Computer based assessment with short free-text responses and tailored feedback

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Centre for Open Learning of Mathematics, Science Computing and Technology (COLMSCT)

My plan

- set the context;

- talk about the development of the Open University's 'OpenMark' computer based assessment system;

- talk about recent developments, especially questions requiring short free-text responses.

Some terminology:

iCMA = interactive computer marked assessment;

OpenMark is the OU's online interactive assessment system, currently being incorporated into Moodle;

Moodle is an open source virtual learning environment, being used by the Open University.
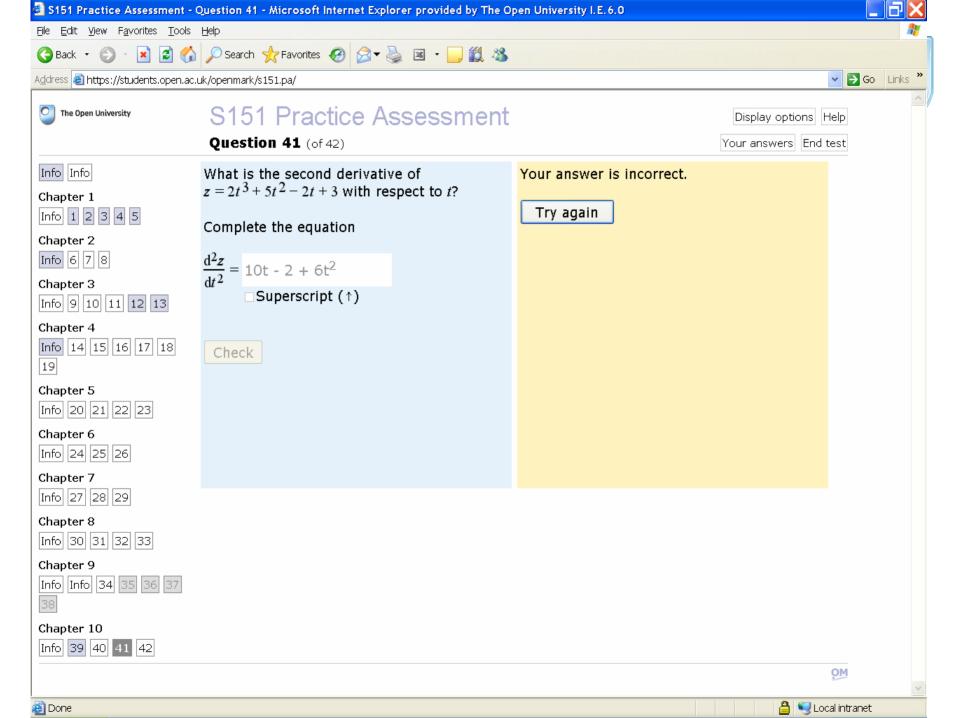
Feedback matters!

- As part of the Formative Assessment in Science Teaching (FAST) Project, a literature review (Gibbs and Simpson, 2003-2004) identified 11 conditions under which assessment supports student learning. 7 of these conditions relate to the provision of feedback.

