Using a Web Based Tool to Innovate Assessment Practices

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Abstract: This paper describes a web based assessment tool that was used by first year undergraduate computing students. The rationale for the project is described, referencing work on educational taxonomies. The process of relating the parts of an assignment to different cognitive levels in Bloom's taxonomy is briefly discussed and the web-based tool is explained. How the tool has been used and evaluated is then presented. Early results suggest that students who used the tool were either very positive or very negative about the product and the concept. Future work, focussing on the development of a generic tool, is outlined.

Introduction

In the undergraduate environment within which this project was based, students are normally assessed by a combination of coursework and examination. The coursework is generally made up of one or more assignments that are task based and are designed to assess a subset of the learning outcomes for the module.

Most of the work on innovation within the student assessment process focuses on e-assessment and the use of tools and paradigms to support this notion (Bull & McKenna, 2001), (Gunnarsson, 2001). Electronic submission and automated testing are seen as key products but the process of assessment has been identified as a weak component of e-learning (Reeves & Aggen, 2002).

The project described here is different in that the students produced a traditional paper based submission following a process in which they '*designed*' their own assignment. The rationale behind this thinking was that this would give students some control over the assessment process which would in turn have a positive effect on their self-confidence and competence (Northcote & Kendle, 2001), (Ames & Ames, 1985). Students were given the opportunity to choose the level at which they wished to work and by making this choice they were also deciding the maximum grade they could achieve for the assessment. Evidence suggests that grades are a motivational factor for students, (O'Reilly & Newton, 2002) and the process of making judgments about one's own learning and level of achievement is a characteristic of self-assessment (Boud & Falchikov, 1989). As a consequence, students who take

control of, and make judgments about their own assessment are expected to experience a sense of individuality that leads to higher motivation under Theory Y (McGregor, 1960).

The process of enabling students to make choices about aspects of their own assignment raises issues concerning the soundness of the assessment. Educational taxonomies were investigated to ensure content validity (Anderson & Krathwohl, 2001), (Biggs & Collins, 1982), (Bloom, 1956). Although any of the identified taxonomies would have aided in generating a valid assessment, Bloom's Taxonomy was applied to the assessment because of its widespread acceptance in educational institutions (Reid, 2002), (Paterson, 2002), (Mayer, 2002). Through the classification of the various tasks within the assignment a formalised grading criteria could be established based on the complexity of the problem.

The Development of the Tool

A sample assignment from a previous year was examined in order to formulate a specification for the web-based tool. This specification was made up of essentially three parts; there was a list of four learning outcomes that the assignment was purporting to test, there was a description of the tasks that were needed to be completed with the deliverables for each task described, and there was a list of assessment criteria which specified to the student what had to be done to achieve grades of 40%, 50%, 60% and 70%. These assessment criteria were largely related to the individual tasks that made up the assessment.

The learning outcomes in this sample assignment were:

- Describe and use a variety of techniques for problem solving
- Generate a range of possible solutions to a problem
- Present discuss and justify solutions
- Apply mathematical techniques for analysis and reasoning about problems

The student tasks in this sample assignment were to:

- Research cryptology and present their findings
- Generate and test an algorithm for encoding data

Defining the Tasks

The assignment that was being designed for the new cohort was expected to test the same learning outcomes as the one that had been used previously; thus, the only thing that needed to change was the tasks that the student would do.

It was determined that there would be three tasks for the students to complete.

- Research about algorithms
- Interpreting / writing algorithms
- Interpreting / writing about how to test an algorithm

Having identified the three tasks, two or more levels at which competence could be measured were added for each task (see Table. 1). This information would originally have been documented in the assessment criteria distributed with the assignment.

	Achievement Level 1	**Achievement Level 2**	**Achievement Level 3**
Task 1	Find information about algorithms and summarize it	Interpret information about algorithms for a novice user	
Task 2	Interpret an algorithm	Modify an algorithm	Write an algorithm
Task 3	Test an algorithm with test data that is supplied	Design and implement a test strategy for an algorithm	

Table 1: Linking different tasks to different levels of achievement.

Further flexibility and choice was added for the students by allowing three levels of task complexity and a choice of different presentation methods. They could therefore select a problem domain that ranged from quite simple to quite complex and were also able to present their work orally, visually or in text, looking at broad areas or at narrow applications.

Analysis

By applying Bloom's taxonomy to the tasks and achievement levels in Table 1, it was possible to relate the level of each task to a specified cognitive level. It was identified that the assignment only tested the first four cognitive levels in the taxonomy, Knowledge/Comprehension (KC), Application (AP) and Analysis (AN).

The decision to consider knowledge and comprehension together was taken following discussion that concluded it was not possible in a piece of work of this nature to assess knowledge without comprehension. A cognitive level was allocated to each entry in Table 1 above, for example in task 2, Level 1 - interpret an algorithm was classified as KC, Level 2 - Modify an algorithm as AP and Level 3 - write an algorithm as AN.

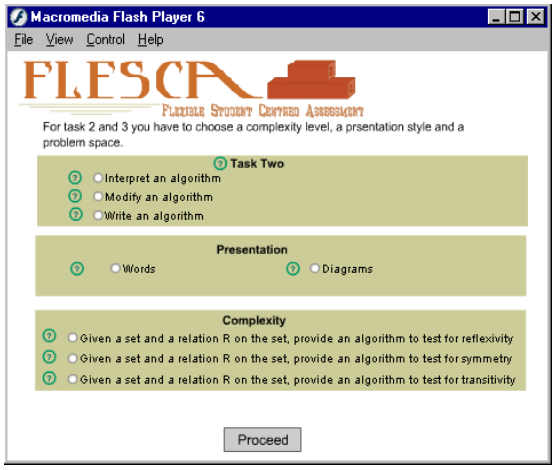
Given this information it was possible to generate a matrix that determined maximum marks for each combination of task complexity and cognitive level (CL) see Table.2.

