

INFORMATIVE REPORTS – EXPERIENCES FROM THE PASS-IT PROJECT

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Informative reports – experiences from the Pass-IT project

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Abstract

The PASS-IT Project (**P**roject on **A**ssessment in **S**cotland using **I**nformation **T**echnology) has organised a series of experiments to measure the effectiveness of on-line assessments in a range of subjects and levels across Scottish schools and colleges (PASS-IT, 2003). In order to analyse the data from these experiments properly it has proved invaluable to prepare electronic reports on candidate performances in the on-line assessments. This paper describes the work of PASS-IT, the role of e-reports to enlighten research findings and how such e-reports can enhance the teaching and learning process.

Some background

In the year 2000 the Scottish education system adopted a two-stage approach to the measurement of learning in schools and colleges. Each traditional annual course was sub-divided into units; typically three units make up one annual course. Each unit, roughly one per term, would have minimum competencies assessed at the end of term with a pass/fail as the only outcome. Only students who gain a pass in all three units of the course are entitled to take the end of course assessment. This end of course assessment contains questions to measure both lower and higher order skills as defined by Bloom et al (Bloom et al 1956/1964). The teacher in the classroom marks the unit tests, taken from what is called the National Assessment Bank (NAB) of questions, and then reports to the Scottish Qualifications Authority (SQA) which of the pupils are eligible to take the end of course assessment. The SQA moderates this process.

The PASS-IT Project is preparing assessments in Scotland using information technology across a wide range of national qualifications for students at both

secondary schools and further education colleges. The two-phase project started in August 2002 with phase one ending at the end of October 2003. The £1M funded project brings together the leading educational agencies in Scotland including the SQA, Learning and Teaching Scotland (LTS), the Scottish Further Education Unit (SFEU), BBC Scotland and the Scottish Centre for Research into On-Line Learning and Assessment (SCROLLA) at Heriot-Watt University.

In phase one, on-line assessments were created to test the minimum competencies in selected units of Higher National Computing, Advanced Higher and Higher Mathematics and Higher Chemistry (Advanced Higher and Higher in Scotland correspond respectively to the A and AS levels in England, Wales & Northern Ireland).

In phase two of PASS-IT, between November 2003 and the end of October 2004, further e-assessments are planned in Access 2/3 and Intermediate 1/2 Mathematics (levels at or below GCSE in England), Higher French (both Reading and Listening), Intermediate 1 English, and Higher Music. For further details about PASS-IT the reader is directed to the website at <http://www.pass-it.org.uk>.

The status of reports pre PASS-IT

The reporting system used in the PASS-IT project has evolved from the embryonic work undertaken at Heriot-Watt University as part of the CALM Project in the middle 1980s (CALM). During the development of learning resources for a first course in Calculus, a formative test, as part of the CALM package, was delivered every week of a 25-week course. The students on this course chose, on average, to spend three-quarters of their tutorial time on the weekly test section and the tutor used a reporting system on performance to feed back his comments to the 250 - 300 students on the course. This supplemented the automatic feedback provided by the tests themselves. This crude but effective reporting system gave the tutor access to marks in all versions of the test (typically three modes of delivery providing different levels of help), the chance to look at an individual student's progress across the range of tests and, if necessary, to go into a particular test to view the answers being input to each step of a question. This level of detail enabled the tutor to make meaningful comments and report them back to groups of students on a weekly basis. It was an efficient way for one person to monitor the performance of such a large group of students but in those early days the data was not saved onto a database for further analysis.

Just before PASS-IT began Heriot-Watt University had undertaken a major educational development to produce high quality, interactive teaching and learning materials in the SCHOLAR Programme (SCHOLAR). SCHOLAR set out to create on-line resources at the levels of Higher and Advanced Higher in Biology, Chemistry, Computing, Mathematics, and Physics and at Advanced Higher in French. These resources included a number of formative

assessments within each unit. The success of SCHOLAR has ensured that all 32 of the Scottish educational authorities have become members of the SCHOLAR Forum, putting over 40,000 students and teachers on-line in this comprehensive programme of on-line education.

As part of SCHOLAR a reporting system was put in place in which students and their teachers could view the record of achievement as the course progressed. Experience at continuing professional development (CPD) events reveals that many teachers are still not aware of the power of the SCHOLAR reporting system, but those who do use it find it most helpful in keeping track of student progress. For students themselves the ability to see how they are performing can also be a driver towards independent learning.

