How do computer-marked quizzes best help students learn?

How does Moodle help you make the best quizzes?

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Tuesday 28th May 2024

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Overview

1	Education – oversimplified!
2	Computer-marked questions
3	Ways to use questions
4	Moodle quiz options for learning
5	Learning from the results
6	Managing questions and quizzes

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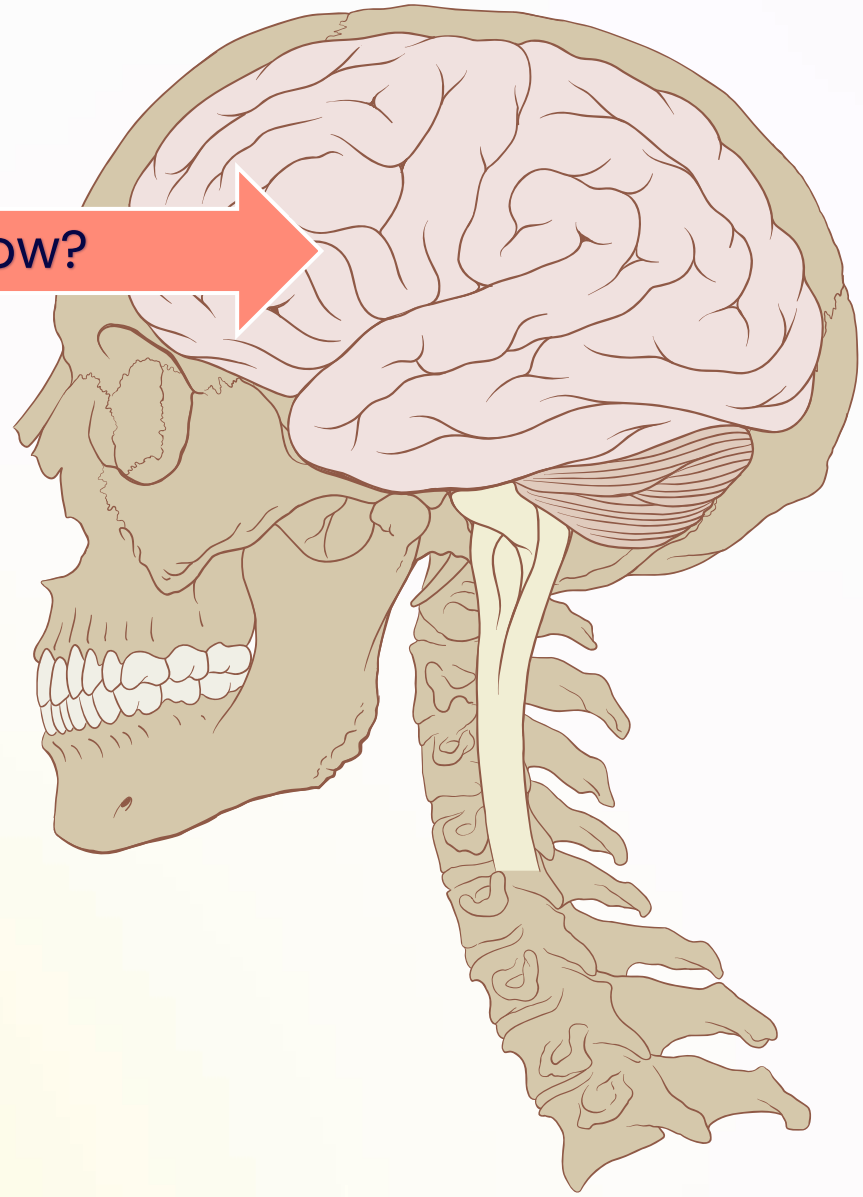
Education – oversimplified!

The problem

Knowledge

Skills

How?



We cannot do the student's learning for them.

Only they can get the knowledge and skills into their own brain.

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What we know

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Two important teaching techniques

Scaffolding

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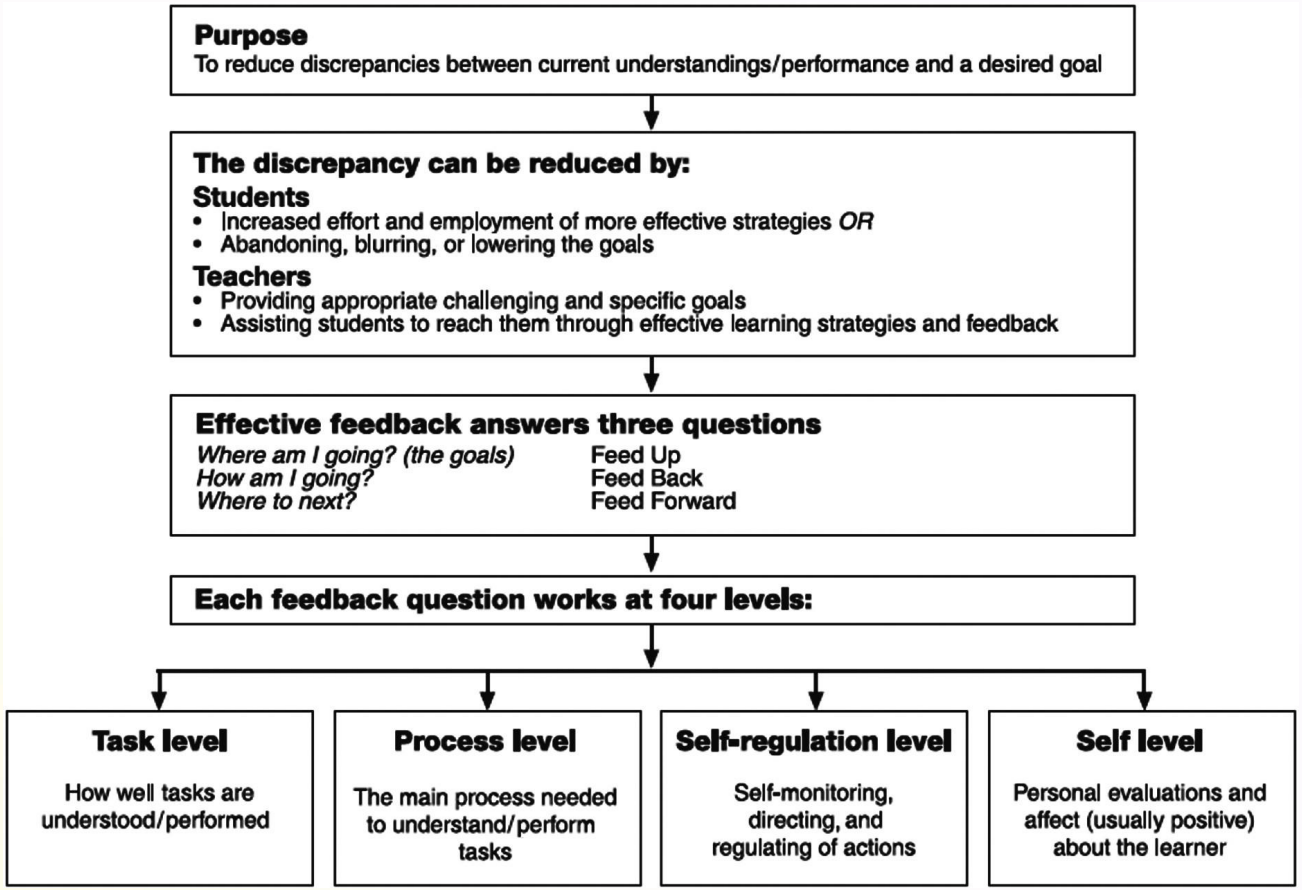
Feedback



Hattie, J., & Timperley, H. (2007). The Power of Feedback. *Review of Educational Research*, *77*(1), 81-112.

These techniques in computer-marked quizzes

Scaffolding

(a) Rewrite the quadratic function $f(x) = 4x^2 - 32x + 65$ in the form $f(x) = a(x-p)^2 + q$.

$f(x) =$ [ ]

(b) Which type of stationary point does this function have? (No answer given)

(c) What are the coordinates of the stationary point?

$(x, y) =$ ([ ] , [ ])

Check

STACK DEMO: Fundamentals of Algebra and Calculus, Question 4

https://stack-demo.maths.ed.ac.uk/demo/mod/quiz/view.php?id=81

Feedback

(a) Rewrite the quadratic function $f(x) = 4x^2 - 32x + 65$ in the form $f(x) = a(x-p)^2 + q$.

