Technology-enhanced learning and teaching in mathematics; enhancing feedback and promoting self reflection

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University of Ulster

CETL MSOR Conference 2014

C OLLECT

L OOK

A PPRAISE

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I NVOLVE

T AKE IN

I MPROVE

Limitations of giving just feedback

Doesn't encourage student reflections.

No support advised.

Uncollected work.

This assessment contributes to 30% of total coursework mark.

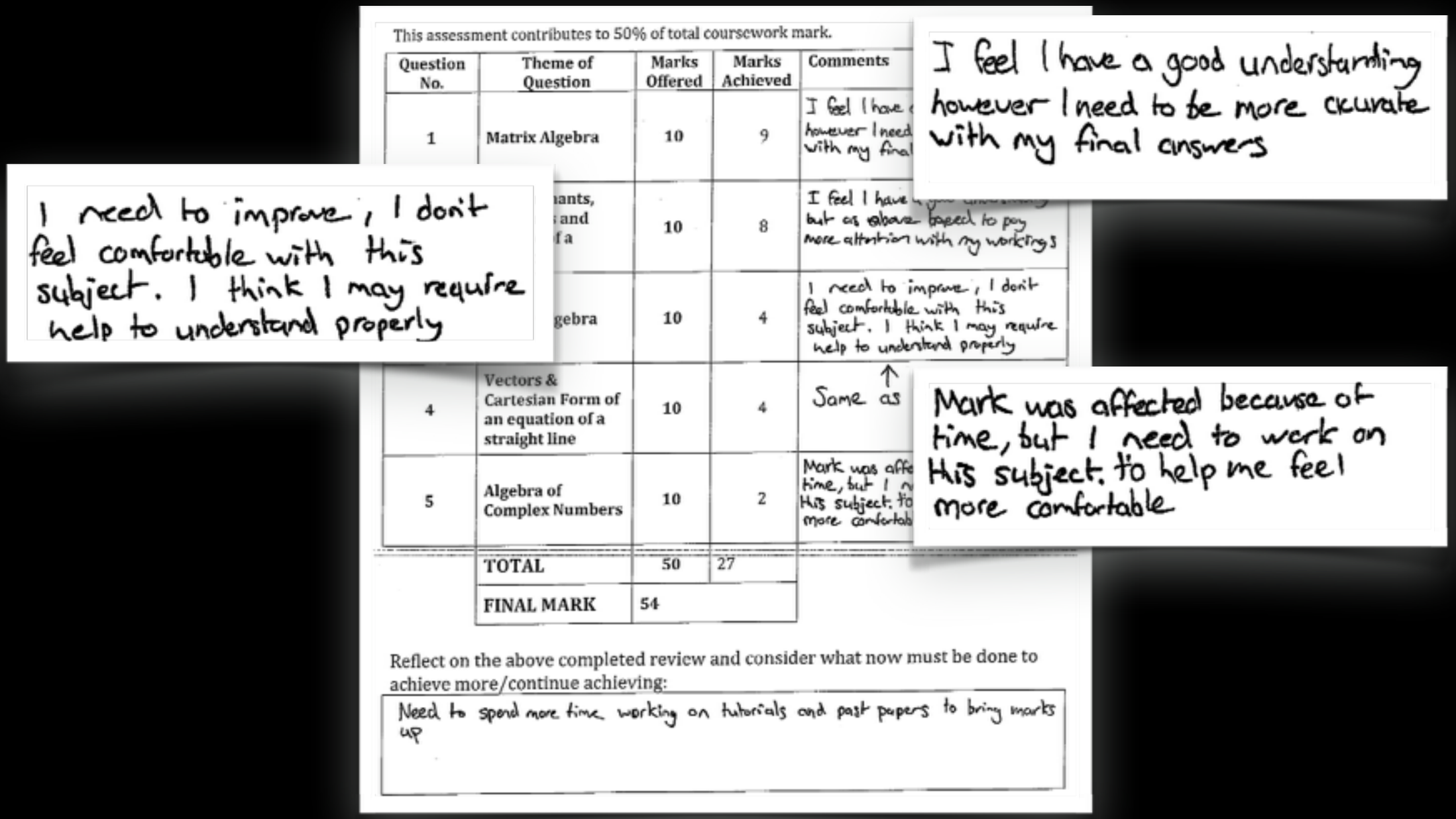
Question No.	Marks Available	Mark Awarded	Comments
1	10	0	See Class Test 1 Solutions.
2	10	7	Reasonable effort.
3	10	8	Very good effort.
4	10	8	Very good effort.
5	10	4	Read question carefully. Only asked to factorise NOT solve.
6	10	0	See Class Test 1 Solutions.
7	10	6	Need to be more careful with subtracting terms
8	10	8	Very good effort.
9	10	0	See Class Test 1 Solutions.
10	10	9	Well done. Need to be careful with accuracy when rounding.
TOTAL	100	50%	

