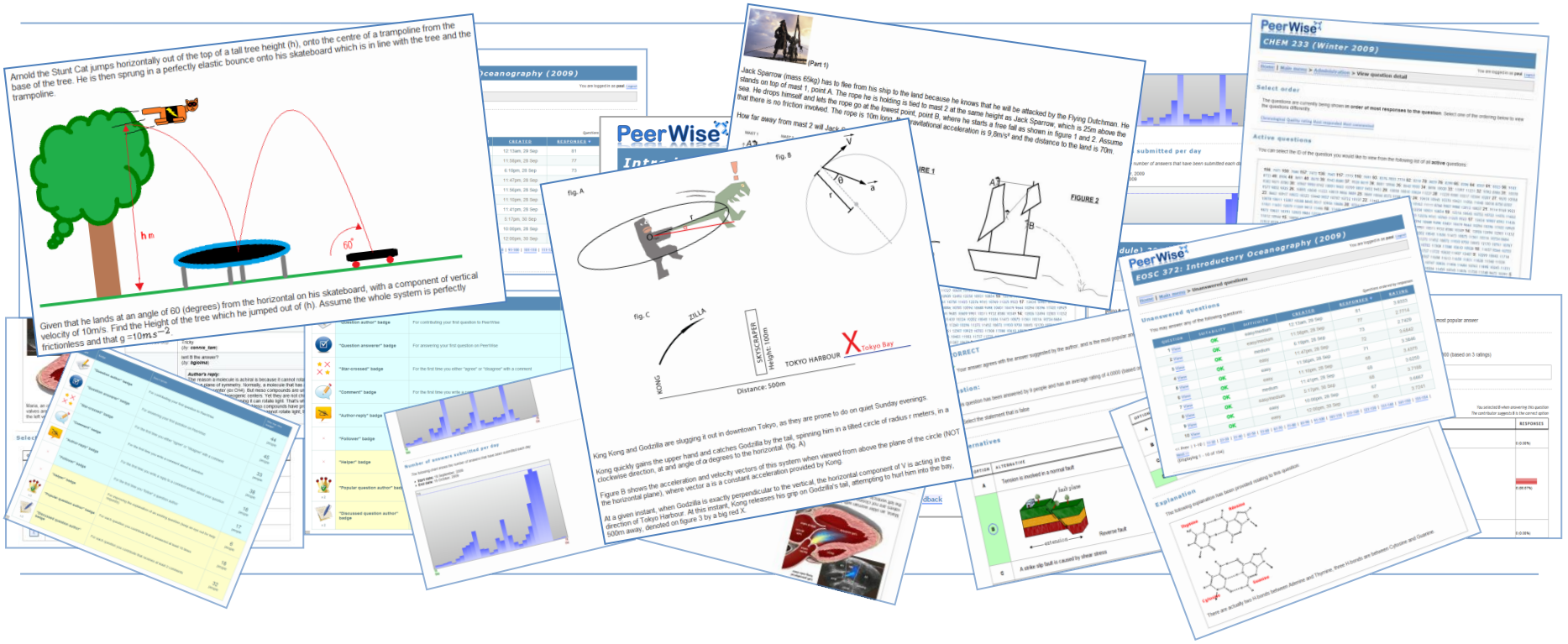
Reflections on student-generated questions

Utilising the generation, testing and self-explanation effects



CDIO

European Regional Meeting

Reykjavik University, Iceland

5th – 6th February, 2015

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THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

The New Zealand Herald

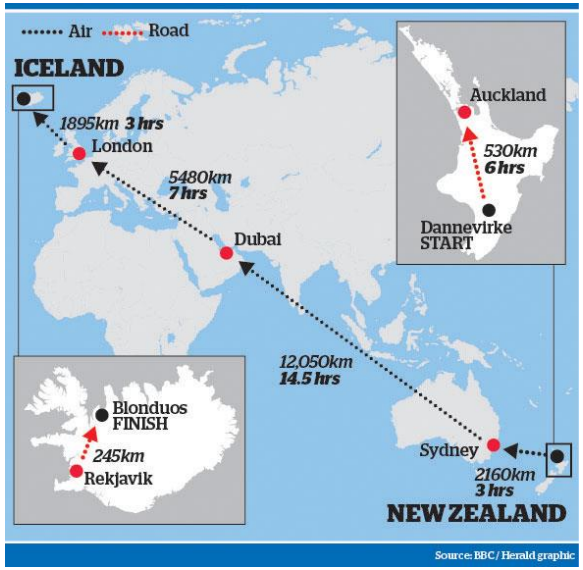
Vaimoana Tapaleao Vaimoana Tapaleao is the New Zealand Herald's Pacific Affairs and People reporter.

Kiwi meat workers have 17,000km commute to Iceland

5:00 AM Friday Nov 21, 2014

Food Processing | Iceland

Anthony Russell (fourth from left) says his fellow meat workers (from left) Victor Te Paea, Ross Gibbons, Kaine Saunders, Wayne Hamlin, Shawn Parkinson, Antony Pike and (rear) Aaron Nohakau (left) and John Murdoch at Keflavik Airport in Iceland, are "the best you can get".