$f(x) =$ 4*(x-4)^2 - 1

Your last answer was interpreted as follows:

$$4(x-4)^2 - 1$$

The variables found in your answer were: $[x]$

✖ **Incorrect answer.**

Your expression is not algebraically equivalent to $4x^2 - 32x + 65$.

(b) Which type of stationary point does this function have? Minimum turning point

✔ **Correct answer, well done.**

(c) What are the coordinates of the stationary point?

$(x, y) =$ (-4 , 1)

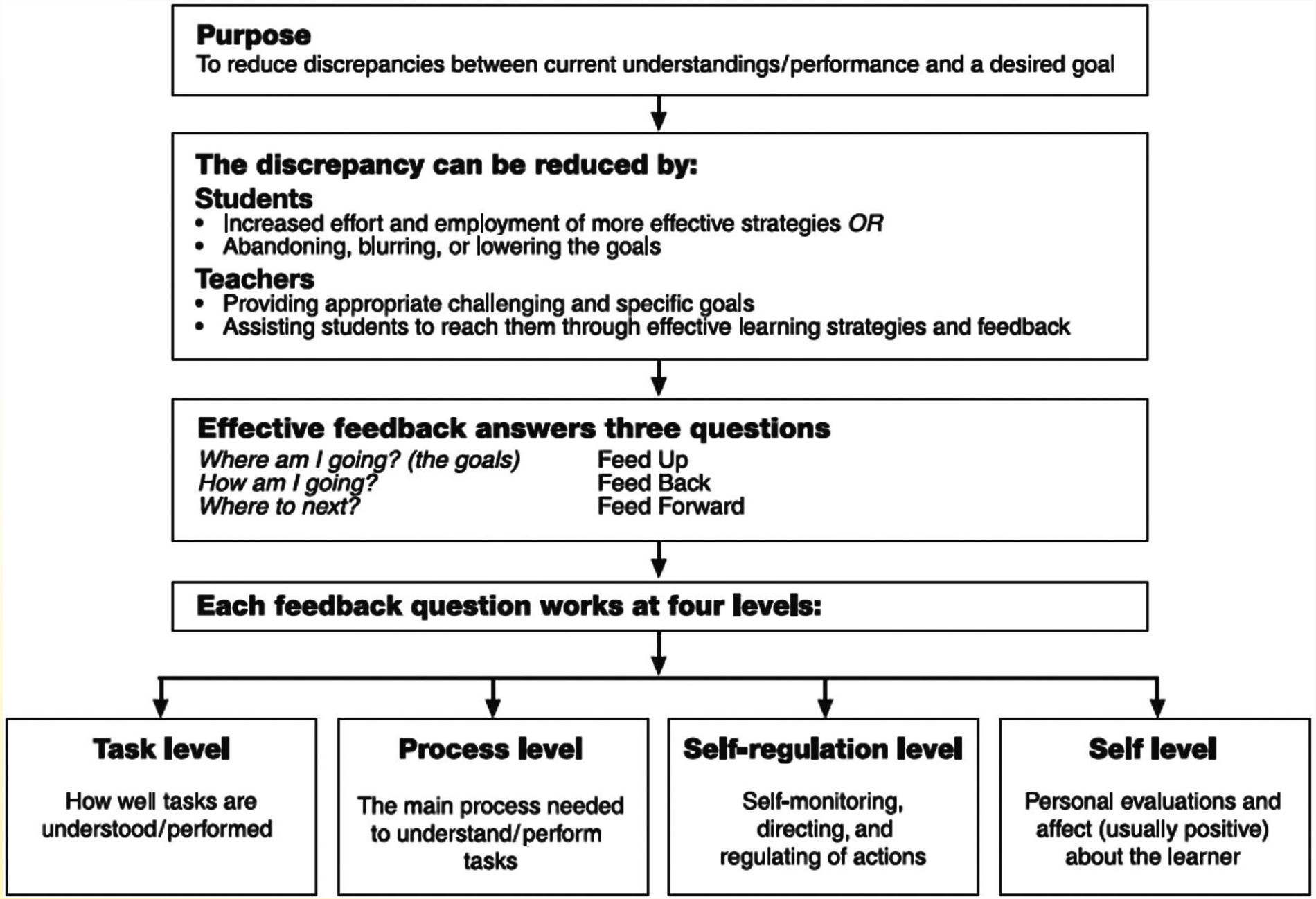
✖ **Incorrect answer.** ✔ **Correct answer, well done.**

To write $4x^2 - 32x + 65$ in completed square form we proceed as follows.

$$\begin{aligned} 4x^2 - 32x + 65 &= 4\left(x^2 - 8x\right) + 65 \\ &= 4(x-4)^2 - 4 \times 81 \\ &= 4(x-4)^2 + 1. \end{aligned}$$

This is a positive quadratic, and so has a minimum value. The coordinates of the turning point can be read off from (in the completed square form, giving $(4, 1)$.

Feedback



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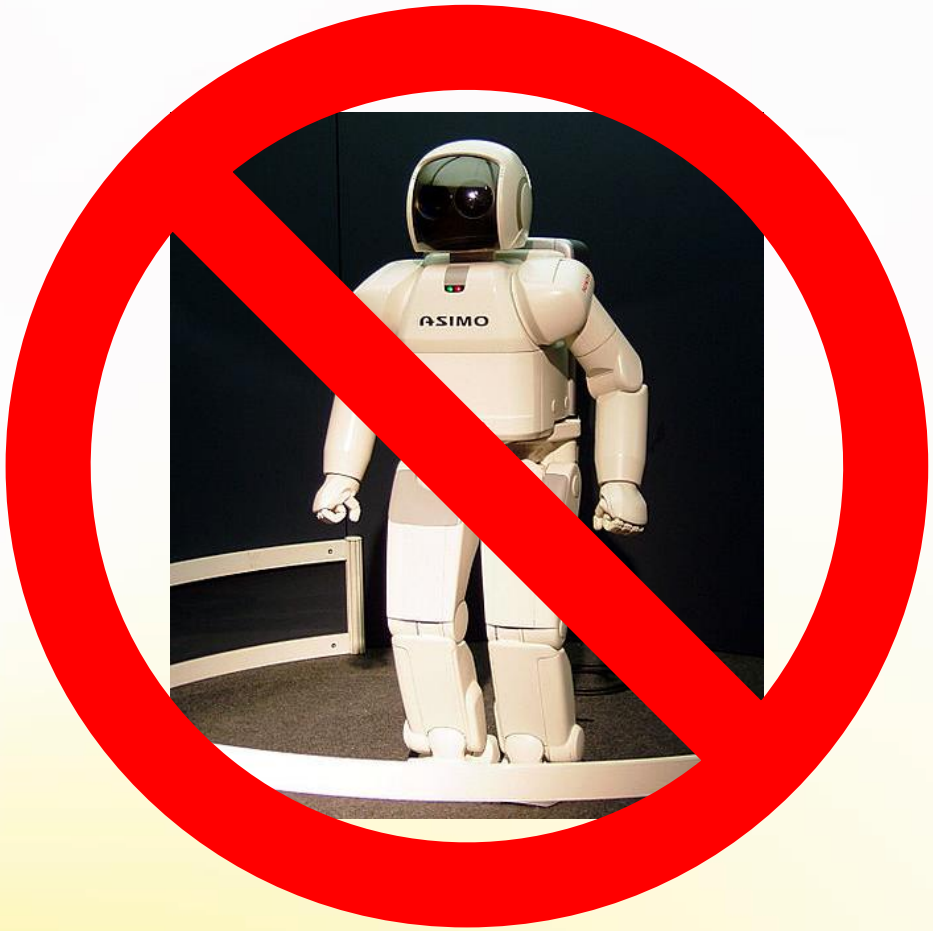
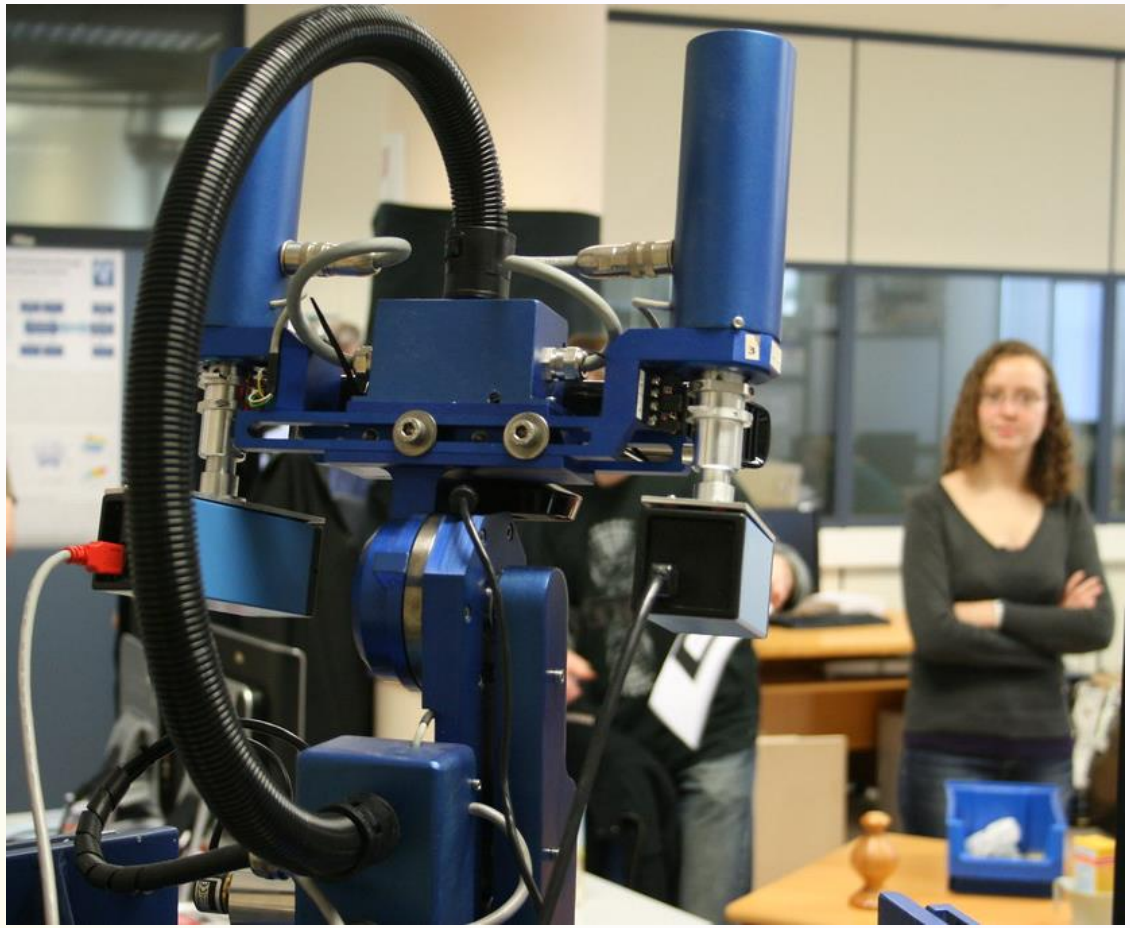
Computer-marked questions