Overall Comments:

See Class Test 1 Solutions. Also follow my comments when preparing for future examination.

Snapshot of coursework feedback report

A paper-based solution inviting reflections…



This assessment contributes to 50% of total coursework mark.

Question No.	Theme of Question	Marks Offered	Marks Achieved	Comments
1	Matrix Algebra	10	9	I feel I have a good understanding however I need to be more ckurate with my final answers
	...ants, ...and ...f a	10	8	I feel I have ... but as above need to pay more attention with my workings
	...gebra	10	4	I need to improve, I don't feel comfortable with this subject. I think I may require help to understand properly
4	Vectors & Cartesian Form of an equation of a straight line	10	4	Same as ↑
5	Algebra of Complex Numbers	10	2	Mark was affe... time, but I n... His subject. to... more comfortab...
	TOTAL	50	27	
	FINAL MARK	54		

I need to improve, I don't feel comfortable with this subject. I think I may require help to understand properly

I feel I have a good understanding however I need to be more ckurate with my final answers

Mark was affected because of time, but I need to work on His subject. to help me feel more comfortable

Reflect on the above completed review and consider what now must be done to achieve more/continue achieving:

Need to spend more time working on tutorials and past papers to bring marks up

Snapshot of feedback and progress summary report

Challenges with this approach

Time-consuming to manage.

No method of dealing with misconceptions.

No mechanism for advising support.

Uncollected work.

Unreviewed work.

