FLeSCA – A LA CARTE ASSESSMENT

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ABSTRACT

This paper describes how a Flexible Student Centred Assessment Tool was developed for first year undergraduate computing students. We describe the rationale for the project, referencing work on learning styles and educational taxonomies. The process of relating the parts of an assignment to different cognitive levels in Bloom's taxonomy and different learning styles is described. The design of the web-based tool is explained and we go on to describe how the tool will be used and evaluated. Early results suggest that the tool has a high level of functionality. Future work, focussing on the development of a generic tool, is outlined.

Keywords

Learning styles, Assessment, Educational Taxonomies

1. INTRODUCTION

The project described in this paper follows on from a pilot study which suggested that first year undergraduate students could benefit from some elements of flexibility in the assessment process [1]. In this earlier study students were offered a choice of two different presentation methods in each of three assignments. The current project takes this a step further by allowing an 'a la carte' choice within one programming–based assignment. This paper begins with an overview of the relevant theory and then goes on to describe the process by which the FLeSCA framework was devised. We then go on to present some early results and in the discussion suggest some areas for further work.

2. DESIGNING FOR INDIVIDUALS

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There were two key reasons for wanting to consider flexibility in this project. One was to investigate the effect of allowing the students to take some control of the assessment process. The second was to investigate the relationship between educational taxonomies, learning styles and the sort of choices that may be offered to the students.

A typical assignment in an undergraduate module is a specified task that aims to assess a subset of the learning outcomes for the module. In this model of assessment the locus of control is entirely with the lecturer and not the student. The lecturer controls the choice of task, the level of achievement required for success and the time limits for completion. Additionally, because of the structure of the academic year, students are often faced with a series of coursework deadlines in quick succession. It is not uncommon for a sense of panic to set in, particularly when students are faced with coursework in 'hard' subjects such as programming or logic.

There is evidence to suggest that a student's intellectual performance may be undermined by a perception that they lack control [2]. Although it may not be advisable to hand control entirely over to the student in an assessment, the FLeSCA project investigates the possibility of handing at least some control to the student. Individual's concepts of control, competence and self-confidence have been shown to be closely inter-linked [3]. It is proposed that by handing back some control to students there may be a positive effect on the self-confidence and competence shown by the student in the assessment process.

The confidence/competence issue is also linked to motivation. In this project students are asked to choose the level at which they wish to work. By making this choice they are also deciding the maximum grade they can achieve for the assessment. Evidence suggests that grades are a motivational factor for students [4]. The process of making judgments about one's own learning and level of achievement is a characteristic of self-assessment [5]. 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 [6].

Another part of the rationale for using flexible assessment is the way in which different cognitive or learning styles may influence a student's preferred method of working. An individual's learning style is a reflection of the characteristic strengths and preferences they display when taking in and processing information. There is extensive literature on the subject of learning styles, and a number of learning styles have been investigated in the process of preparing for this project [7] [8] [9]. Although a wide variety of models of learning styles are proposed in the literature, some common themes run across the different approaches. The wholist/analyst and the verbaliser/imager are two dimensions that are frequently referred to across a wide range of the research. In the wholist/analyst dimension, analysts prefer to acquire and process information in component parts, while wholists prefer to refer back to a global view of the topic. In the verbaliser/imager dimension, verbalisers prefer to think and handle information in words while imagers prefer to think and handle information in pictorial form. In this study we use these two dimensions to create choices for the students.

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 [10] [11] [12]. For the purpose of this study any of the identified taxonomies would have aided in generating a valid assessment. However, due to our familiarity with Bloom's taxonomy and its widespread acceptance in educational institutions this was applied to the assessment [13] [14] [15]. Through the classification of the various tasks within the assignment a formalised grading criteria can be established based on the complexity of the problem. Reliability is still considered to be an issue and we expect that analysis of the students' results will help construct conclusions about the validity of this assessment process.

3. HOW THE MENU WAS CONSTRUCTED

The project began with an idea and a previous assignment brief. We hypothesized that we could break up the assignment objectives and make multiple representations for each objective that could be specified in different ways to suit different learning styles. A plan was devised that would ensure the successful completion of the project (Figure 1). This was essential as we were working to a tight timetable.