Does the computer do the marking?





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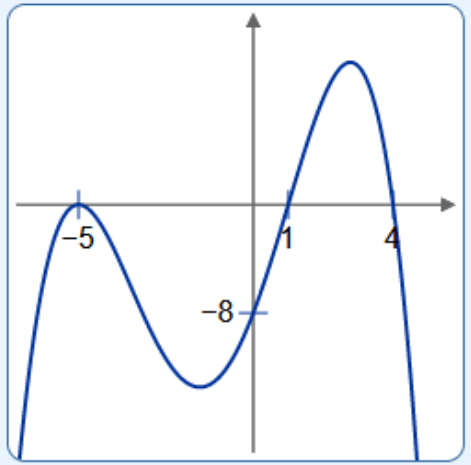
Questions: selected vs. constructed response

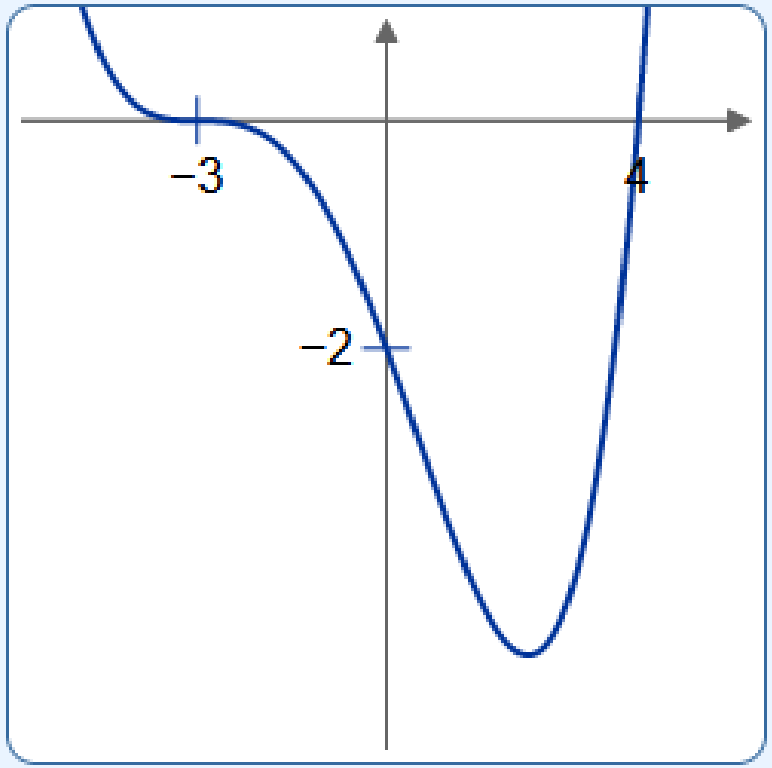
Here is the graph of a quartic:



(a) Which of the following is the correct form for the quartic equation shown in the graph?

- $y = k\,(x-4)\,(x-1)\,(x+5)^2$
- $y = k\,(x-5)^2\,(x+1)\,(x+4)$
- $y = k\,(x+1)\,(x+4)\,(x+5)^2$
- $y = k\,(x+1)\,(x+4)\,(x+5)\,(x+8)$
- $y = k\,(x-4)\,(x-1)\,(x+5)$
- $y = k\,(x-4)\,(x-1)\,(x+5)\,(x+8)$

Find the equation of the quartic shown in the graph:



$y =$

Check

https://stack-demo.maths.ed.ac.uk/demo/mod/quiz/view.php?id=82

Moodle question types

Selected response

True/false

Multiple choice

Matching

Select missing words

Drag-drop into text

Drag-drop onto image

Ordering

…

Word select

?????

Drag-drop markers

Embedded answers (Cloze)