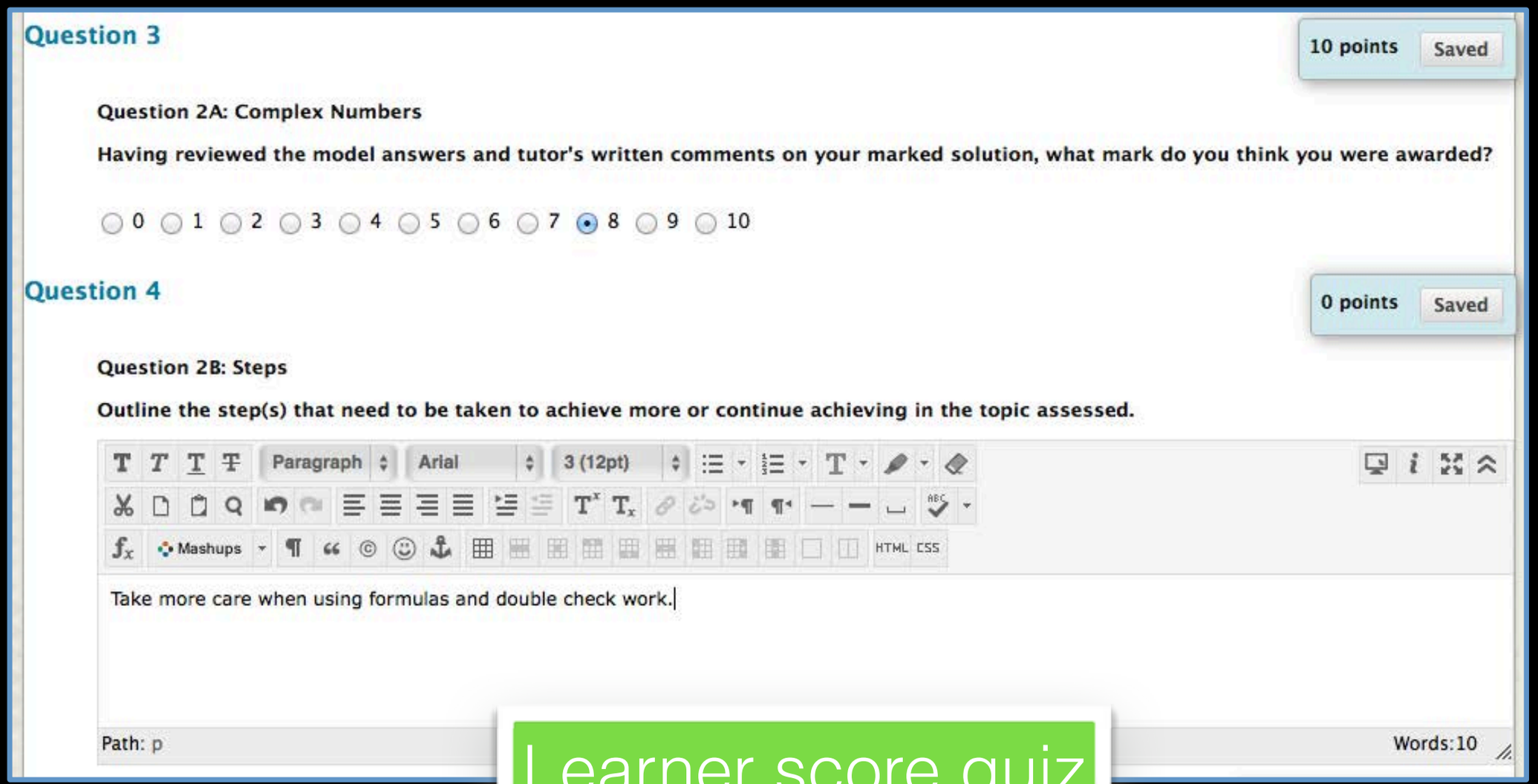
A technology facilitated solution …

- Funded by the University's Technology Facilitated Learning (TFL) Development Programme.
- 60+ students - first year mathematics and engineering students.
- Mathematical Methods module and Engineering Mathematics module.
- Corrective feedback and model solutions returned electronically.

From a student perspective

Corrective and enriched feedback received … but no score!

Invited to share anticipated score and reflections.



From a student perspective.

Pencast solutions with mark schemes.

Interactive, digital handwritten solutions synced with audio.

Replayed as many times as needed.

From a student perspective

email with a link to their
feedback and progress summary report, with …

their scores, reflections and the tutors scores, feedback and advice…

Student Name:	Mathematical Methods I (71460)
Student No:	**Module Co-ordinator - Dr Madonna Herron** **Coursework No: 2 worth 20% of the module mark.**

Question	Theme	Marks Offered	Student Mark	Tutor Mark	Outline the steps that need to be taken to achieve more or continue achieving in the topic assessed.	Marcs Advisability
4A	Ordinary Differential Calculus	20	5	6	Definitely need to study this topic more thourougly, practice questions and leave more time to complete assignment.	Yes, essential for maximum benefit to course progression
3A	Elementary Functions	10	6	7	take more care with the question. follow an example from this topic properly and revise topic thoroughly.	Yes, possibly, as desired/required
1A	Systems of Linear Equations	10	10	10	continue to practice these questions to be able to do well in exam.	No, unless desired regarding specific issue
2A	Complex Numbers	10	8	9	Take more care when using formulas and double check work	No, unless desired regarding specific issue
	MARK	50	29	32	64%	

Tutor Comments
A very good action plan - keep to it. You should review your solution along side the pencast solutions as soon as possible. Do not leave it to the last minute.