	CL = KC	CL = AP	CL = AN
Least complex task	40%	50%	60%
Average complexity	50%	60%	70%
Most complex	60%	70%	80%

Table 2: Marks given for each task/level.

Implementation

The application constructed can be viewed at http://www.uclan.ac.uk/flesca/index.htm. It takes the student through the choices for each of the three tasks.



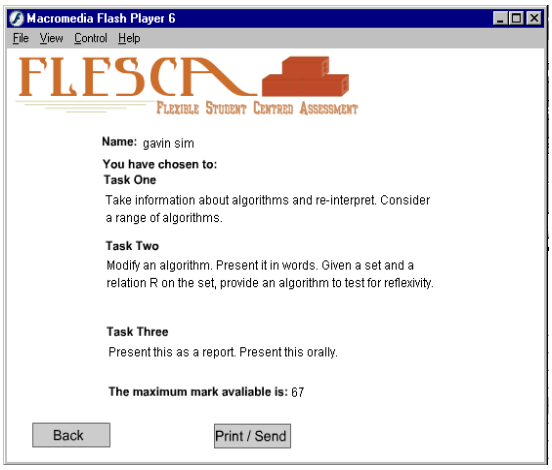


Figure 1: Making choices in the FLeSCA tool **Figure 2**:. The final assignment brief.

Student choices were validated to avoid incorrect and incomplete entries. A default assignment choice was added to the first screen that generated an assignment for any student who was uncomfortable with the process. As this was a new concept for many students, on-line help was made available by means of pop-up text files. The application was developed in Flash ®and used Active Server Pages (ASP) to connect to the Microsoft Access ® database. It was hosted on the department web server and was available to students both from inside and outside the University.

When the student had made his/her choices, s/he was presented with a maximum mark that could be achieved for the assignment. This was generated automatically from the selections that the student had made. Students had the opportunity to revisit their selections if they wanted to re-consider their choices. When they were satisfied, their personal assignment specification was created; this was made up of learning outcomes, tasks, deliverables, and assessment criteria.

Evaluation

In May 2003, seventy-five students used the tool to design their final assignment for a first year undergraduate module. Feedback about the process was collected in a variety of ways, there was the submitted work from the students, the content of emails from the students to the module leader, person-to-person communiqués and comments that were elicited from a questionnaire that was completed by forty students after the assignment had been handed in (but before it was marked).

Findings

Students generally reported that using and accessing the web site was straightforward. About equal numbers accessed from home as from the university. Some students encountered difficulties with the tool, there was an early usability problem that related to printing the assignment and as a number of students did not print the assignment this resulted in their choices not being recorded in the database. Additionally, it was not easy to export the file to another location but the students resolved this themselves (being IT literate!).

31 students emailed the module leader with a range of problems. The majority of these related to their understanding of the requirements of the assignment specification but some were about the operation of the web site; a recurring problem was that students complained that the site was down when they had simply failed to download the Flash player.

In the questionnaire, 18% reported that they had only used the tool once, 75% claimed to have used it between 2 and 5 times with the remaining 7% visiting more than 5 times.

Marking the Students' Work

The module leader marked the work that the students submitted. The variety and the differing nature of each assignment meant that a new approach had to be taken to the marking process. It was initially decided to start with the assignment specification that allowed the maximum mark to be gained. Following this the lecturer established whether the tasks had been completed and then further assessed the competence with which they had been completed. This proved problematic on three counts:

1. Some students did not include an assignment specification, or included an incorrect assignment specification
2. Some students had misunderstood the specification and had typically done task two wrong
3. Some students were getting 100%

Most of these problems were overcome by adopting a two handed marking system, one for those assignments for which 1 and 2 above did not apply, and the second for those assignments for which special allowances had to be

applied. Two students gained 100%, this was considered to be exceptional but it was decided to let these marks stand.

Evaluation of the Process

Students who completed the post task questionnaire were asked to comment on the site, the tool, and the process of designing their own assignments. They were asked whether or not they would like this flexible approach to be applied to other assignments. The results were that 52% were in favour of such an extension, 5% were undecided and the rest were against. The questionnaire also asked for positive criticism and gave students the chance to add their own thoughts as to how the process could be improved. The positive comments that were made related to fairness, flexibility, and the opportunity to use ones own initiative. Some students suggested that this sort of process would be particularly well suited to programming or Investigative assignments.

Discussion

In adopting an innovative assessment strategy a number of issues arose that affected both the lecturer and the students. It has been identified that for this sort of assessment to be effective, clear instructions and guidance must be provided to students to ensure they are familiar with the procedures and so that there is no ambiguity in relation to the assignment specification. Marking the assignment caused additional workload as grading criteria for a range of possible assignments had to be produced. Despite some of the technical problems the general feedback from the students was positive and further development of the tool especially the production of the assignment specification could enhance the software.

Further research is planned with other modules and the concept will be expanded into a generic framework that will assist staff to dissect their assessments in a similar manner. Future work is planned to generalise the process of breaking an assignment into components and relating it to educational taxonomies. Ideally this tool would include a facility to automatically generate a student interface for the generation of individualised assignments.

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