

Sharing Assessment across Institutions and VLEs

Sue Milne, Mary McVey & Niall Barr, University of Glasgow; Mastaneh Davis, Kingston University; Jon Mason, University of Oxford; Roger Greenhalgh, Harper Adams University; Sue Barnes, University of Strathclyde; Kate Durkacz, Napier University; Leslie Fletcher, Liverpool John Moores University

The Story so far...

- 6 JISC/HEA projects
- MathAssess preparing the tools
- FETLAR collecting Open Educational Resources (needs a home...)
- QTI-IPS dissemination, dissemination, dissemination!
- Uniqurate a friendly editor
- QTI-DI delivery via Moodle, Blackboard, Sakai,...
- QTI-PET get new people making and using questions & tests

Where are we now? Tools

- Uniqurate editor modular, extendable
- QTIWorks delivery engine links easily into Moodle 2, Blackboard 9, Sakai, etc
 Partners
- Glasgow: Maths for BTechEd, Maths Support, Biology sequencing T
- Oxford MedSci: Maths questions replace paper assessment Sakaj
- Strathclyde: training for colleagues in Engineering, Business Studies,....
- Harper Adams: Engineering Maths questions in agricultural context
- Napier: Maths questions replace paper assessment in the second s
- Liverpool John Moores: GU Biology sequencing becomes Maths proof
 Bb
- Kingston: using resources from GU BTechEd collection Bb

Glasgow – BTechEd Maths T1

- Maths for student Technology teachers
- Revision: arithmetic, algebra, trig, geometry, logs, exponentials, differentiation, complex numbers
- Previously CALMAT learning materials & assessment
- Updated to use online learning materials MathCentre, etc, and QTI for formative & summative assessment
- 270 questions delivered individually
- 10 mock tests + 10 REAL(!) tests reusing the questions

Glasgow BTechEd Questions

- Randomised (numbers and variable names)
- Manipulate Maths expressions using Maxima CAS
- Maths input where needed inspect input with CAS
- Good numerical input features too
- Hints and (full) Solutions for all questions
- Feedback usually better than "Correct" or "Incorrect"
- Used individually for formative assessment
- Reused in mock tests, then in summative Topic Tests

Glasgow - Biology

Maths questions

- Maths for Biologists reconstructing paper resource online
- Part of internal mini-project with Maths Support

Sequencing questions

- Biologists use sequencing questions paper based, students complete question using ICR form scanned and marks extracted
- Want electronic delivery via online course content keep marking scheme use QTI
- Creating good sequencing questions takes time
- Students design questions build up bank of questions as learning/revision resource
- Students work in groups to design sequencing questions 30-45 mins per question design
- ... Idea picked up by Leslie Fletcher as a neat way to work with Maths proofs

Kingston

- Engineering Foundation Course
- Previously CALMAT heard about BTechEd
- BTechEd questions made available from Sue's Google drive
- Questions re-used individually and in tests
- QTIWorks via LTI in Blackboard

Oxford Medical Sciences

- Maths workbook (PDF) given to students to attempt before starting course
- Requirement to monitor completion and test students' maths skills
- Reused BTechEd questions, with modifications if needed
- 'Building Blocks' blog posts: <u>tinyurl.com/qtiblocks</u>
- Delivered using QTIWorks via LTI in Sakai
- Lowish uptake, but good feedback

BTechEd Question

Question used as is, but also adapted...

Factorise a quadratic, a=1

Not Answered

This assessment item is being delivered using a set of default 'delivery settings'. You can create and use your settings when logged into QTIWorks via its LTI instructor connector or with an explicit QTIWorks system account.

Factorise this quadratic expression:

 $x^2 + 12x + 32$

Input Maths: (x+8)(x+4)

I have interpreted your input as: $(x+8) \cdot (x+4)$

Show Hint

Show Solution

SUBMIT RESPONSE

Adapted Question

Additional (randomised) factor to be taken out of the quadratic before factorisation

Factorising a Quadratic (3.3I)

Not Answered

This assessment item is being delivered using a set of default 'delivery settings'. You can create and use your settings when logged into QTIWorks via its LTI instructor connector or with an explicit QTIWorks system account.

Factorise this quadratic expression:

$$48x^3y^6 + 28x^4y^5 + 4x^5y^4$$

Input Maths: <u>4x^3y^4(x+3y)(x+4y)</u>

I have interpreted your input as: $4 x^3 y^4 (x + 3 y) (x + 4 y)$

Show Solution

SUBMIT RESPONSE

Strathclyde

- Training for colleagues as part of QTI-PET project
- Sue Barnes has taken on training role at Strathclyde
- Colleagues in Engineering, Business Studies,...

Harper Adams

- Training for colleagues as part of QTI-PET project
- Question production by part -time staff member
- Contextualising maths questions for agricultural engineering
- Multi-part questions about farm management, vet nursing,...