From a tutor perspective

For paper submission

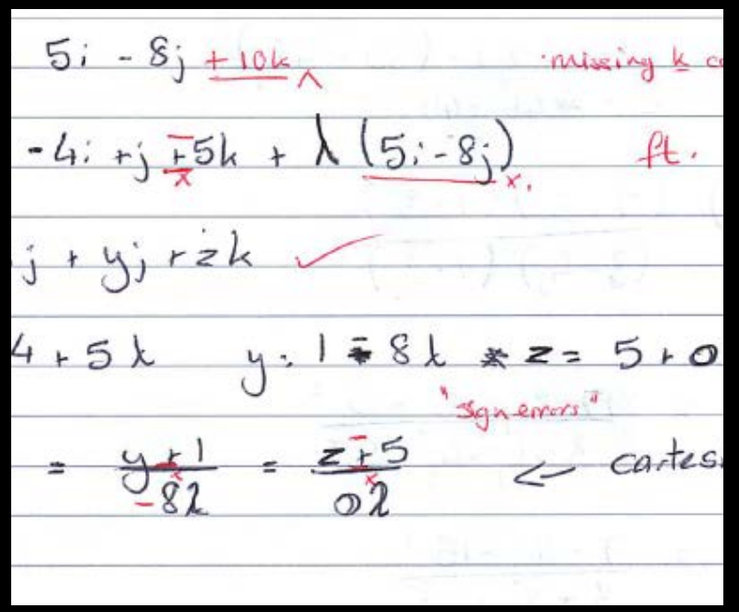
Marked with minimal feedback.

Enriched generic feedback.

Marking quicker.

Feedback more timely.

Scores recorded but withheld.



From a tutor perspective

Less admin allows more time to invest in providing enriched generic feedback

Q Find the general solution of the differential equation

$(x+2)\frac{dy}{dx} = x^2y$ ✱ | $P(y)\frac{dy}{dx} = Q(x)$

Write in the form $y = f(x)$ ✓

Q STEP 1. SEPARATE THE VARIABLES — ▲ Mark

$\frac{1}{y}\frac{(x+2)}{(x+2)}dy = \frac{x^2}{(x+2)}\frac{y}{y}dx$ — (2) $\frac{x^2}{x+2} = x-2+\frac{4}{x+2}$

Q STEP 2 INTEGRATE BOTH SIDES

$\int\frac{1}{y}dy = \int\frac{x^2}{x+2}dx$ — (1)

$x-2$ ✓
$x+2 \overline{)x^2}$
$-x^2 \mp 2x$
$-2x$
$+2x+4$
4

Q $\ln y = \int\left(x-2+\frac{4}{x+2}\right)dx$ — (2)

$= \frac{x^2}{2} - 2x + 4\ln(x+2) + \ln A$ — (1) $n\log A = \log A^n$, $\log(x+2)^4 = 4\ln(x+2)$

Q $\ln y = \frac{x^2}{2} - 2x + \ln[A(x+2)^4]$ ✱✱ — (1) $\log A + \log B = \log AB$

Q STEP 3 WRITE GENERAL SOLUTION IN FORM $y=f(x)$ — $a^m \times a^n = a^{m+n}$ ✓

Q $y = e^{x^2/2 - 2x + \ln[A(x+2)^4]}$ — (1)

Q $y = e^{x^2/2-2x} \cdot e^{\ln[A(x+2)^4]}$ — (1)

Q $y = A(x+2)^4 e^{x^2/2-2x}$ — (1)