Versions of the SCHOLAR material are used internally at Heriot-Watt University in Physics and Chemistry to teach first year undergraduates. Here the reporting system is employed to supply information on student performances in the end-of-topic tests (typically ten topics per unit). The marks in such tests are saved onto the database of results, are reported back to both the students and their tutors, are transferred into Excel and form 25% of the overall mark for that module of work. In this incarnation of SCHOLAR on the Riccarton campus of Heriot-Watt University, the tests at the end of each topic perform both a continuous formative and summative role.

At the start of the PASS-IT Project both candidates and their teachers could view summary reports showing highest/average/first/last percentage marks. In addition to the summary reports information could be filtered by unit or assignment, for individual students and classes, showing question and assessment marks. Figures 1 and 2 below show screen shots of the kind of data that was available.

Pass -it

| [Contact Us](#) | [Help](#)

[Home](#) | [Students](#) | [View Classes](#) | [Exit](#)

| | |
|------------------|----------------------------------|
| Student: | Joe Bloggs |
| Test: | Higher Mathematics end of unit 2 |
| Test Type: | End of unit |
| Min. Percentage: | 20.9 |
| Max. Percentage: | 100 |
| Avg. Percentage: | 53.4 |

| Attempt | Date | Test Started | Duration | Questions Attempted | Mark | Possible Mark | Percentage | Test Performance |
|---------|------------|--------------|----------|---------------------|------|---------------|------------|------------------|
| 1 | 03/12/2003 | 09:47:54 | 01:26:07 | 6 | 17 | 43 | 39.5 | |
| 2 | 05/12/2003 | 13:55:00 | 00:48:00 | 13 | 43 | 43 | 100 | |
| 3 | 10/12/2003 | 10:04:47 | 01:09:31 | 3 | 9 | 43 | 20.9 | |

Pass-It Project

Figure 1: A student report on an individual assessment showing multiple attempts and summary data

Results of assignment:

| Question ID | Actual Score | Available Mark | Time Taken |
|--------------------|--------------|----------------|------------|
| hgmth2_0eu0q2 | 2 | 2 | 00:02:24 |
| hgmth2_0eu0q6 | 0 | 3 | 01:00:14 |
| hgmth2_0eu0q1Flash | 4 | 4 | 00:10:57 |
| hgmth2_0eu0q3 | 3 | 3 | 00:03:42 |
| hgmth2_0eu0q4 | 5 | 5 | 00:04:02 |
| hgmth2_0eu0q5Flash | 3 | 3 | 00:04:44 |

Figure 2: A student report for a single attempt at an individual assessment showing details for attempted questions

The PASS-IT Process

PASS-IT has adopted a cyclic process for the development of online assessment questions. There are five main stages (Figure 3), briefly described below.

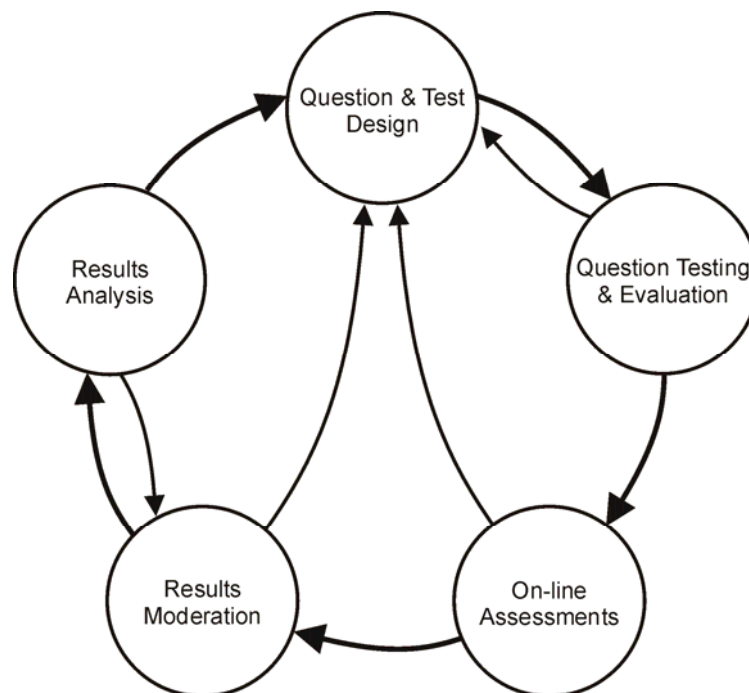


Figure 3: The PASS-IT Assessment Cycle

Question & Test Design

This is generally the start of the process. This stage begins with subject specialists and learning technologists reviewing the learning points that need to be assessed. Once these are well defined, the process of working together to develop one or more approaches for the online assessment of each point begins. This process often involves the review of previous, usually paper based, assessment items. Numerous iterations of evaluation, reflection and

development occur, resulting in one or more assessment items associated with a learning point. These individual items can then be combined into an assessment. It should be noted that this process is also influenced by the research questions under investigation.