…

Combined

Constructed response

Short answer

Numerical

Calculated

Drag-drop markers

…

Formulas

STACK

CodeRunner

Pattern-match

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Ways to use questions

Range of uses

Assessment of learning

Exams

Summative assessment

Assessment for learning

Formative assessment

Diagnostics assessment

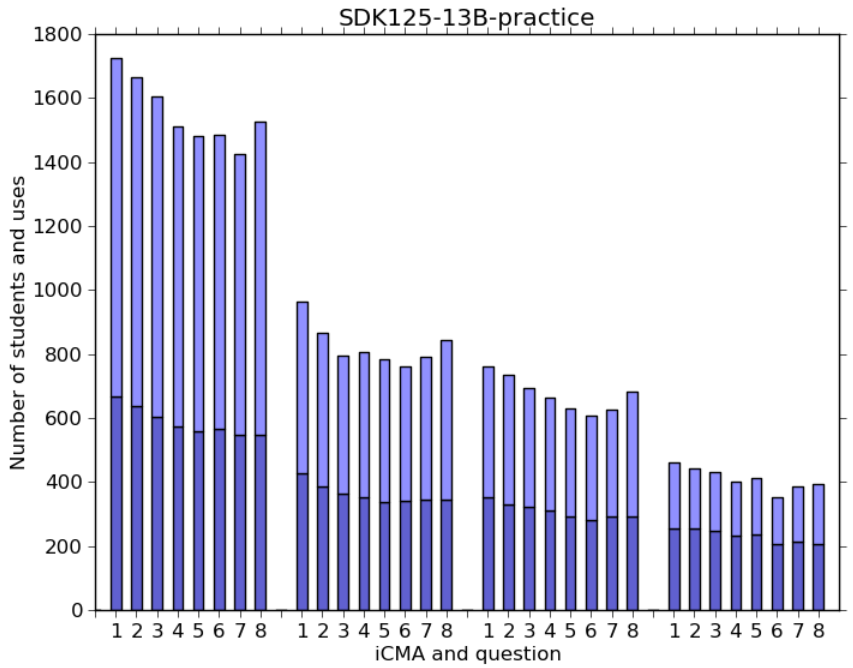
Assessment as learning

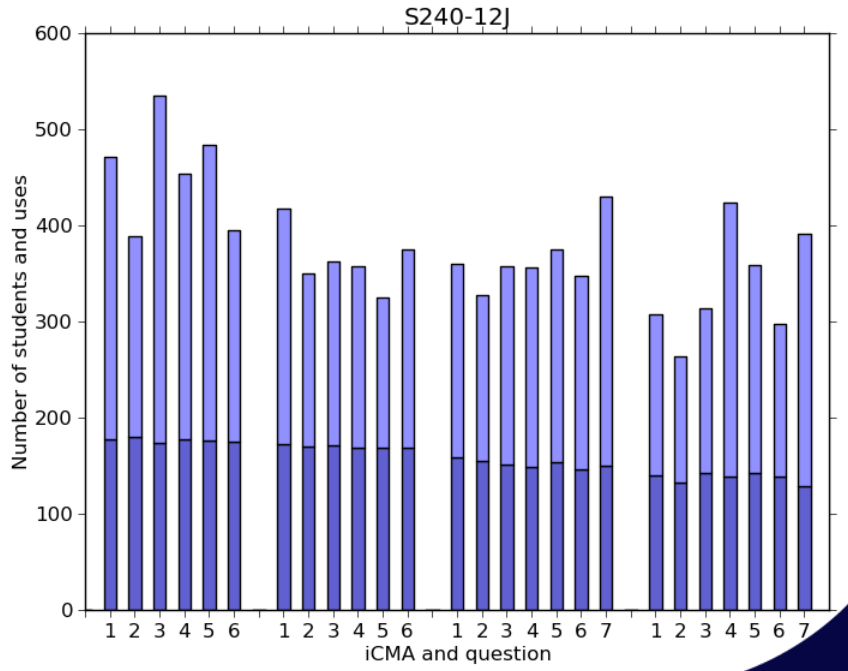
Practice

Learning & Teaching

Use marks to control students?

Quizzes help students → Give course credit? → Students use more / Policies!





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Questions within learning

The next activity focuses on the implications of Thirlwall's Law for rates of development and for inequalities among countries.

Activity 13 Constraints on commodity exporters

Allow 5 minutes for this activity

Which of these situations would lead to industrialised countries growing faster than agriculturally based countries, for the reasons put forward by Thirlwall? Fill in the blank from the list below.

Demand for commodity exports being [ ] than demand for industrial exports

Check

Tries remaining: 3 | For staff: Edit question | Question bank | Fill with correct

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< Previous

6.4 An equation for 'balanced' growth

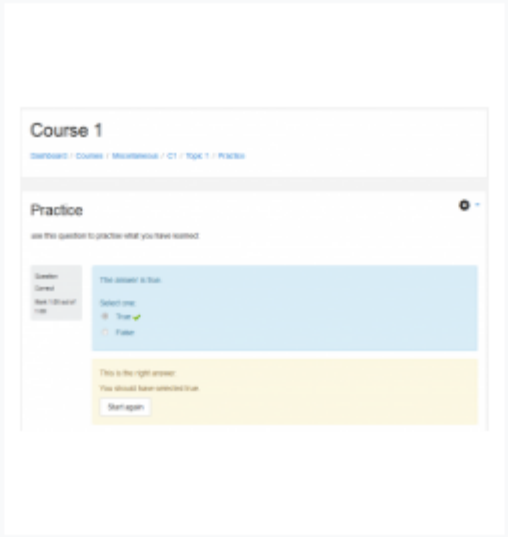
Next >

7 The eurozone: an optimum currency area?

Embedded question plugins

Embed questions filter

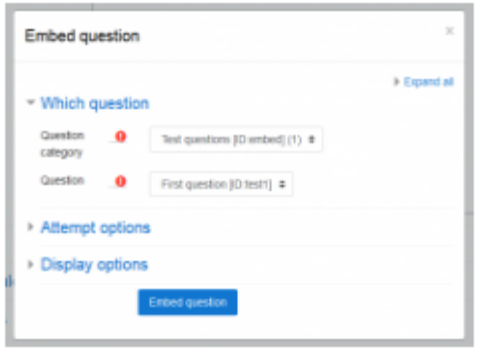
A Moodle text filter plugin that displays interactive questions from the question bank embedded in the page.



20 months 1230 512 60 6

Embed question atto button

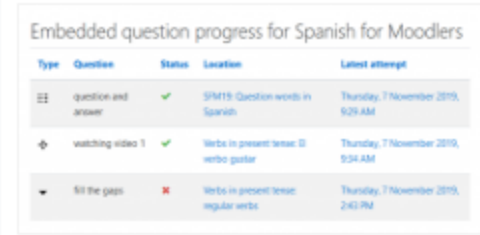
An Atto editor plugin for use with the embed questions filter.



20 months 997 444 36 6

Embedded questions progress

Works with the Embed questions filter to store Student's attempts permanently and make them available for review.



20 months 526 258 16 5

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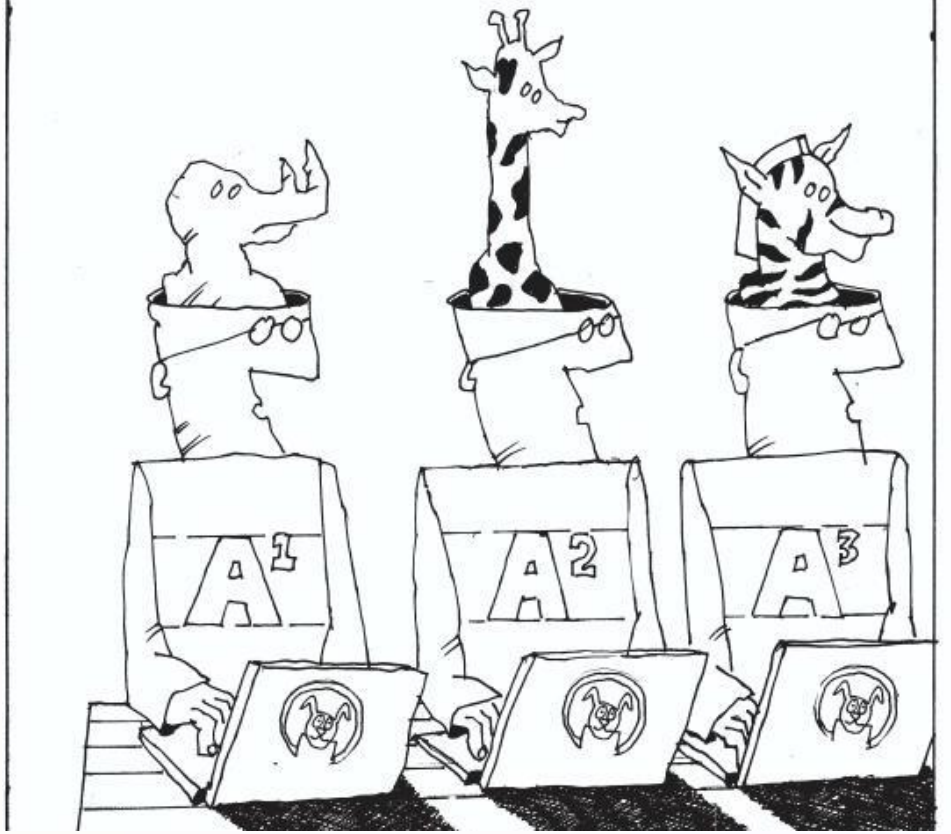
Moodle quiz options for learning

Effective educational technology

- Helps students learn
- Practically usable by educators
- Can be administered at institutional scale
- Technically maintainable (servers, security, update)
- Complies with legislation (accessibility, GDPR, …)