X Generic Feedback — TOTAL MARK 10

#1

#2

From a tutor perspective

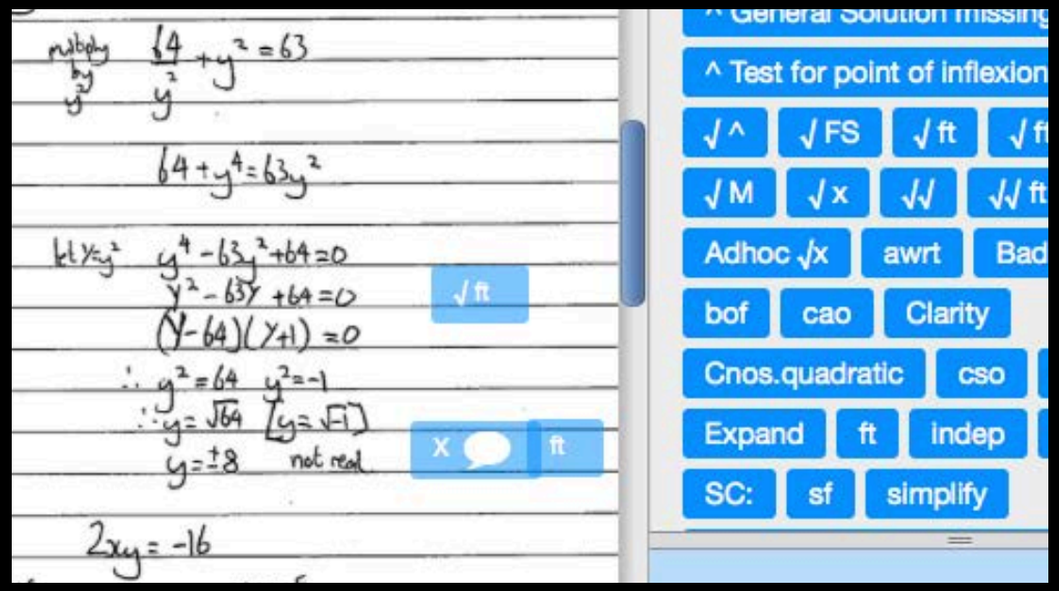
For electronic submission

Marked inline using GradeMark.

Quick marking.

Feedback released using Post Date.

Scores recorded but withheld.



GradeMark digital markup tool

From a tutor perspective

Bespoke software application

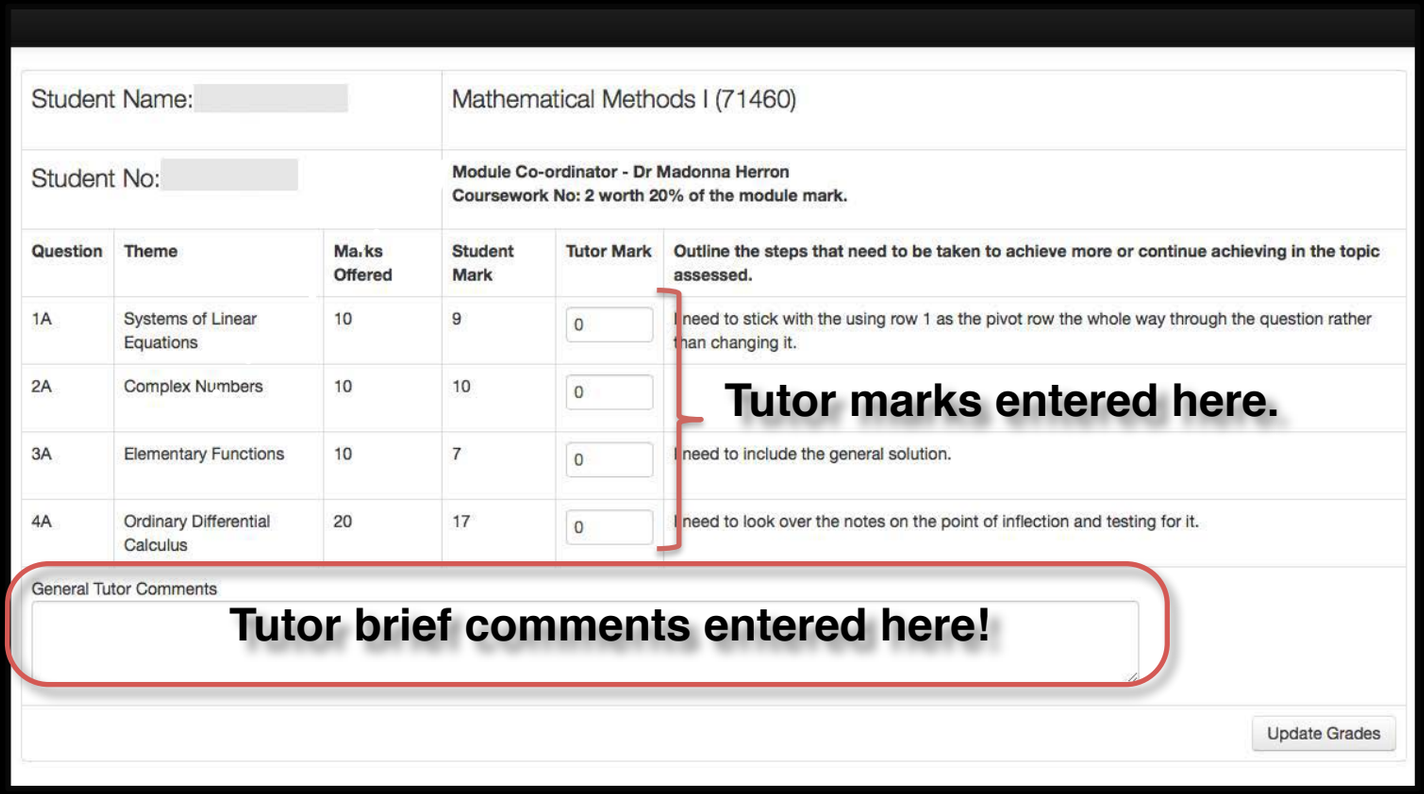
Quiz closed.