Question Testing & Evaluation

To ensure the reliability and validity of the question and marking scheme design, learning technologists and subject specialists carry out rigorous quality assurance testing. Usability and accessibility evaluations are also carried out at this stage. Naturally this informs the design process and may lead to modification to the question design. Finalised assessments are then signed off by learning technologists and subject specialists.

On-line Assessments

A number of different types of pilots are run as part of the project, depending on the area of research. Papers detailing the pilots for phase one are available (PASS-IT, 2003; Ashton et al, 2004^{1,2}).

Results Moderation

Following use in pilot studies the student responses and questions are reviewed. At this stage it is important to ensure the validity and reliability of both the question design and marking scheme. Experienced markers check student responses and the marks awarded to ensure that marks have been awarded correctly, and report instances where correct answers have been omitted from the marking scheme.

Results Analysis

Question responses, marks and usage data are analysed in accordance with the research objectives. In particular, part of the research was to analyse whether the use of steps was an alternative method of awarding partial credit normally associated with follow through marking. This necessitated a review of the student responses, and rough working, to ascertain what marks a human marker, applying follow through would award.

Utilisation of Reporting in the PASS-IT Project

The PASS-IT assessment engine records all navigation and submission events during an individual student's assessment. Naturally, each assessment will differ in the number of questions and parts, but for a typical single assessment an individual student would trigger approximately 100 events – this figure will vary depending on the strategy the student takes i.e. in pre-reading all questions first, in reviewing etc. Given that a teacher will typically have between 20 and 30 students in their class, taking many tests, this quickly becomes an unmanageable figure for manual processing. To

cope with the amount of data, and the increase in detail required during the research phase, the existing reporting system needed to be improved.

The remainder of this paper provides examples of some of the uses of the new reporting system in the PASS-IT project, and the potential benefits that a reporting system of this nature could provide to the teaching and learning process.

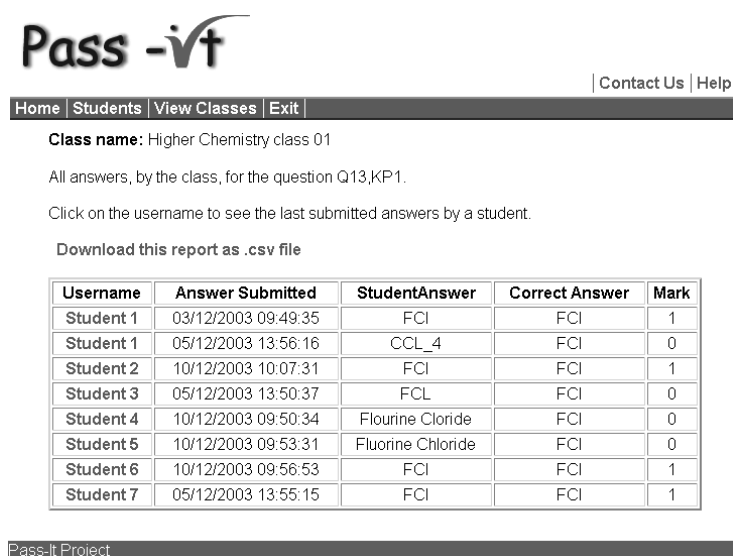
Reporting for Results Moderation

Results moderation assesses the validity of questions and marking schemes by ensuring that

- the appropriate mark has been awarded according to the specification;
- the marking specification is appropriate;
- the question is not open to misinterpretation.

From the range of responses obtained to a question it is possible to gauge confidence in the question's ability to measure the desired learning points. In the traditional marking process this type of moderation is usually a by-product of the marking process, often resulting in modifications to the marking scheme, or remarking/mark adjustment. As the teacher is no longer marking the students' responses in an automatically marked assessment, there is an inherent danger for this part of the process to be overlooked. The importance of this is best illustrated by the following example.

