green line points from this text to the question indicator buttons.

At the bottom of the interface, there is a yellow bar with four buttons: "Highlight", "Previous", "Next", and "Submit".

The standard all-at-once template

Web assessments at LU

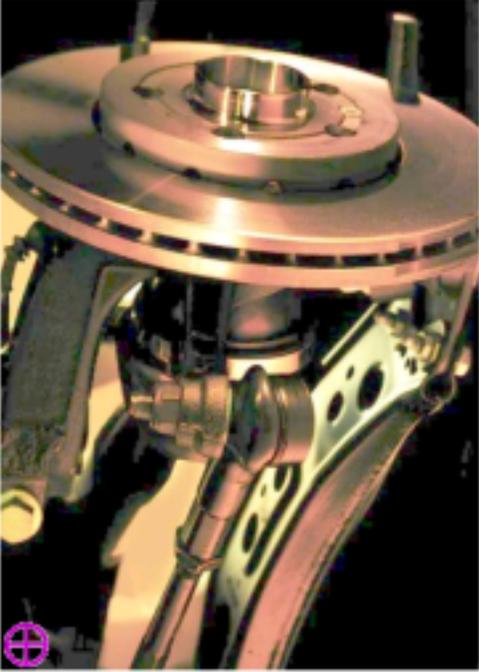
	Assessment Title: Web assessments at LU	
Candidate: Bryan	Module: Editing	

1 of 7 questions in this block. (1 blocks of questions)

N.B. Questions 1 - 6 have been removed

7 of 7 questions in this block. (1 blocks of questions)

Click on the item you would turn in order to adjust the tracking on this vehicle.



This question is worth 5 mark(s)

Submit

This template displays all of the questions in a block on one page, with a scrollbar to access questions which are out of sight. The header details will eventually scroll out of view.

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