Data downloaded.

Data uploaded.

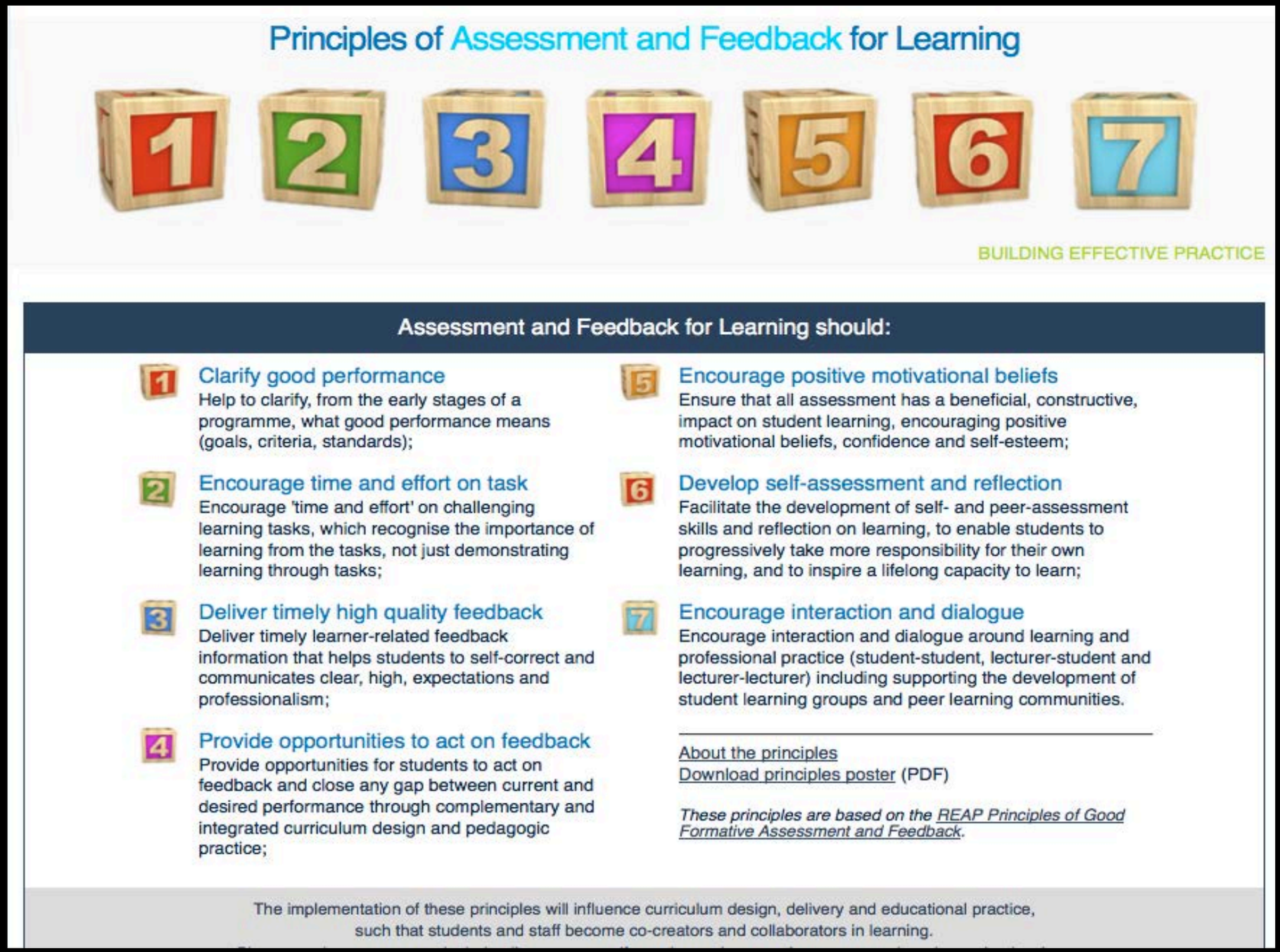
Retrieves and merges data.