- Contact through Scottish Maths Support Network
- Old on-line resource needed translating into more up-to-date, editable and flexible form
- Using Uniqurate editor and Maxima
- All 25 questions have now been rewritten, and 2 have been registered and tested through Moodle
- Next stage: grouping the 25 questions into a test and getting second year students to test them out
- Steep learning curve for xml, mathml and maxima! Prior knowledge of html and tex helps and Sue has been extremely supportive.

 Workshops have been held at Edinburgh Napier and at least one other colleague is using Uniqurate for developing on-line technical questions

• The next steps include:

- Responding to feedback from student testers
- Implementing the new test in 2014/2015
- Getting feedback following the test
- Developing similar resources, to be used for revision in the first instance, for complex numbers and calculus
- A demonstration of where we are with QTI to make others at Edinburgh Napier aware of this resource

• Example of question running in Moodle:







• Example of question with a diagram:



In the isosceles triangle ABC, AB = AC and is of length x and the angle BAC is equal to φ . Find an expression for BC.

 \odot 2 $x \cos(\varphi)$

•
$$2x\sin(\varphi)$$

• $2x\sin\left(\frac{\varphi}{2}\right)$
• $2x\cos\left(\frac{\varphi}{2}\right)$
• $x\sin\left(\frac{\varphi}{2}\right)\cos\left(\frac{\varphi}{2}\right)$
SUBMIT RESPONSE

Liverpool John Moores University

- Sequencing questions for mathematical proof
 - "Put these statements in a correct order"
 - Using an idea from a parasitology question!
- Repurposing access-level questions for maths support
 - Simple arithmetical/algebraic reasoning
 - "Why does 600mg/day mean 25mg/hour?"
- Resources for specialist areas
 - Spherical trigonometry, terrestrial navigation

Liverpool John Moores University Starting point - Biology sequencing question

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Liverpool John Moores University Mathematical Proof sequencing question

Mathematical proof sequencing example

Leslie Fletcher

June 12, 2013

Ten of the 13 numbered statements below if put in the right order prove this theorem:

Theorem 1 Let $\{a_n\}$ and $\{b_n\}$ be sequences of real numbers such that

 $a_n \rightarrow a \ as \ n \rightarrow \infty$ $b_n \rightarrow b \ as \ n \rightarrow \infty$

Then

 $a_n - b_n \rightarrow a - b \text{ as } n \rightarrow \infty$

A correct sequence

1. Suppose $\epsilon > 0$

- 2. We must find N such that if n > N then $|(a_n b_n) (a b)| < \epsilon$
- 3. Because $a_n\to a$ as $n\to\infty$ there exists $N_1>0$ such that if $n>N_1$ then $|a_n-a|<\epsilon/2$
- 4. Because $b_n\to b$ as $n\to\infty$ there exists $N_2>0$ such that if $n>N_2$ then $|b_n-b|<\epsilon/2$