In this instance a review of actual student responses to a specific part was instrumental in a review of the marking scheme. Figure 4 shows a typical set of answers to a single question in a Chemistry assessment.



Pass-IT

Home | Students | View Classes | Exit | Contact Us | Help

Class name: Higher Chemistry class 01

All answers, by the class, for the question Q13, KP1.

Click on the username to see the last submitted answers by a student.

Download this report as .csv file

| Username | Answer Submitted | Student Answer | Correct Answer | Mark |
|-----------|---------------------|-------------------|----------------|------|
| Student 1 | 03/12/2003 09:49:35 | FCI | FCI | 1 |
| Student 1 | 05/12/2003 13:56:16 | CCL_4 | FCI | 0 |
| Student 2 | 10/12/2003 10:07:31 | FCI | FCI | 1 |
| Student 3 | 05/12/2003 13:50:37 | FCL | FCI | 0 |
| Student 4 | 10/12/2003 09:50:34 | Flourine Chloride | FCI | 0 |
| Student 5 | 10/12/2003 09:53:31 | Fluorine Chloride | FCI | 0 |
| Student 6 | 10/12/2003 09:56:53 | FCI | FCI | 1 |
| Student 7 | 05/12/2003 13:55:15 | FCI | FCI | 1 |

Pass-IT Project

Figure 4: A typical set of answers to a Chemistry question

In this example it was anticipated that students would enter FCl as the correct answer. However, it can be seen that one student gave the answer Fluorine Chloride. A chemistry subject specialist would know that FCl is the symbolic way to write Fluorine Chloride. A human marker would automatically make a judgement as to whether Fluorine Chloride should be awarded a mark. In making this judgement there are two decisions to be made – firstly, given the question that was presented to the student, have they submitted a correct response? Secondly, if Fluorine Chloride was not a desirable response, does the design of the question need to be revisited? For example, was the intention to evaluate knowledge of the chemical name or the formula? Furthermore Figure 4 illustrates other submitted answers that would require additional scrutiny; FCL: is capitalisation important?; Flourine Cloride: is spelling important?

Once the appropriate decisions have been made this information can be used to re-specify the marking scheme, and to inform revision of the assessment item. One of the advantages of an on-line assessment is that where changes are made to the marking scheme the responses can be quickly re-marked.

With a computer based system it is not until the marked answers are moderated that many of these issues come to light. The variety of student answers provides useful insight that can be used to review both the marking scheme and the question to ensure clarity, validity and reliability.

When designing questions for online delivery, the challenge is to ensure that question specifications include both explicit and implicit details in the marking scheme. Most people are not yet skilled in this manner of specifying a marking scheme, making informative reports that support the process of moderation and review even more vital.

Reporting for Results Analysis

Over the years 2000 - 2002 researchers at Heriot-Watt University worked with SQA colleagues to determine whether results in paper-based tests in mathematics could be replicated by ICT tests (Fiddes et al, 2002; McGuire & Youngson, 2002; McGuire et al, 2002). This work highlighted the need for strategies for awarding partial credit. Initial work on partial credit (Beevers et al, 1995; Beevers et al, 1999) led to the following approach in mathematics.

A typical question with optional steps is shown in Figure 5. This question consists of 3 keyparts. When the question is first presented the student only sees the 3 keyparts, and a steps button for key part 2.

Q8 Outcome 3 (12 marks)

Exit

8

Express $\sin(x)\cos(10) + \cos(x)\sin(10)$ in the form $\sin(A+B)$.

Use this result to solve the equation $\sin(x)\cos(10) + \cos(x)\sin(10) = \frac{2}{3}$ for $0^\circ \leq x < 180^\circ$.

If you use steps for this question, you can get a maximum of 4.5 marks. [5]

8.1) In the form $\sin(A+B)$, $\sin(x)\cos(10) + \cos(x)\sin(10) =$

Your currently accepted answer:

String Format:

8.2) Find the solutions to the equation.

The smaller value of x is:

Your currently accepted answer:

String Format:

8.3) The larger value of x is:

Your currently accepted answer:

String Format:

Steps

Figure 5: A typical mathematics question with optional steps

Considering keypart 2 only, the student can take one of two approaches:

1. Provide an answer to the part without obtaining any further information.
2. Choose to use the optional steps for keypart 2.