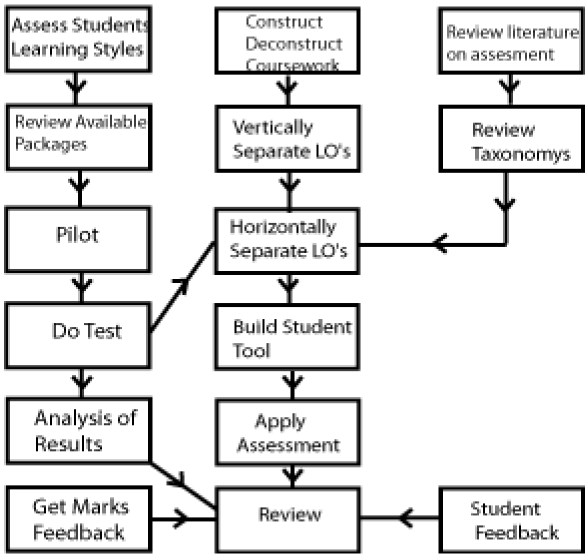

Figure 1. Outline plan for project

3.1 The Original Assessment

The equivalent assignment from the previous year assessed four learning outcomes and consisted of two tasks. The learning outcomes 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 were to:

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

3.2 Defining the tasks

It is the policy within the host institution to revise coursework annually, hence our first task was to decide what would be in this year's coursework and then we had to build in flexibility. The learning objectives had to be met and it was expected that the student tasks would involve finding out about, describing and testing algorithms. We determined that there would therefore be three tasks for the students to complete. Having identified these three tasks, we then decided on two or more levels at which competence could be measured for each task (see Table 1).

	L1	L2	L3

T1	Find information about algorithms and summarize it	Interpret information about algorithms for a novice user	
T2	Interpret an algorithm	Modify an algorithm	Write an algorithm
T3	Test an algorithm with test data that is supplied	Design and implement a test strategy for an algorithm	

Table 1. Linking different tasks (T1, T2, T3) to different levels of achievement (L1, L2, L3).

For each of these three tasks, it was also considered that different presentation methods could be used. The motivation for allowing this sort of choice was that different students had different learning styles and they may prefer one mode of presentation to another (see Table 2).

	P1	P2
T1	Investigate a range	One in detail
T2	Words	Diagrams
T3	Oral	Written

Table 2. Linking different tasks (T1, T2, T3) to different presentation methods (P1, P2).

For task one (T1), either a range of algorithms could be explored or one in detail; for task two (T2), the algorithm could be presented in words or in a diagrammatic way and for task three (T3), the work could be presented in writing or orally.

More choice was added by allowing three levels of task complexity (see Table 3). This allowed students to select a problem domain that ranged from quite simple to quite complex. In different circumstances it would also be possible for C1, C2 and C3 to be equally weighted.

C1	Given a set and a relation R on the set, provide an algorithm to test for reflexivity
C2	Given a set and a relation R on the set, provide an algorithm to test for symmetry
C3	Given a set and a relation R on the set, provide an algorithm to test for transitivity

Table 3. Different levels of task complexity (C1, C2, C3).

3.3 Analysis

By applying Bloom's taxonomy to the tasks and levels in Table 1, it is possible to link the level of each task with the taxonomy. We decided that there were three cognitive levels (CL) to consider for this assignment, these were:

Knowledge / Comprehension (KC)

Application (AP)

Analysis (AN)

The decision to consider knowledge and comprehension together was taken following discussion during which we felt that it was not possible in a piece of work of this nature to just assess knowledge without comprehension.

	L1	L2	L3
T1	Find information summarize it = KC	Take information and interpret it = AP	
T2	Interpret an algorithm = KC	Modify an algorithm = AN	Write an algorithm = AN
T3	Test an algorithm with supplied data = AP	Design and implement a test strategy = AN	

Table 4. Linking tasks to Bloom's Taxonomy.

Given this structure it was possible to generate a matrix that determined maximum marks for each combination of complexity and cognitive level (CL)

	CL = KC	CL = AP	CL = AN
C1	40%	50%	60%
C2	50%	60%	70%
C3	60%	70%	80%

Table 5. Marks given for each task/level.

4. IMPLEMENTATION

We developed a website (www.uclan.ac.uk/flesca) and built an application which enables students to generate their own personalized assignments. The application leads the student through the choice process for each of the three tasks. For task one (T1) students had to decide which level they were aiming at and how they would present their findings. This resulted in a three-piece code consisting of a choice of task, level and presentation type, e.g. T1, L2, P1, which was stored in a database.

For task two (T2) the student had to decide which level they were aiming at, how they would present their findings and what complexity of problem they wanted to solve. This resulted in a four-piece code consisting of a choice of task, level, presentation type and complexity, e.g. T2, L3, P1, C2. This was also stored in the database.