- Within the Open University context, students are at a distance and we cannot assume that they will meet their tutor in order to receive feedback. Tutor marked assignments (TMAs) therefore have an important teaching function.
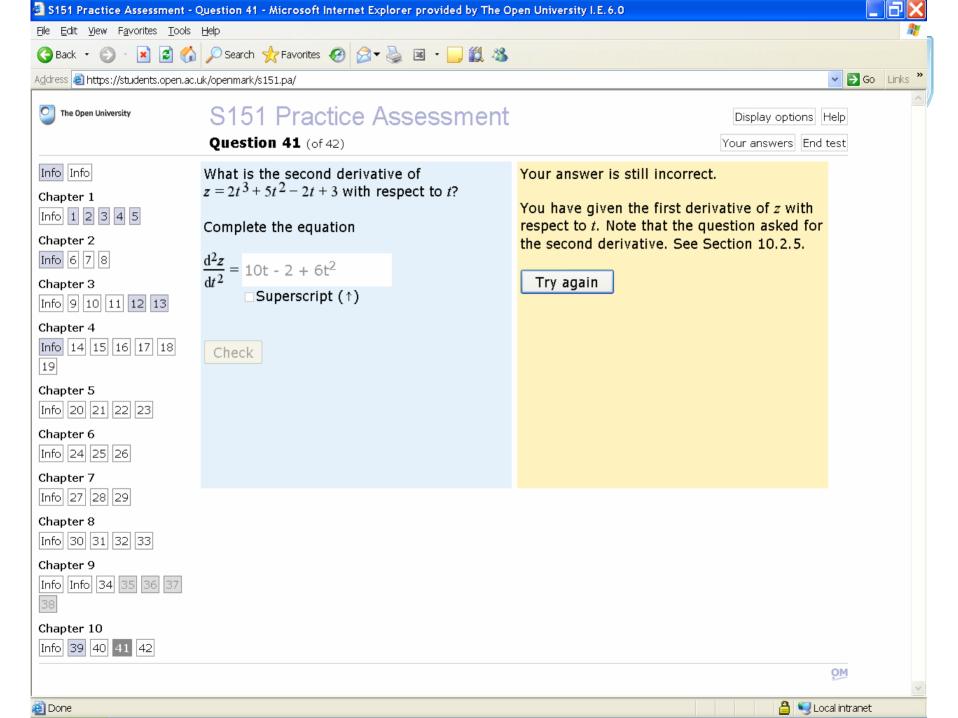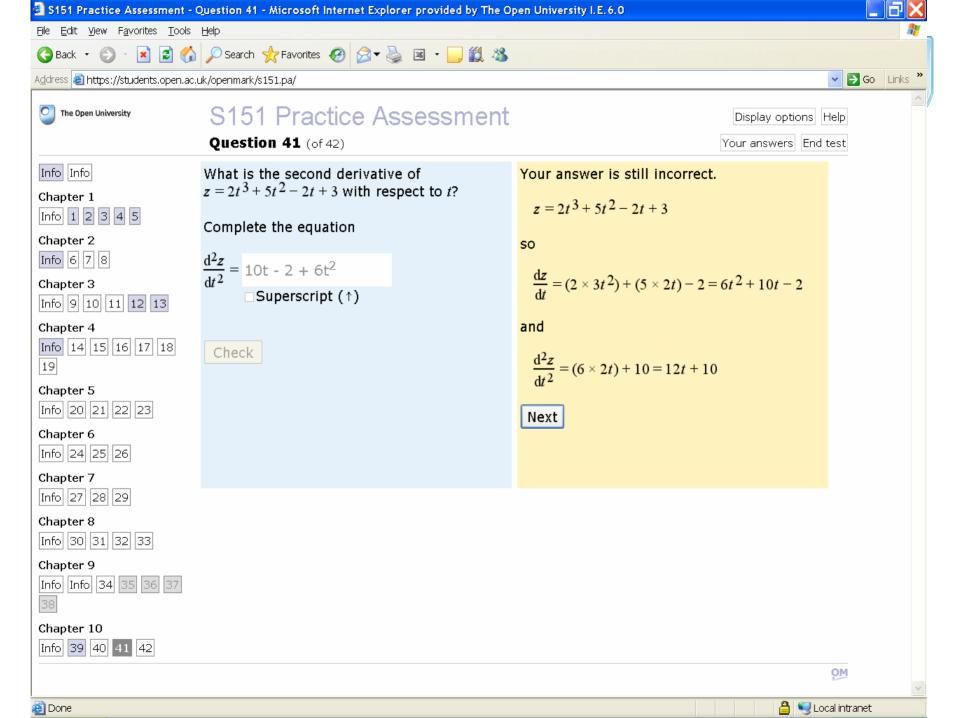
The *S151 : Maths for Science* experience

- This course does not have tutor marked assignments;
- But we wanted to be able to provide students with targeted and relatively detailed feedback on their answers;
- And we wanted to be able to provide this feedback rapidly;
- We wanted more than multiple choice questions;
- And this was for summative assessment.

