THE DESIGN OF MULTIMEDIA ASSESSMENT OBJECTS

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Introduction

Computer programs delivering MCQ date back to the 1970s (Morgan, 1979) and with the evolution of technology and research more sophisticated question styles have emerged within Computer Assisted Assessment systems enabling diverse assessment methods. Many universities have invested in learning management systems (LMS) which provide assessment features but these are often limited in contrast to specialist CAA software (Pretorius, 2004). For example Questionmark offers a diverse array of question styles that enable graphical elements to be incorporated to facilitate the development of drag and drop style questions and this feature is not available within many LMS. The inclusion and integration of other forms of multimedia questions comprising of simulations, video and audio into Questionmark is feasible but requires development in an authoring environment such as Macromedia Flash. However, the adoption of these multimedia style questions have largely been ignored due to feasibility reasons (Bennett et al., 1999).

Flash has successfully been utilised in the development of multimedia learning objects. There is evidence to suggest that these objects can improve students' ability to understand abstract concepts such as arrays in computer programming (Bradley, Boyle, & Haynes, 2003). However, (Gadanidis, 2004)

suggests that one of the weakest aspects of learning objects is the formative assessment aspect, which can merely require the user to drag random words to a location and if incorrect these words are returned to their original position, offering the user very little feedback. An example of this is evident within the multimedia learning objects developed for first year programming http://www.ics.heacademy.ac.uk/Resources/Learning_Objects/example.shtml, in the 'if statement' example the students are required to identify the errors in several lines of code by clicking in the appropriate place, however, at the position where the incorrect code occurs the cursor changes appearance, thus informing them of the right answer.

By separating the multimedia learning objects into learning and assessment objects the flexibility of these items could be enhanced. The multimedia assessment objects can be embedded into course web pages and learning objects to facilitate learning through formative assessment or alternatively integrated into LMS or CAA systems such as Questionmark or TRIADS for summative assessment. There is considerable literature surrounding the design and implementation of CAA (Bull & McKenna, 2004; Sim, Holifield, & Brown, 2004) and this paper examines the feasibility of combining the two paradigms, CAA and learning objects, to devise multimedia assessment objects that can complement both fields.

Question Design

Flash was used to author a number of multiple choice style questions with a predefined number of options, see Figure 1. The user interacts with the CAA system, which in turn interfaces with the Flash code, concurrently producing the question with random parameters. Based on these random parameters a correct answer and a number of suitable distracters are created. The correct answer is randomly assigned to one of the options and to the remaining options distracters are assigned.
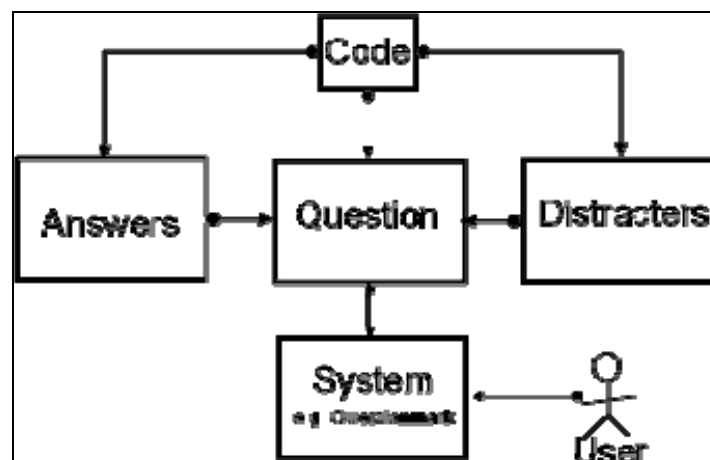

Figure 1. Flash random question model

For summative assessment randomisation could help reduce the chance of cheating, as students are less likely to receive the same questions. However,

comparability of the randomly generated questions was a concern, therefore in some instances the randomisation was limited and the lecturer also ensured that the variations were all assessing the same cognitive level.

This approach caused initial difficulties as students usually need to be able to navigate freely between questions and alter their answers at any interval during the test. Therefore, the randomisation needed to be constrained to ensure that although the question initially used random parameters, when a student returned to the question at any given time during the test the same parameters would have to be loaded, along with their answer. This was achieved through using local shared objects within Flash, these perform like cookies storing both the students answer and the question parameters.