The optional steps break down the problem into smaller parts, providing extra scaffolding and support for the student as well as a mechanism to obtain partial credit (Figure 6). This approach has previously been discussed by McGuire et al (McGuire et al, 2002) and Ashton et al (Ashton et al, 2003, 2004³).

Q8 Outcome 3 (12 marks)
 Exit
 8

Express $\sin(x)\cos(10) + \cos(x)\sin(10)$ in the form $\sin(A+B)$.
 Use this result to solve the equation $\sin(x)\cos(10) + \cos(x)\sin(10) = \frac{2}{3}$ for $0^\circ \leq x < 180^\circ$.
 [5]
 If you use steps for this question, you can get a maximum of 4.5 marks.

8.1) In the form $\sin(A+B)$,
 $\sin(x)\cos(10) + \cos(x)\sin(10) =$
 Submit
 Your currently accepted answer:
 String Format:

8.2) Find the solutions to the equation.
 The smaller value of x is:
 Submit
 Your currently accepted answer:
 String Format:

8.3) The larger value of x is:
 Submit
 Your currently accepted answer:
 String Format:

8.2.1) In order to solve the equation, you must first
 find y such that $\sin(y) = \frac{2}{3}$.
 8.2.2) If $\sin(y) = \frac{2}{3}$ where $0^\circ \leq y < 90^\circ$, what
 is the value of y ?
 Submit
 Your currently accepted answer:
 String Format:

Done

Figure 6: A typical mathematics question with steps selected

As part of the research into partial credit it was important to understand the students' responses during an assessment. More specifically it was not only necessary to have the marks per question but also: what the students' answers were to each part of a question; how many times they had submitted an answer; all their attempts at answers; and whether they had used steps. This needed to be available on both an individual and a class basis to recognise the pattern of common errors or questions that caused many difficulties. The previous reporting system, which only reported question marks, was not adequate for the task.

Figure 7 shows a screenshot of a section of a typical student report for a single attempt at one assessment. This report contains a number of important features:

- It shows individual part marks awarded and the accumulative question mark (N.B. Q1 KP2 was worth 3 marks, constructed from 0.5 marks for the keypart and 2.5 marks for the steps. If steps are not taken a correct keypart answer is also automatically awarded the marks for the steps.).
- Individual answers to parts can be viewed.
- Mathematical answers are shown in the string input format and a rendered mathematical formula (i.e. Q3, KP1, string format: $-2/x$, rendered format: $-\frac{2}{x}$).

- Last submitted answer to each part can be seen.
- It shows the number of attempts to a part (right hand column), and links to all attempts by that student.
- There are links (via Part ID) to all answers from a class to a single part.
- If steps have been used the report would show as STEPS in Steps Used column.

Student: Firstname Surname

| QNo | Mark Awarded | Avail Mark | Part | Steps Used | Part Mark | Student Answer | Correct Answer | Part Attempts |
|-----|--------------|------------|--------|------------|-----------|---|--|---------------|
| 1 | 3 | 4 | KP1 | | | Put the factor, -1 and use it in synthetic division and check that the final value after the synthetic division is zero. If it is, $x+1$ is a factor of zero. | | 2 |
| | | | KP2 | | 0.5 | $(x+1)(x+3)(x-2)$ $(x+1)(x+3)(x-2)$ | $(x+1)^*(x+3)^*(x-2)$ $(x+1)(x+3)(x-2)$ | 1 |
| | | | KP2SP1 | | | | | |
| | | | KP2SP2 | | | | | |
| | | | KP2SP3 | | | | | |
| 2 | 1 | 2 | KP1 | | 1 | -7 -7 | -7 -7 | 1 |
| | | | KP2 | | | The roots are unreal | | 2 |
| 3 | 1.5 | 3 | KP1 | | 0.75 | $-2/x$ $-\frac{2}{x}$ | $(-2)^*x^*(-1)+C$ $-2x^{-1}+C$ | 1 |
| | | | KP1SP1 | | | | | |

Figure 7: A student report for a single attempt at an assessment

It is worth pausing on Q3, KP1 for a moment. Two interesting features can easily be identified from the report above. Firstly, an example of partial credit being awarded without the use of steps can be noted. In this case the student has got part of the answer correct ($-2/x$), but has forgotten the $+C$ part. Secondly, a demonstration of one of the features of the assessment engine – the ability to mark mathematically equivalent answers ($-2/x$ and $-2x^{-1}$ are equivalent).