For task three (T3), as with task two, the student had to decide which level they were aiming at, how they would present their findings and what complexity of problem they were solving. In this particular application, students had to choose the same complexity of problem across both tasks two and three and so the code for C for task three was automatically generated.

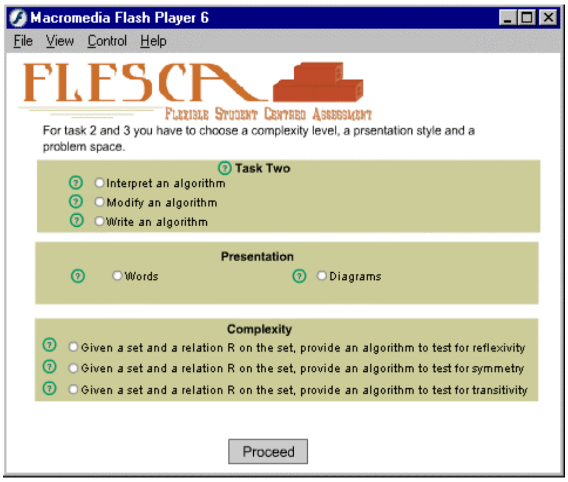

Figure 2 Making choices in the FLeSCA tool

Student choices were validated to check for illegal choices. In addition, there was a default assignment choice added to the first screen that generated an assignment for any student who was uncomfortable with the process. On-line help was made available by means of pop-up text files. The application was built in Flash and used Active Server Pages (asp). It was hosted on the department web server and was available to students both from inside and outside the University.

Figure 3. The final assignment brief.

When the student had made his/her choices, s/he was presented with a guideline maximum mark that could be achieved for the assignment. This was generated automatically from the codes for each task, the data in Table 4 and the weightings applied to the three tasks that were 30: 40: 30 (T1: T2: T3).

Students had the opportunity to go back if they wanted to re-consider their choices. When they were satisfied, the assignment specification was created which was made up of learning outcomes, tasks, deliverables, and assessment criteria.

5. Results and Findings

At the time of writing this paper, the students have not yet begun to do the assignment, therefore it is too early to report results on their choices and their opinions of the site and the process. However, we are able to report some preliminary findings.

5.1 Usability of the site

The prototype tool was evaluated for usability by a group of second year students. Students liked the fact that the tool opened in a new window and found the rollover help very supportive. It was commented by these students, who had done a similar task last year, that the assignment specification generated by the tool did not include enough detail and it was suggested that the help files be incorporated into the generated assignment. Students commented on small issues such as font size, the links on the website and some difficulties with the Flash player on some machines. A repeated observation was that when students were using the tool they could not go back and also that there appeared to be no validation of the email address. This group of students also made some constructive suggestions relating to the content of the individual pages.

5.2 Learning Styles

In this study we have used Riding's 'Cognitive Styles Analysis' instrument [16] to help students to identify their learning style. We have begun this process and have observed that the instrument appears to generate a wide range of results. Anecdotal feedback from the students indicates that they find the instrument straightforward to use. However testing each student's learning style is a time-consuming process and at this stage we remain unsure of the validity of the results and their usefulness for this study.

6. Discussion

6.1 Further Work with the FLeSCA Tool

The usability evaluation has informed us of potential problems with the tool before it goes 'live'. These are currently being resolved, as it is essential that the tool is robust and accessible to all students, since they have to have initial access to the site on the same day.

To evaluate the tool in action we intend to gather both quantitative and qualitative data. We will monitor web site activity – noting particularly how often students revisit the site, and whether or not they change their assessments before settling on one specification. Students will be asked to complete a questionnaire that will elicit their views, not only on the tool, but also of the choices offered to them. We have data from previous cohorts relating to the time taken by lecturing staff to mark a similar assignment. It is proposed that measurements be taken for this assessment, given that it is likely that there may be a difference. When the assessments have been marked and returned to students, a separate questionnaire will determine whether or not, given the mark that they then have, students are satisfied with the process.

6.2 Future Work

Future work is planned to generalise the process of breaking an assignment into parts and relating it to learning styles and educational taxonomies. It is hoped that we will be able to produce a generic tool that can be used by lecturers to support this process. Ideally this tool would include a facility to automatically generate a student interface for the generation of individualised assignments.

6.3 Acknowledgements

We acknowledge the support of the LTSN-ICS development fund for this project.

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