For formative assessment the randomisation would offer the students the chance to have multiple attempts at the questions with slightly different parameters. Tests could be scheduled allowing unlimited attempts or alternatively the questions could be embedded into e-learning content. This would enable students to gain an insight into their understanding of the subject domain and upon returning to the test alternative questions may be generated reinforcing their understanding of the subject or providing additional feedback.

Figure 2 shows an example of a question generated using this approach in Networking. The students are required to identify which one of the images is a correct network configuration. The question is generated by selecting one correct answer and two distracters. At present there are two correct diagrams and three incorrect distracters enabling six variations of the question to be generated. The scope for future development is based on these questions acting as templates and by developing new graphics additional questions can be derived.

Figure 2. Example of network question based on model

Similar multiple choice style questions have been generated using the same principles for a first year web development module, examining HTML and JavaScript syntax.

A different style of question was developed for networking Figure 3. The network diagram question required more complex user interaction, the users have to attach repeaters and cables to the buildings using point and click. Due to the complex interface there is a greater need for usability testing and evaluation (Dix, Finlay, Abowd, & Beale, 2004; Fulcher, 2003). Usability testing was conducted with a small sample using a structured walkthrough approach and the results prompted a redesign to make the process of answering the question more efficient.
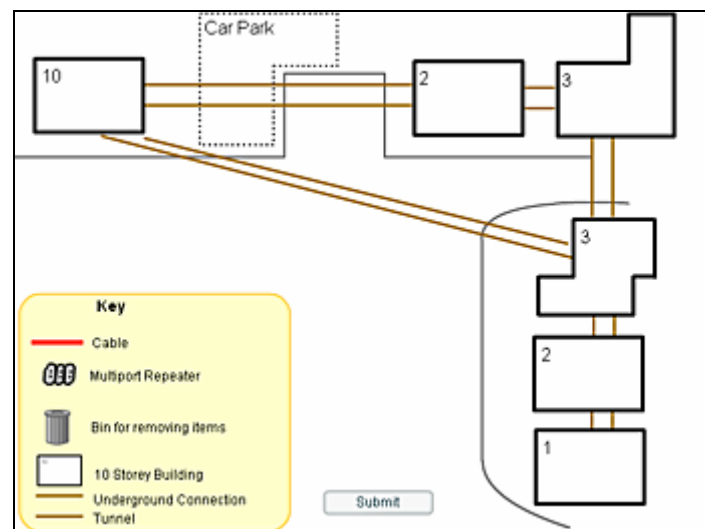

Figure 3. Network Question Interface

Students Evaluation

To evaluate the students' perception of the multimedia assessment objects nine questions were made available to the students on the web development module. The objects were embedded into Questionmark to produce a test and this was initially accessed during their practical class. Following the test the students completed a questionnaire to obtain feedback and their initial thoughts, comprising of a series of Likert style questions (1=strongly disagree and 5= strongly agree) and a number of open-ended questions. A total of 35 students completed the questionnaire and some of the results are displayed in table 1.

Question	Mean
These styles of questions would support my revision	3.86 (.81)
I would like more of these styles of questions to support my learning	3.83 (.89)
I would like these styles of questions in my graded test	3.40 (.95)
I would find similar questions in other subjects beneficial for my learning	3.61 (.86)

Table 1. Means and standard deviations for the questionnaire

Although there were a limited number of questions covering a small aspect of the syllabus, it would appear that the students felt that the multimedia assessment objects could have the potential to assist them in their studies. For revision purposes one student commented 'Its good to help revision – so you can go through the questions again but they change the order and stuff' and another student completed the test five times the evening before their final exam, supporting the use of using randomised parameters.

Discussion and Limitations

This paper has examined the feasibility of developing multimedia assessment objects using Flash. Once the question is generated it is possible to export it in various formats to be integrated with LMS and CAA systems such as Questionmark. However, the amount of data that can be transferred between the two systems is limited with only two parameters being passed, either correct or incorrect. It is possible to transfer other variables to enable partial credit within Questionmark but this requires amending the source code. Further research will be conducted with WebCT to evaluate whether partial credit can be awarded. If partial credit cannot be awarded then the more complex simulation style questions may be limited to formative assessment.

Accessibility was a concern and as a consequence the radio button components were used with Flash to ensure the content is accessible to certain screen readers. In adopting this approach the number of characters per option was limited to one line of text. However the questions requiring point and click do not enable the same level of accessibility and alternatives styles may be required.

Further research will examine the objects from a usability and Human Computer Interaction perspective. Additional evaluations of the questions with first year undergraduate students within Questionmark will also be conducted to ascertain their attitude and any further limitations.

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