From a teacher's perspective being able to see where students have needed to use steps can inform future teaching practice. If students consistently use steps in a particular question or question type this would indicate that students are having difficulty starting this question. This may be due to a poorly designed question or it may indicate that students have not yet understood the strategy for this type of question.

Previously the use of reporting in moderation was discussed, and showed how reviewing all answers to a question part can be useful. An additional use of this type of report is in identifying common errors and misconceptions. Being able to see all the answers a student has submitted for a question part can help the teacher understand any strategies or misconceptions that a student or class has. This is especially useful when assessments are being

taken in a formative mode, essentially the teacher is being given access to a type of 'rough working' only previously available from written submissions.

One such example of identifying problem areas can be illustrated using the question shown in Figure 5. Most students can manage to answer the first keypart, giving a correct answer of $\sin(x+10)$. The student must then use this to find x . The correct value of x in this case is 31.8 . However, sometimes students forget to, or do not know how to, deal with the $+10$ in the answer to KP1, giving an answer for x that is greater by 10 , i.e. 41.8 . By simply scanning all answers to this keypart this mistake can easily be identified (Figure 8). If the student in this case was struggling with the concepts involved, the option of steps (Figure 6) could prove helpful.

| Username | Answer Submitted | StudentAnswer | Correct Answer | Mark |
|-------------------|---------------------|---------------|----------------|------|
| Firstname Surname | 01/05/2003 11:24:13 | 31.8 | 31.8 | 0.5 |
| | | 31.8 | 31.8 | |
| Firstname Surname | 01/05/2003 11:24:49 | 31.8 | 31.8 | 0.5 |
| | | 31.8 | 31.8 | |
| Firstname Surname | 01/05/2003 11:28:30 | 31.8 | 31.8 | 0.5 |
| | | 31.8 | 31.8 | |
| Firstname Surname | 01/05/2003 11:27:56 | 41.8 | 31.8 | 0 |
| | | 41.8 | 31.8 | |
| Firstname Surname | 01/05/2003 11:17:35 | 31.8 | 31.8 | 0.5 |
| | | 31.8 | 31.8 | |

Figure 8: A set of student answers to 8.2 (Figure 5)

Supplementary Features and Benefits

There are a number of other features of the reporting system that have been useful in the research, to researchers and subsequently teachers. A number of these will be discussed here along with some of the benefits.

As can be seen in Figure 7, the system shows both the mathematical string answer ($-2/x$) and renders this into a more familiar form ($-\frac{2}{x}$). This is consistent with the assessment engine which shows submitted mathematical answers in both string and rendered forms. This is important for a number of reasons: it enables the teacher to spot patterns in answers; it ensures teachers see the answer in the same manner as the student; it improves usability; and it enables common input errors to be identified.

In order to become familiar with the assessment system, students who took part in the project trials were given access to practice electronic assessments of a similar standard to those that would appear in the trials. These assessments utilised features of the system such as random parameters and different feedback modes to encourage repeated practice. During this process it was important to inform the teachers of usage and potential areas of difficulty. One report that was useful for this purpose can be seen in Figure 9. The graphical nature of this report allows for various levels of information

to be ascertained quickly. For example as each row represents a single attempt at an assessment, it is possible to see how far a student has progressed through an assessment and if any specific questions seem to be causing problems. Where a student has not visited a question the column is left blank. A similar report is also available for class wide analysis.

In a formal summative assessment where usage is prescribed, e.g. students have a finite time in which to complete as many of the available questions as possible, overall assessment marks and question marks can provide useful information to student and teacher. However, marks should be interpreted with care, especially in formative assessments where the reasoning behind a student's behaviour may not be obvious.

For example, different approaches by an individual student can be seen in Figure 9. The report shows that this student began by attempting the majority of the questions in the assessment, and then to repeatedly target specific questions until they were ready to move on (as each question was randomised the student could get different parameters to practise with each time they sat a test). If teachers were only to review summary marks for an assessment a student may appear to be scoring very poorly whereas visual representations such as that shown in Figure 9 allow patterns like this to be identified.