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Useful quiz settings

Attempts allowed

7

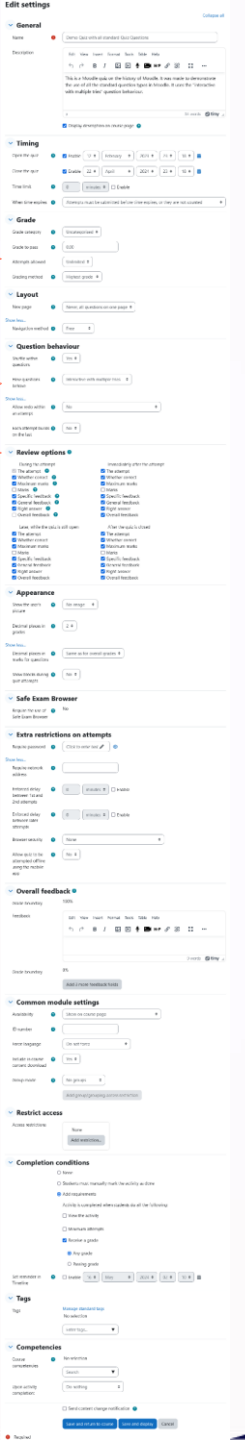
Review options

	During the attempt	Immediately after the attempt
The attempt	☑	☑
Whether correct	☑	☑
Maximum marks	☑	☑
Marks	☐	☐
Specific feedback	☑	☑
General feedback	☑	☑
Right answer	☐	☐
Overall feedback	☐	☑

How questions behave

Interactive with multiple tries

- Adaptive mode
- Adaptive mode (no penalties)
- Deferred feedback
- Deferred feedback with CBM
- Immediate feedback
- Immediate feedback with CBM
- Interactive with multiple tries



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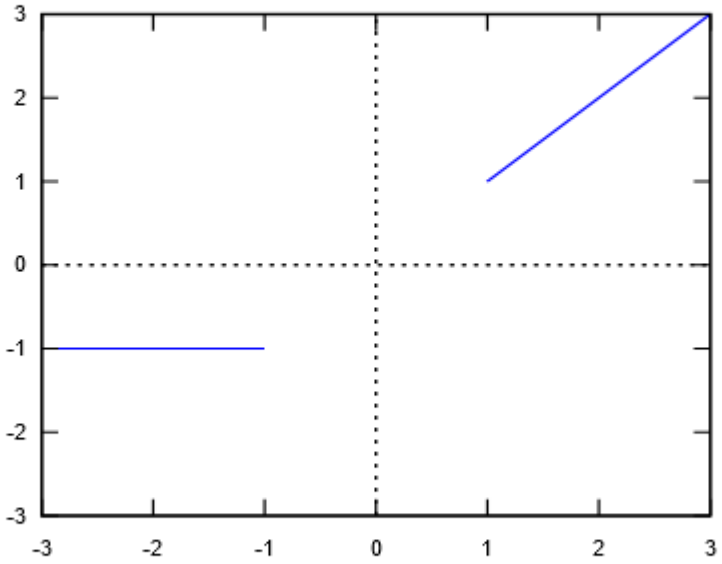
Interactive with multiple tries

Question 20 Tries remaining: 3

Marked out of 4.00 | Flag question

Can you find a function which smoothly bridges the gap between these two straight lines:



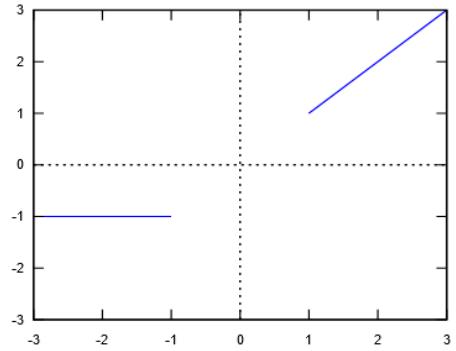
$f(x) =$

Check

Question 20 Tries remaining: 2

Marked out of 4.00 | Flag question

Can you find a function which smoothly bridges the gap between these two straight lines:



$f(x) =$ x

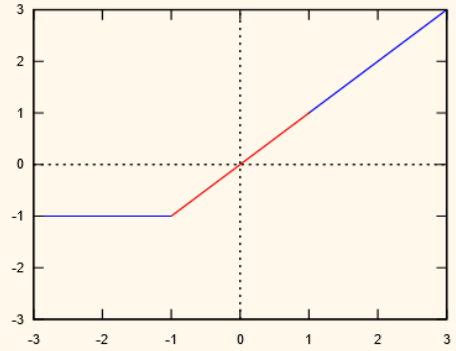
Your last answer was interpreted as follows:

x

The variables found in your answer were: $[x]$

Your answer is partially correct!

Here is what your answer looks like:



Well done, you function has value -1 when $x = -1$, so it joins up on the left.

When $x = -1$, your function has slope 1 so the join on the left is not smooth. The slope there needs to be 0.

Well done, you function has value 1 when $x = 1$, so it joins up on the right.

Well done, you function has slope 1 when $x = 1$, so the join on the right is smooth.

If you have nothing better to do, try just guessing the answer x. It works surprisingly well! However, can you come up with something better?

Try again

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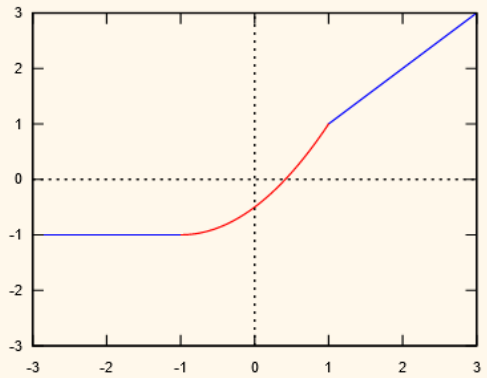
Your last answer was interpreted as follows:

$$\frac{1}{2}\cdot(x+1)^2-1$$

The variables found in your answer were: $[x]$

Your answer is partially correct!

Here is what your answer looks like:



Well done, you function has value -1 when $x=-1$, so it joins up on the left.

Well done, you function has slope 0 when $x=-1$, so the join on the left is smooth.

Well done, you function has value 1 when $x=1$, so it joins up on the right.

When $x=1$, your function has slope 2 so the join on the left is not smooth. The slope there needs to be 1.

To acutally solve this is a moderately tricky bit of maths. However, it is perhaps more interesting when you get it wrong, because then you can see the kind of feedback that STACK is able to generate.

If you want to do the calculations, then one way to simplify things is to notice that we want to start at value -1 when $x=-1$ and continue smootly from there starting with zero gradient. So there might be a solution of the form:

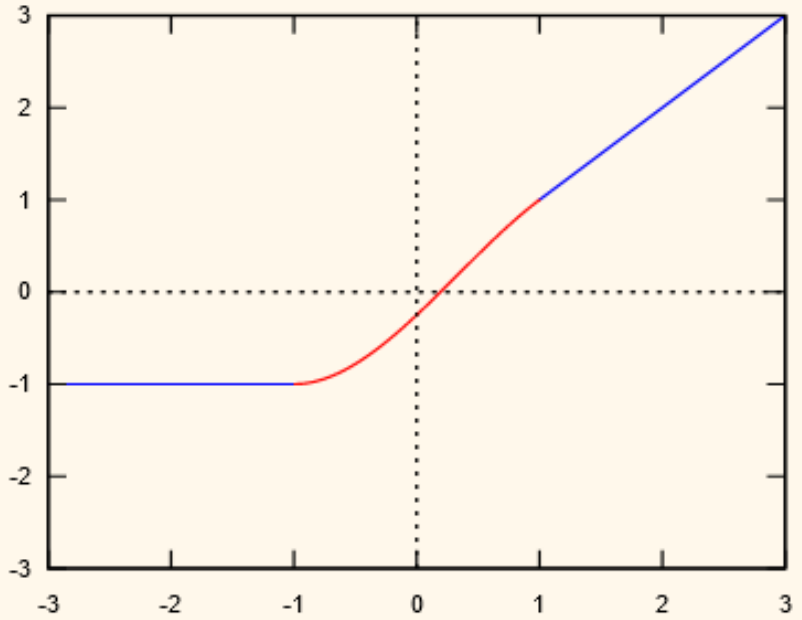
$$f(x)=-1+A(x+1)^2+B(x+1)^3$$

Then using the conditions that when $x=1$ this function must have value 1 and slope 1 lets you find A and B.

Try again

Correct answer, well done!

Here is what your answer looks like:



Well done, you function has value -1 when $x=-1$, so it joins up on the left.