Demonstration

The Open University

S151 Practice Assessment

Display options   Help

Question 41 (of 42)

Your answers   End test

Info   Info

Chapter 1
Info   1   2   3   4   5

Chapter 2
Info   6   7   8

Chapter 3
Info   9   10   11   12   13

Chapter 4
Info   14   15   16   17   18   19

Chapter 5
Info   20   21   22   23

Chapter 6
Info   24   25   26

Chapter 7
Info   27   28   29

Chapter 8
Info   30   31   32   33

Chapter 9
Info   Info   34   35   36   37   38

Chapter 10
Info   39   40   41   42

What is the second derivative of
$z = 2t^3 + 5t^2 - 2t + 3$ with respect to t?

Complete the equation

$$\frac{d^2z}{dt^2} = \boxed{10t - 2 + 6t^2}$$

☐ Superscript (↑)

Check

Your answer is incorrect.

Try again

The Open University

S151 Practice Assessment

Display options   Help

Question 41 (of 42)

Your answers   End test

Info   Info

Chapter 1
Info 1 2 3 4 5

Chapter 2
Info 6 7 8

Chapter 3
Info 9 10 11 12 13

Chapter 4
Info 14 15 16 17 18 19

Chapter 5
Info 20 21 22 23

Chapter 6
Info 24 25 26

Chapter 7
Info 27 28 29

Chapter 8
Info 30 31 32 33

Chapter 9
Info Info 34 35 36 37 38

Chapter 10
Info 39 40 41 42

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Complete the equation

$$\frac{d^2z}{dt^2} = \boxed{10t - 2 + 6t^2}$$

☐ Superscript (↑)

Check

Your answer is still incorrect.

You have given the first derivative of z with respect to t. Note that the question asked for the second derivative. See Section 10.2.5.

Try again

OM

The Open University

S151 Practice Assessment

Display options   Help

Question 41 (of 42)

Your answers   End test

What is the second derivative of
$z = 2t^3 + 5t^2 - 2t + 3$ with respect to t?

Complete the equation

$$\frac{d^2z}{dt^2} = \boxed{10t - 2 + 6t^2}$$

☐ Superscript (↑)

Check

Your answer is still incorrect.

$$z = 2t^3 + 5t^2 - 2t + 3$$

so

$$\frac{dz}{dt} = (2 \times 3t^2) + (5 \times 2t) - 2 = 6t^2 + 10t - 2$$

and

$$\frac{d^2z}{dt^2} = (6 \times 2t) + 10 = 12t + 10$$

Next

OM

Done   Local intranet

The S151 experience continued

- S151 has been running since 2002 with 4 presentations each year, and has been studied by more than 7000 students;

- S151 has an online interactive summative End of Course Assessment, plus a purely formative Practice Assessment;

- The assessments have been well received by students: e.g. 'It was fun!'

- And we have learnt a lot about students' misconceptions by analysing their responses to the questions.

OpenMark online interactive assessment with feedback

- Now used by several Open University courses;
- Used formatively, summatively and diagnostically e.g.

https://students.open.ac.uk/openmark/science.ayrfl1.intro/

- OpenMark is being incorporated into Moodle at both the question and the assessment level;
- Lots of innovative question types and innovative uses of this type of question. See

http://www.open.ac.uk/openmarkexamples/index.shtml

The Open University

Clinical Decision Making

Display options   Help

Question 1 (of 1)

Your answers   End test

Screen 0: Clinical Decision-Making Tool – leg ulcer

Miss Alice Phelps, a lively and independent 80 year old lady came to the surgery on 17th February with an ulcer on left lower leg. It was approximately 4 cm in size and had been developing for a period of time. The ulcer was dry and crusty and the actual wound could not be seen. The surrounding area was inflamed and very red.