5. Put $N = \max(N_1, N_2)$

```
6. If n > N then
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$(a_n - b_n) - (a - b) $	=	$ (a_n - a) - (b_n - b) $	(7)
	\leq	$\left a_{n}-a\right +\left b_{n}-b\right $	(8)

1

<	$\epsilon/2 + \epsilon/2$			
=	e	as required	(10)	

Items 2, 3 and 4 can come in any order but must follow 1 and precede 5. Otherwise the order is fixed.

Spoilers

11. Because $a_n \rightarrow a$ there exists N such that if n > N then $|a_n - a| < \epsilon$

12. $\leq |a_n - a| - |b_n - b|$ 13. Put $N = N_1 - N_2$

Feedback

Using Statement 11: This is true but does not help satisfy Statement 2, which expresses the destination a rigorous proof must arrive at.

Using Statement 12: Think more carefully about modulus signs. It cannot be true in general that |x - y| is smaller than |x| - |y| as |x - y| is non-negative whereas |x| - |y| could be negative — if x = 1 and y = 2 for example.

Using Statement 13: The bigger the value of n, the more likely it is that the inequality in Statement 2 is satisfied so N given by $N_1 - N_2$ is likely to allow in too small values of n in Statement 6. Statement 5 could be replaced by "Put $N = N_1 + N_2$ " as this would ensure values of nallowed by Statement 6 are big enough.

2

Liverpool John Moores University

Mathematical Proof question in QTIWorks

A subset of the statements below, if put in the right order, prove this theorem:

Let $\{a_n\}$ and $\{b_n\}$ be sequences of real numbers such that

 $a_n \rightarrow a \text{ as } n \rightarrow \infty \quad b_n \rightarrow b \text{ as } n \rightarrow \infty$

Then

$a_n - b_n \rightarrow a - b$ as $n \rightarrow \infty$

Select those statements that are relevant, and place them in correct sequence.

Please note that:

Not all the statements may be relevant or appropriate. NOTE that there may be more than one correct order (statements may justifiably be placed in more than one order relative to each other). The marking scheme takes account of alternative correct answers. Marks are given for partially correct answers.

Drag unused items from here...

 $|(a_n - b_n) - (a - b)| \le |a_n - a| - |b_n - b|$

 $|(a_n - b_n) - (a - b)| \le |a_n - a| + |b_n - b|$

[§] Since $a_n \to a$ as $n \to \infty \exists N_1 > 0$ such that $n > N_1 \Rightarrow |a_n - a| < \epsilon/2$

Since $b_n \rightarrow b$ as $n \rightarrow \infty \exists N_2 > 0$ such that $n > N_2 \Rightarrow |b_n - b| < \epsilon/2$

 $Put N = max(N_1, N_2)$

Suppose $\epsilon > 0$

If n > N then

 $|(a_n - b_n) - (a - b)| = |(a_n - a) - (b_n - b)|$

 $|(a_n - b_n) - (a - b)| < \epsilon$ as required

Since $a_n \rightarrow a \exists N$ such that $n > N \Rightarrow |a_n - a| < \epsilon$

 $Put N = N_1 - N_2$

 $|(a_n - b_n) - (a - b)| < \epsilon/2 + \epsilon/2$

We must find N such that $n > N \Rightarrow |(a_n - b_n) - (a - b)| < \epsilon$

Show Solution

SUBMIT RESPONSE

Drop and order your selected items here...

OTI Question Bank Dick Bacon

- QTI pioneer
- Author of...
- The Physical Sciences Question Bank PSQB
- Storage facilities
- Upload/download
- Search, filter, organise,...
- ... which has been replicated as the QTI Question Bank

OTI Question Bank Early days

- Filling the bank one question at a time
- Development continues...

We have

- Storage facilities
- Upload/download
- Search, filter, organise,...
- https://cloud3.niallbarr.me.uk/qbank/admin/qblogin.php
- Logins available from <u>r.bacon@surrey.ac.uk</u>

QTI Question Bank

Log in at https://cloud3.niallbarr.me.uk/qbank/admin/sqltree/psqbs.php

QTI-IPS	QTI-PET project Question Bank v1.0 March 2013	QTLIPS
	Log in here to use the question bank as an administrator	
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	and then Sign In	
	This question bank is a resource for UK academics working with QTI v2.1. This version is for administrators only. If you want to use the Question Bank, contact Dick Bacon at "r.bacon@surrey.ac.uk".	

Round Trip – starting point

• Question running in QTIWorks

Use Pythagoras to find hypotenuse

Not Answered

These delivery settings let the candidate do pretty much anything, so might be very useful for debugging QTI items. Just remember that some features will only make sense if the item has been authored to support it, such as model solutions and re-initialisation.

In triangle ABC, angle B is 90°, the length of AB is 11 and the length of BC is 20.

Find the length of AC.

You may find it helpful to draw a diagram.

Give your answer correct to 2 decimal places.



Show Hint

Show Solution

SUBMIT ANSWER

The candidate currently has the following options for this item. You can choose exactly which options are available via the "item delivery".



Round Trip - prepare package

 Uniqurate editor - add metadata to manifest and save as a content package



Round Trip – upload package

• In the Question Bank's Question Manager, upload the file

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Round Trip - try in SToMPII

• Select the new question from the list and click Try

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Round Trip - download a question

 Using the Question Bank, add the question to the shopping cart - it's highlighted in green in the bank and appears in the download list

QTI-F	ET project Question Bank - admin mode - no stats. (UKEL 8)		
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Round Trip - save the file

Select how and where the file should be saved



Round Trip – run in QTIWorks

- Run the downloaded package in QTIWorks
- ... Round trip complete!

Use Pythagoras to find hypotenuse Not Answere
This assessment item is being delivered using a set of default 'delivery settings' we have created for you. You will be able to change and edit these settings to suit if you have a QTIWorks account.
In triangle ABC, angle B is 90°, the length of AB is 8 and the length of BC is 9.
Find the length of AC.
You may find it helpful to draw a diagram.
Give your answer correct to 2 decimal places.
Show Hint
Show Solution
SUBMIT RESPONSE
Reset Reinitialise Finish and review Exit

Contacts...

- Sue Milne <u>sue.milne@glasgow.ac.uk</u>
- Niall Barr <u>niall.barr@glasgow.ac.uk</u>
- Mary McVey <u>mary.mcvey@glasgow.ac.uk</u>
- Jon Mason jon.mason@medsci.ox.ac.uk
- Leslie Fletcher <u>I.r.fletcher@ljmu.ac.uk</u>
- Uniqurate: <u>http://uniqurate.kingston.ac.uk/demo</u>
- Paul Neve (Uniqurate Developer) p.r.neve@kingston.ac.uk
- QTIWorks: https://webapps.ph.ed.ac.uk/qtiworks/
- David McKain (QTIWorks Developer) <u>david.mckain@ed.ac.uk</u>
- Question bank <u>https://cloud3.niallbarr.me.uk/qbank/admin/qblogin.php</u>
- Dick Bacon (Question Bank Developer contact for logins) <u>r.bacon@surrey.ac.uk</u>