Well done, you function has slope 0 when $x=-1$, so the join on the left is smooth.

Well done, you function has value 1 when $x=1$, so it joins up on the right.

Well done, you function has slope 1 when $x=1$, so the join on the right is smooth.

A correct answer is $f(x)=-\frac{x^3}{4}+\frac{x^2}{4}+\frac{5\cdot x}{4}-\frac{1}{4}$.

There are many other possible answers that would work. This technique of finding functions which smootly interpolate between two ends is very important in computer-aided design applications. This is the basis of how the nice smooth shape of your car is designed.

Notice the way that STACK is able to give feedback based on information derived from the response you entered, including showing it on a graph.

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Randomisation

Page 1

i **icma42 instructions** ICMA42 INSTRUCTIONS This i... Always latest

Page 2

1 **02.03.B: Gradient, intercepts from line (implicit)** ... Always latest 1.00

Page 3

2 **02.04.B.Equation of line through two points** Find,... Always latest 1.00

Page 4

3 **02.06 Displacement-time graph** The displacement-... Always latest 1.00

Page 5

4 **Random (02.07 Simultaneous equations)** (See questions) 1.00

Allow redo within an attempt

No

No

Yes, provide the option to try another question

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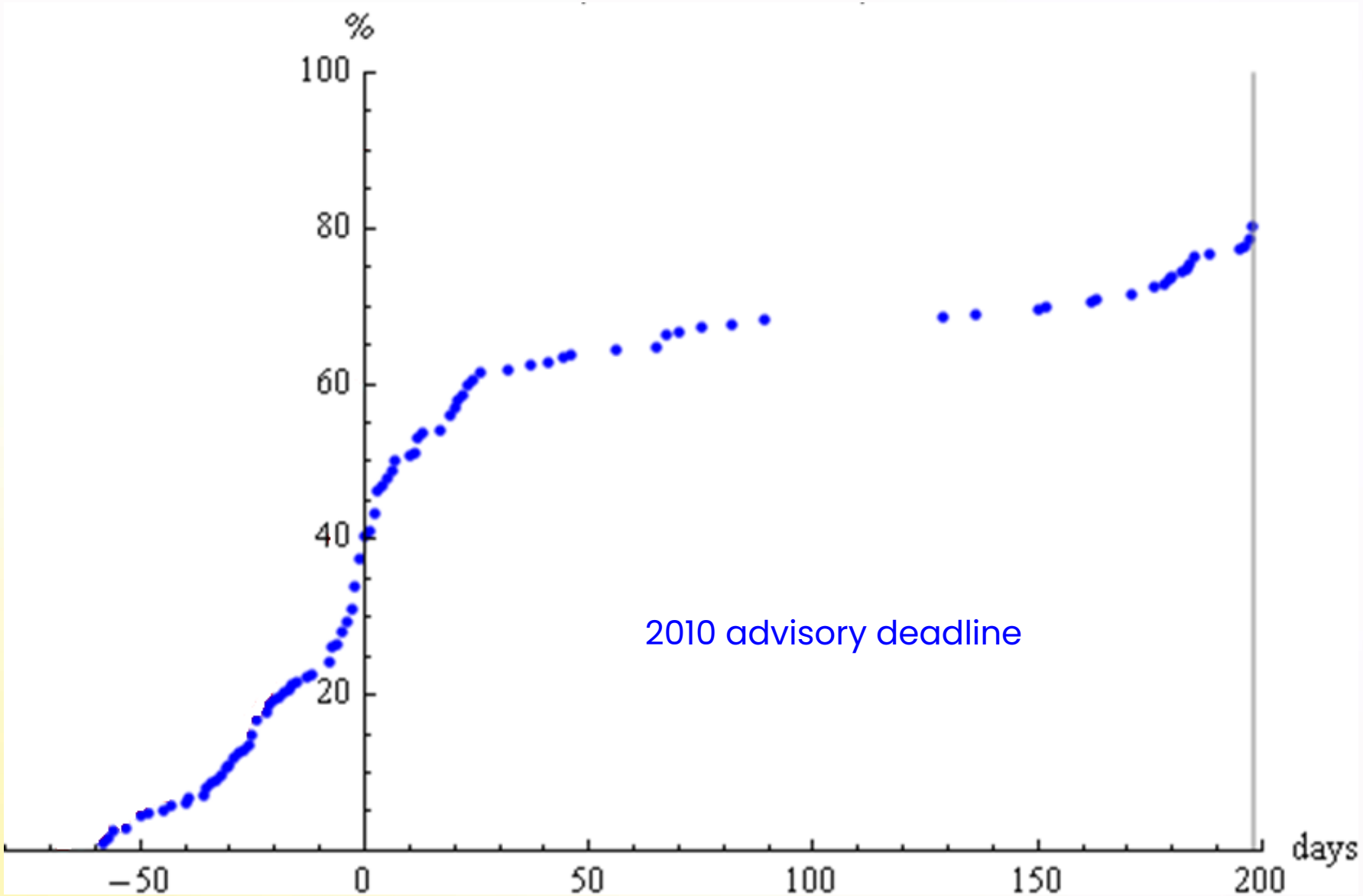
Effect of deadlines



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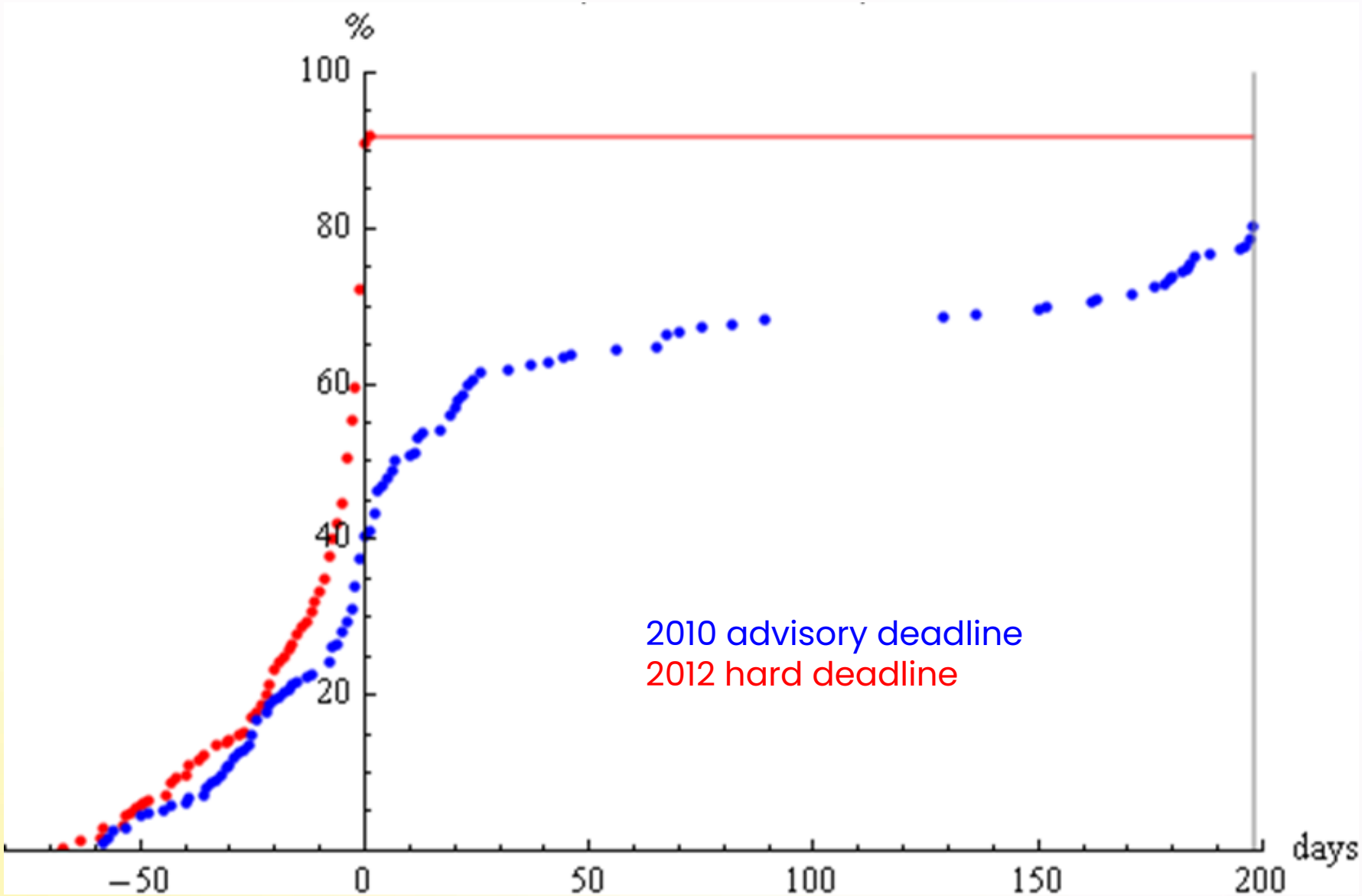
Effect of deadlines