Email released.



Online feedback and progress summary report

Maps to Ulster's …



Principles of Assessment and Feedback for Learning

BUILDING EFFECTIVE PRACTICE

Assessment and Feedback for Learning should:

1 Clarify good performance
Help to clarify, from the early stages of a programme, what good performance means (goals, criteria, standards);

2 Encourage time and effort on task
Encourage 'time and effort' on challenging learning tasks, which recognise the importance of learning from the tasks, not just demonstrating learning through tasks;

3 Deliver timely high quality feedback
Deliver timely learner-related feedback information that helps students to self-correct and communicates clear, high, expectations and professionalism;

4 Provide opportunities to act on feedback
Provide opportunities for students to act on feedback and close any gap between current and desired performance through complementary and integrated curriculum design and pedagogic practice;

5 Encourage positive motivational beliefs
Ensure that all assessment has a beneficial, constructive, impact on student learning, encouraging positive motivational beliefs, confidence and self-esteem;

6 Develop self-assessment and reflection
Facilitate the development of self- and peer-assessment skills and reflection on learning, to enable students to progressively take more responsibility for their own learning, and to inspire a lifelong capacity to learn;

7 Encourage interaction and dialogue
Encourage interaction and dialogue around learning and professional practice (student-student, lecturer-student and lecturer-lecturer) including supporting the development of student learning groups and peer learning communities.

About the principles
Download principles poster (PDF)

These principles are based on the REAP Principles of Good Formative Assessment and Feedback.

The implementation of these principles will influence curriculum design, delivery and educational practice, such that students and staff become co-creators and collaborators in learning.

🔗 URL: http://ee.ulster.ac.uk/assessment_and_feedback/

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Student views: Enhanced Feedback

82% of students indicated that the model answers and marking schemes were easy to understand.

79% of students indicated that the model answers and marking schemes helped them decide where they could improve.

86% of students indicated that the model answers and marking schemes helped them decide what score they deserved.

“… are a great way for me to understand where I went wrong and the areas in which I need to work at in order to improve.”

“.. help me a lot when learning, you can follow the correct method, and see where your going wrong.”

Student views: Self-reflection

89% of students indicated that this approach encouraged them to look at their feedback.

82% of students indicated that this approach encouraged them to appraise what they did well in and what they could do to improve.

Over 75% of students indicated that this approach encouraged them to reflect and review their work.

"… gives me more confidence in myself. In my marking, I am harder on the scores. So when I see I have been awarded more it is very encouraging."

"… going forward into the exam I now know which areas will need more attention in my revision."

What else? …

Over 80% agreed that inviting them to outline an action plan, or outline steps that need to be taken to improve their learning was helpful.

82% of students spent 15 to 60 minutes reviewing their work. Remaining 18% spent less than 15 minutes reviewing their work.

75% of students feel confident that the feedback self-reflection process encouraged in this module will help them improve in future.

Feedback reflection process encouraged in this module has achieved

Assessment and Feedback Principles @ Ulster*	Strongly agree or Agree
1. Clarify good performance.	74%
2. Encourage time and effort on task.	72%
3. Deliver timely high quality feedback.	79%
4. Provide opportunities to act on feedback.	68%
5. Encourage positive motivational beliefs.	72%
6. Develop self-assessment and reflection.	75%
7. Encourage interaction and dialogue.	79%

* URL: http://ee.ulster.ac.uk/assessment_and_feedback/

What did we think?

- 94% of the marked feedback was collected.
- 75% of students looked at their feedback.
- Students were involved in their learning.
- Many students provided meaningful and reflective action plans.
- Support was advised.
- Administration was reduced.

What did we think?

- Some timing issues with pilot.
- Not all students engaged.
- Lack of tool integration.

Future work and improvements

- Induct students at start of year.
- Create student focus group.
- Extend out to other modules.
- More development work required but ….

    worth seeking out funding or ways to do this!

Thank-you for listening!

Any Questions?