What would be your initial course of action ?

Resources

Audio: Consultation between practice nurse and Patient
▶️■

Text:
Venous Leg Ulcers
Treatment for venous leg ulcers
PRODIGY Quick Reference Guide
Patient records

What are you going to do? Make a decision.

○ Take a swab and apply a viscopaste dressing	○ Apply a dressing impregnated with silver	○ Apply an algae-based dressing

Why? Give reasons for your decision.

Done   Local intranet

S104 : Exploring science

- A new course from February 2008;

- Students will spend 9 months studying the course, and we want to keep them up to date and engaged with it;

- So we are using *regular* iCMAs (interactive computer marked assignments) with feedback (alongside conventional tutor marked assignments);

- The iCMAs will be summative (but low stakes), so that students do them, but their primary function is to provide pacing and feedback.

Questions for *S104 : Exploring science*

- We want to be able to ask questions that require slightly longer free text answers;

- So we are working with a commercially provided, linguistically based authoring tool to write questions that require answers of about a sentence in length;

- Student responses are being used to refine the questions;

- We are providing targeted feedback on incorrect and incomplete answers.

Short answer questions

- We want to mark many different answers as correct;

- ..but we want to mark incorrect answers as incorrect;

- The fact that the software is linguistically based means that it recognises 'dog bites man' as different from 'man bites dog';

- It copes well with poor spelling and, usually, with poor grammar;

- We want to give feedback on incorrect and partially correct answers.

Demonstration

- [Demo 1](#)

- [Demo 2](#)

- [Demo 3](#)

Interesting issues

- Answers that are difficult to parse include those that are very long, those that are very short and those with unnecessary full stops;

- However we are reluctant to tell students how to frame their answers until we know more about student perceptions of the system.

Other interesting issues

- Questions have to be quite tightly constrained e.g.

  'You are handed a rock specimen that consists of interlocking crystals. How would you decide, from its appearance, whether it is an igneous or a metamorphic rock?'

has become

  'You are handed a rock specimen that consists of interlocking crystals. How could you be sure, from its appearance, that this was a metamorphic rock?'

- But we're learning to write questions which assess more than recall;

- Writing questions is time consuming, but great fun! We will be sharing expertise in question authoring with colleagues in the autumn/spring.

Evaluation

- Research Lab observation of student perception and use of the system. How do students respond to questions of this type and what do they do with the feedback provided? June 2007 onwards.

- Human-computer marking comparison. June 2007 onwards.

- We also want to compare with a 'bag of words' system. We suspect they will have fundamentally different uses (the bag of words system will not be so sophisticated but it will allow for longer answers);

- We want to investigate other feedback options e.g. telling students which part of their answer has 'matched';

- Student reaction is likely to be different when used summatively.

So what is it all about?

- Improving our students' learning experience
- Making learning relevant, active and fun

'I hear and I forget, I see and I remember, I do and understand'

(proverb attributed to Confucius)

'The link between assessment and learning [is like] a three-legged race in which neither partner can make progress without the other's contribution.'

Robert Harding and Patrick Craven, UCLES

So what's it all about?

Two of the Gibbs and Simpson conditions under which assessment supports student learning:

5. Sufficient feedback is provided, both often enough and in enough detail;

6. The feedback is provided quickly enough to be useful to students.

Acknowledgements

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Useful websites

- OpenMark examples website

  http://www.open.ac.uk/openmarkexamples/

- 'Are you ready for' quizzes:

  http://www.open.ac.uk/science/courses-qualifications/are-you-ready-for-science/index.php

Useful websites cont.

Short answer questions:

https://students.open.ac.uk/openmark/s103-07b.block3world/

https://students.open.ac.uk/openmark/s103-07b.blocks45world/

https://students.open.ac.uk/openmark/s103-07b.block7v1aworld/

https://students.open.ac.uk/openmark/s103-06j.block11world/