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Learning from the results

Quiz data from Moodle

Download table data as Comma separated values (.csv) Download

	First name / Last name	Email address	Status	Started	Completed	Duration	Grade/ 10.00	Q. 1 /0.83	Q. 2 /0.83	Q. 3 /0.83	Q. 4 /0.83	Q. 5 /0.83	Q. 6 /0.83	Q. 7 /0.83	Q. 8 /0.83	Q. 9 /0.83	Q. 10 /0.83	Q. 11 /0.83	Q. 12 /0.83
	**Sam Student** Review attempt	student@example.com	Finished	9 October 2018 11:00 PM	9 October 2018 11:03 PM	2 mins 58 secs	**Not yet graded**	✓ 0.83	✗ 0.00	✗ 0.00	☑ 0.28	✗ 0.00	✗ 0.00	✓ 0.83	✓ 0.83	✓ 0.83	✓ 0.83	✓ 0.83	Requires grading
	**Sally Student** Review attempt	student2@example.com	Never submitted Reopen	10 October 2018 3:19 AM	-	-	-	✓ 0.83	-	✗ 0.00	-	-	-	✓ 0.83	-	-	-	-	-
	Overall average						-	0.83 (2)	0.00 (1)	0.00 (2)	0.28 (1)	0.00 (1)	0.00 (1)	0.83 (2)	0.83 (1)	0.83 (1)	0.83 (1)	0.83 (1)	-

		First name / Last name	Email address	Status	Grade/ 10.00	Response 1	Response 2	Response 3	Response 4	Response 5	Response 6	Response 7	Response 8	Response 9	Response 10	Response 11	Response 12
		**Sam Student** Review attempt	student@example.com	Finished	**Not yet graded**	✓ True	✗ Groupings first appeared in... -> Moodle 2.3; Repositories made their début in... -> Moodle 2.4; Group assignments	✗ May 2014	☑ Moodle documentation is in the Public Domain ; There are three Moodle demonstration sites ; The word Moodle is a registered trademark.	✗ September	✗ 2004	✓ 23	✓ 10	✓ 75.6	✓ In which Australian city is Moodle HQ situated? -> Perth; In which Australian city was the 2011	✓ part 1: Crete, Greece	MOST USEFUL QUESTION TYPE: MULTIPLE CHOICE LEAST USEFUL QUESTION TYPE: ESSAY

Statistics

Q#			Question name	Attempts	Facility index	Standard deviation	Random guess score	Intended weight	Effective weight	Discrimination index	Discriminative efficiency
1			Random question	123	94.42%	16.20%		20.00%	18.01%	33.16%	40.72%
1.1			q1 v1b	23	90.14%	20.78%	20.00%	20.00%		74.82%	84.59%
1.2			q1 v2b	19	100.00%	0.00%	20.00%	20.00%			
1.3			q1 v3b	29	94.94%	15.50%	20.00%	20.00%		74.03%	91.86%
1.4			q1 v4b	22	99.39%	2.84%	20.00%	20.00%		-0.82%	-1.73%
1.5			q1 v5b	30	90.00%	21.57%	20.00%	20.00%		47.81%	65.05%

Q#			Question name	Attempts	Fac						
1			Random question	123	9						
			Range of statistics for these questions View details	19 – 30	90.00%						
2			Random question	123	8						
			Range of statistics for these questions View details	20 – 27	86.92% – 90.00%	11.56% – 17.50%	50.00% – 50.00%	20.00% – 20.00%		52.73% – 71.33%	59.16% – 76.04%
3			Random question	123	95.88%	11.24%		20.00%	16.43%	55.00%	66.26%
			Range of statistics for these questions View details	17 – 32	92.71% – 99.22%	3.23% – 14.86%	20.00% – 20.00%	20.00% – 20.00%		20.88% – 83.16%	45.16% – 92.87%
4			Random question	123	93.98%	17.79%		20.00%	18.56%	28.06%	33.92%
			Range of statistics for these questions View details	20 – 29	83.00% – 100.00%	0.00% – 30.70%	20.00% – 20.00%	20.00% – 20.00%		0.00% – 79.01%	0.00% – 87.86%
5			Random question	123	73.50%	31.04%		20.00%	29.39%	38.69%	44.22%
			Range of statistics for these questions View details	18 – 30	51.72% – 92.00%	18.81% – 32.81%	16.67% – 16.67%	20.00% – 20.00%		70.13% – 80.94%	81.53% – 87.96%

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Response analysis

Question 1 Correct

Marked out of 5.00

The Bachwoche Ansbach is a festival to celebrate the music of Johann Sebastian Bach. The following extract has been taken from a longer text about the history of the festival. Read the extract carefully and complete the text by dragging an appropriate word into each gap. You will need five out of the six words provided. You may need a dictionary to complete this task.

Die Geschichte der Bachwoche Ansbach

1947-1953: Der Beginn

Die Geschichte der Bachwoche Ansbach beginnt in München. Nach den traumatischen Ereignissen der Nazizeit und des zweiten Weltkriegs [trafen] ✔ sich hier der Kunsthändler Dr. Carl Weymar, der Cellist Ludwig Hoelscher und der Dirigent Ferdinand Leitner. Sie beschlossen, eine Reihe von [Konzerten] ✔ mit Musik von Johann Sebastian Bach zu [veranstalten] ✔ . Die Pläne sprachen sich herum, und so versammelte sich rund um Bachs Todestag, vom 27. Juli bis 3. August 1947, eine [Anzahl] ✔ von Musikfreunden im oberfränkischen Pommersfelden. Hier lebte Graf Schönborn, der für die Bachwoche Räumlichkeiten in seinem Schloss Weißenstein zur Verfügung stellte.

Die [Räume] ✔ im Schloss reichten jedoch nicht aus. Deshalb zog die Bachwoche 1948 um nach Mittelfranken, in die Stadt Ansbach.

(Bachwoche Ansbach, 2017)

[machten]

Sehr gut. Your answer is correct.

The correct answer is:

Die Geschichte der Bachwoche Ansbach beginnt in München. Nach den traumatischen Ereignissen der Nazizeit und des zweiten Weltkriegs **trafen** sich hier der Kunsthändler Dr. Carl Weymar, der Cellist Ludwig Hoelscher und der Dirigent Ferdinand Leitner. Sie beschlossen, eine Reihe von **Konzerten** mit Musik von Johann Sebastian Bach zu **veranstalten**. Die Pläne sprachen sich herum, und so versammelte sich rund um Bachs Todestag, vom 27. Juli bis 3. August 1947, eine **Anzahl** von Musikfreunden im oberfränkischen Pommersfelden. Hier lebte Graf Schönborn, der für die Bachwoche Räumlichkeiten in seinem Schloss Weißenstein zur Verfügung stellte.

Die **Räume** im Schloss reichten jedoch nicht aus. Deshalb zog die Bachwoche 1948 um nach Mittelfranken, in die Stadt Ansbach.