| Attempt | Duration | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 | Q11 | Q12 | Q13 | Total Mark | Student Responses |
|---------|----------|----|----|------|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------------|-------------------|
| 1 | 00:33:46 | 2 | 4 | 3 | 0 | 3 | 2 | 4 | 3.5 | 2 | 0 | 1 | 3 | 0 | 27.5 | |
| 2 | 00:33:46 | 1 | 4 | 2.09 | 5 | 3 | 2 | 4 | 3.5 | 1.5 | 1 | 0 | | | 27.09 | |
| 3 | 00:39:48 | 2 | 4 | 0 | 0 | 3 | 2 | 2.5 | 3.5 | 2 | 3 | 4 | 4 | | 30 | |
| 4 | 00:23:02 | 2 | 4 | 2.09 | 0 | 3 | 2 | 2.5 | 0 | 0 | 0 | 0 | 3 | | 18.59 | |
| 5 | 00:01:28 | 2 | | | | | | | | | | | | | 2 | |
| 6 | 00:02:53 | 0 | 4 | | | | | | | | | | | | 4 | |
| 7 | 00:01:46 | 0 | | 3 | | | | | | | | | | | 3 | |
| 8 | 00:02:32 | 0 | | | 5 | | | | | | | | | | 5 | |
| 9 | 00:01:47 | 0 | | | | 3 | | | | | | | | | 3 | |
| 10 | 00:01:53 | 0 | | | | | 2 | | | | | | | | 2 | |
| 11 | 00:01:51 | 0 | | | | | 0 | | | | | | | | 0 | |
| 12 | 00:01:33 | 0 | | | | | 1 | | | | | | | | 1 | |
| 13 | 00:00:56 | 0 | | | | | 2 | | | | | | | | 2 | |
| 14 | 00:01:26 | 0 | | | | | 0 | | | | | | | | 0 | |
| 15 | 00:00:39 | 0 | | | | | 2 | | | | | | | | 2 | |
| 16 | 00:00:25 | 0 | | | | | 0 | | | | | | | | 0 | |
| 17 | 00:01:39 | 0 | | | | | 2 | | | | | | | | 2 | |
| 18 | 00:04:42 | 0 | | | | 0 | 2.5 | | | | | | | | 2.5 | |
| 19 | 00:02:33 | 0 | | | | | | 3.5 | | | | | | | 3.5 | |
| 20 | 00:01:16 | 0 | | | | | | 1.5 | | | | | | | 1.5 | |
| 21 | 00:01:15 | 0 | | | | | | 2 | | | | | | | 2 | |
| 22 | 00:01:21 | 0 | | | | | | 0 | | | | | | | 0 | |
| 23 | 00:02:17 | 0 | | | | | | 1.5 | | | | | | | 1.5 | |
| 24 | 00:03:04 | 0 | | | | | | 5 | | | | | | | 5 | |
| 25 | 00:00:49 | 0 | | | | | | 2 | | | | | | | 2 | |
| 26 | 00:02:29 | 0 | | | | | | 0 | 1 | | | | | | 1 | |
| 27 | 00:01:29 | 0 | | | | | | | 1 | | | | | | 1 | |
| 28 | 00:02:28 | 0 | | | | | | | 0 | | | | | | 0 | |
| 29 | 00:01:36 | 0 | | | | | | | 0 | | | | | | 0 | |

Figure 9: Graphical representation of assessment performance

Summary

Reporting functionality is one of the key benefits of delivering assessment online, especially as CAA is introduced to schools and colleges on a large scale. On the simplest level, reporting is just a summary of the assessment delivered, but analysis of responses could be used to provide many benefits to both students and teachers as well as to aid the development of online assessments. A more detailed reporting system places a lot of powerful information in the hands of both teachers and students. It can enable both teachers and students to reflect on progress, and can inform teachers of problem areas and common misconceptions. A good, informative reporting system is key with on-line assessments where students are often carrying out independent learning. In these situations there is a danger that the teacher may become removed from the learning process and it becomes increasingly difficult for a teacher to be involved in, or even aware of what learning a student is doing outside their classroom.

It is clear that sharp, accurate reports can only enhance the teaching and learning process. Individual students will adopt their own learning style in tackling assignments and will benefit from viewing their own progress. However, bringing the teacher into this cycle retains the teacher at the centre of the learning process, where they have always been in traditional teaching. What becomes essential for on-line education is to maintain this position by giving the teachers (and their students) what they want in the way of reports, information and records so that the human can further supplement any automatic feedback mechanism. Students become empowered to learn in a manner that suits them whilst safe in the knowledge that a teacher is able to enter a learning dialogue without the need 'to remember' what they entered as an answer to each question.

Some of developments of the PASS-IT reporting system have been outlined, however these have been primarily research driven. It is hoped that future work will involve students and teachers in the design process and focus on their requirements in presenting the vast amount of information that is available.

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