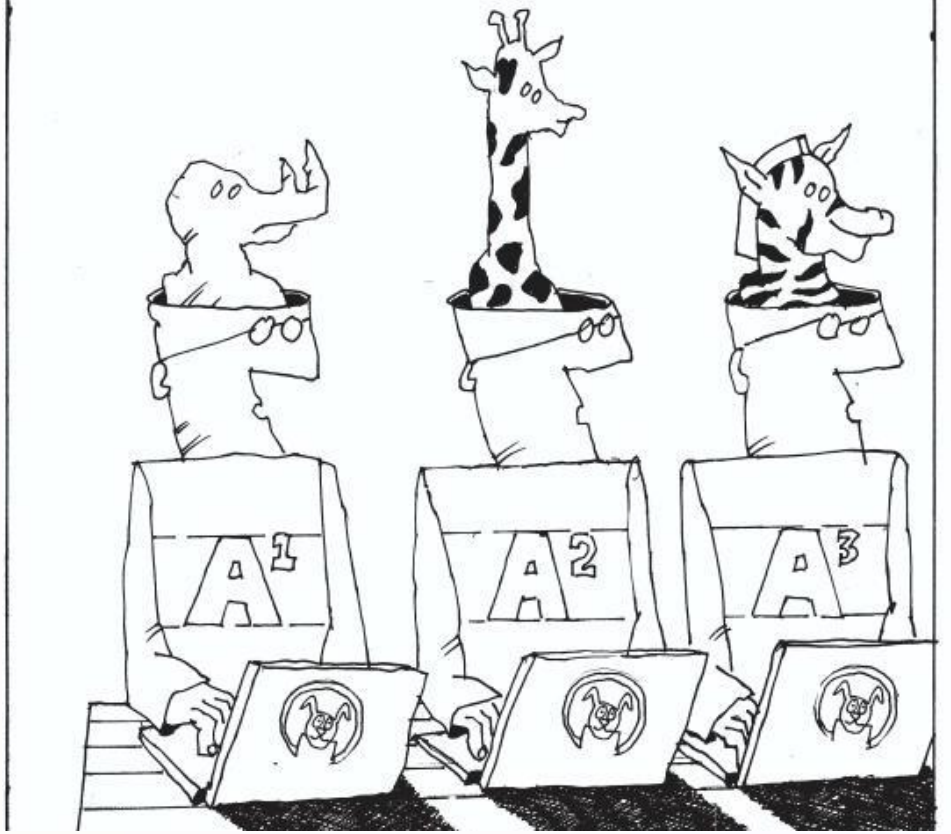
Analysis of responses

Part of question	Model response	Partial credit	Count	Frequency
1	trafen	20.00%	12	66.67%
	Konzerten	0.00%	0	0.00%
	veranstalten	0.00%	2	11.11%
	Anzahl	0.00%	1	5.56%
	Räume	0.00%	0	0.00%
	machten	0.00%	3	16.67%
	[No response]	0.00%	0	0.00%
2	trafen	0.00%	1	5.56%
	Konzerten	20.00%	17	94.44%
	veranstalten	0.00%	0	0.00%
	Anzahl	0.00%	0	0.00%
	Räume	0.00%	0	0.00%
	machten	0.00%	0	0.00%
	[No response]	0.00%	0	0.00%
3	trafen	0.00%	2	11.11%
	Konzerten	0.00%	0	0.00%
	veranstalten	20.00%	12	66.67%
	Anzahl	0.00%	0	0.00%
	Räume	0.00%	0	0.00%

Managing questions and quizzes

Effective educational technology

- Helps students learn
- Practically usable by educators
- **Can be administered at institutional scale**
- Technically maintainable (servers, security, update)
- Complies with legislation (accessibility, GDPR, …)



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Management

Workflow status report

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Website	Activity	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8	Step 9	Step 10	Workflow	Two weeks before open date	Open date	Close date
L185-24J	iCMA 41	Active 9 Feb 2024	Not started	Not started	Not started	Not started	Not started	Not started	Not started	Not started	Not started	iCMA Assessed Deferred (Score & Feedback after cut-off date)	19/10/24, 01:00	2/11/24, 01:00	8/11/24, 00:59
LXT191-23J	iCMA44 (French listening)	Completed 30 Jun 2023	Aborted 30 Jun 2023	Not started	Not started	Completed 3 Jul 2023	Completed 13 Jul 2023	Active 13 Jul 2023	Not started	Not started	Not started	iCMA Assessed interactive (Immediate feedback, score/feedback after cut-off date)	23/09/23, 00:00	7/10/23, 00:00	6/06/24, 23:59
LXT191-23J	iCMA44 (German listening)	Completed 30 Jun 2023	Aborted 30 Jun 2023	Not started	Not started	Completed 3 Jul 2023	Completed 3 Jul 2023	Active 3 Jul 2023	Not started	Not started	Not started	iCMA Assessed interactive (Immediate feedback, score/feedback after cut-off date)	23/09/23, 00:00	7/10/23, 00:00	6/06/24, 23:59
LXT191-23J	iCMA44 (Spanish listening)	Completed 30 Jun 2023	Aborted 30 Jun 2023	Not started	Not started	Completed 3 Jul 2023	Completed 3 Jul 2023	Active 3 Jul 2023	Not started	Not started	Not started	iCMA Assessed interactive (Immediate feedback, score/feedback after cut-off date)	23/09/23, 00:00	7/10/23, 00:00	6/06/24, 23:59
LXT191-23J	iCMA44 (Chinese listening)	Completed 30 Jun 2023	Aborted 30 Jun 2023	Not started	Not started	Completed 3 Jul 2023	Completed 3 Jul 2023	Active 3 Jul 2023	Not started	Not started	Not started	iCMA Assessed interactive (Immediate feedback, score/feedback after cut-off date)	23/09/23, 00:00	7/10/23, 00:00	6/06/24, 23:59
L113-23J	iCMA 44	Completed 21 Apr 2023	Aborted 21 Apr 2023	Not started	Not started	Completed 24 Apr 2023	Completed 24 Apr 2023	Completed 14 May 2024	Active 14 May 2024	Not started	Not started	iCMA Assessed interactive (Immediate feedback, score/feedback after cut-off date)	23/09/23, 00:00	7/10/23, 00:00	16/05/24, 23:59

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iCMA Assessed Deferred (Score & Feedback after cut-off date)

Currently active task

Step 8 Approve iCMA scoring

To be completed by

Any Website updater Show names (3)

Instructions

The module team should review the iCMA reports three days before the cut-off date. A sufficient sample would be if 50% of the student cohort have already submitted, numbering >100 submissions in total (< 100 submission will skew the statistics).If this criterion has not been met, the reports should be reviewed immediately following the cut-off date. A brief guide on how to interpret the statistics, can be found here.

Comments

No comments have been made about this step yet

Tasks for completion

☐ 8.1 Check: that all questions have behaved satisfactorily

Edit comments

Finish step

Workflow overview

Effort required

Traditional Human-marked assessment

Computer-marked assessment

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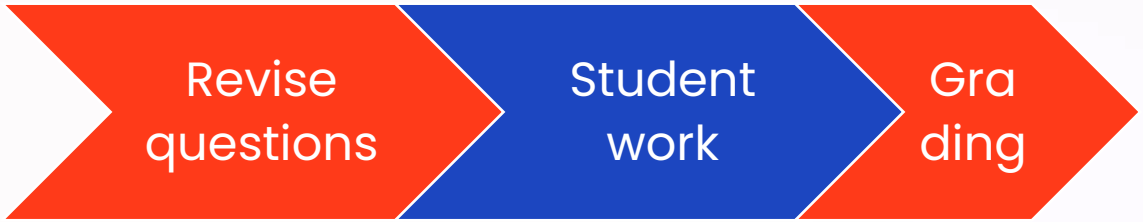
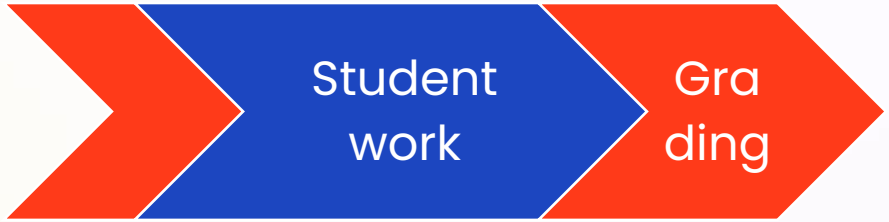
Effort required - continued

Computer-marked assessment – second time



Computer-marked assessment – later



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Teaching effort

Traditional Human-marked assessment

Computer-marked assessment

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Summary

Tim Hunt

Tim.Hunt@open.ac.uk

Moodle Quiz forum

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Computer-marked assessment

- can scaffold new tasks.
- can create feedback cycles for students.
- is your assessment – available when you are not.
- can test selected and constructed responses.
- can be ‘as’, ‘for’ and ‘of’ learning.

- has many options – to tailor the experience.
- generates useful data – feedback for you.
- requires teaching effort at different times.
- Is this somewhere to leverage open education?