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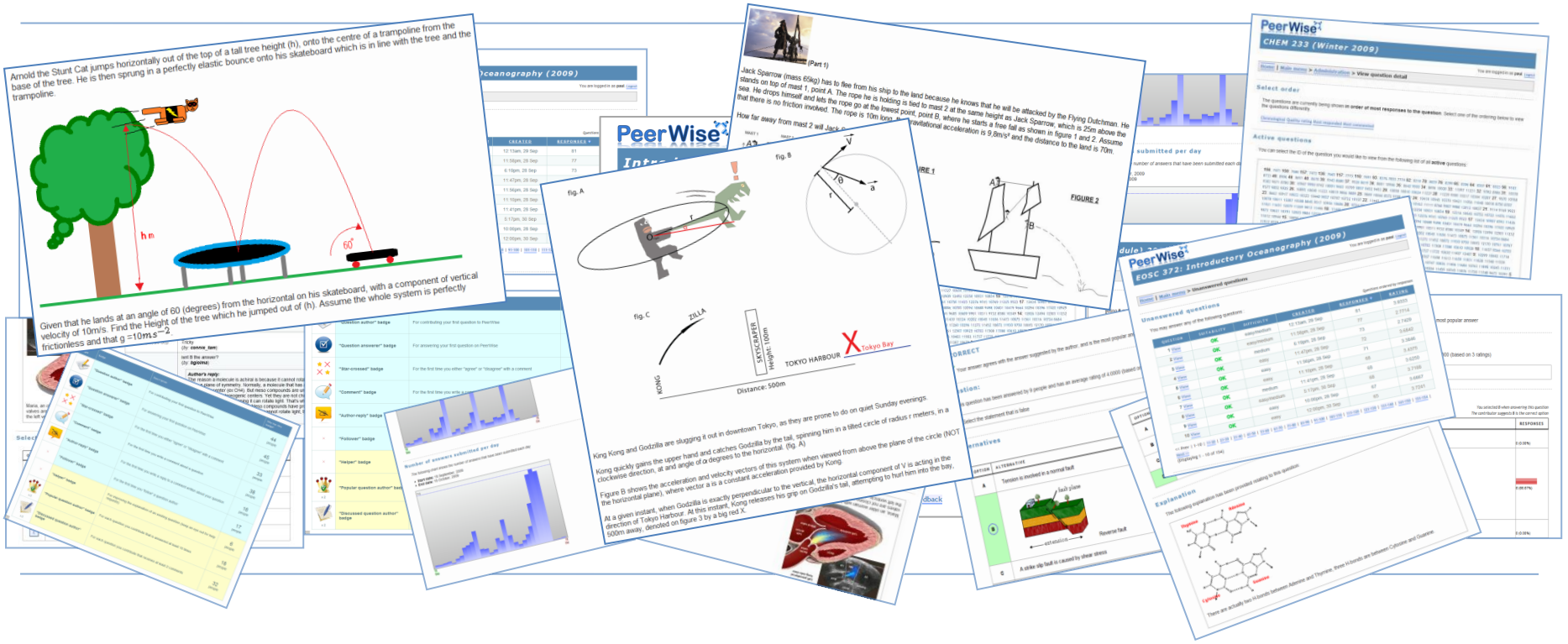

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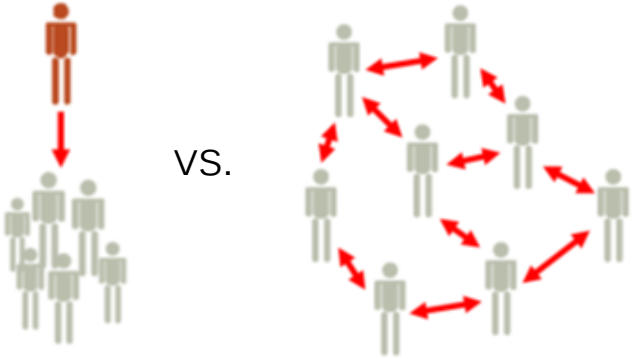
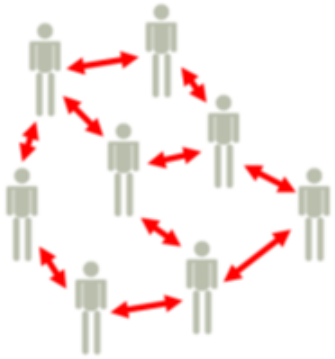


Reflections on student-generated questions

Utilising the generation, testing and self-explanation effects

VS.



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CONCEIVE DESIGN IMPLEMENT OPERATE™

CDIO Standards 2.0

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Navigation

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STANDARD 1: The Context'
STANDARD 2: Learning Out
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STANDARD 6: Engineering
STANDARD 7: Integrated Le
STANDARD 8: Active Learni
STANDARD 9: Enhancemen
STANDARD 10: Enhanceme
STANDARD 11: Learning As

Standard 8 — Active Learning

Teaching and learning based on active experiential learning methods

Description

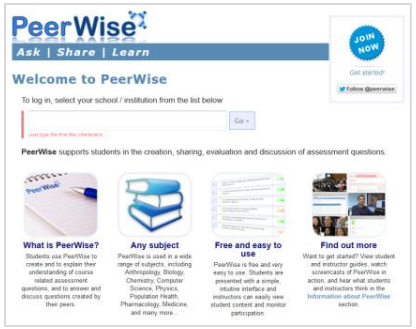
Active learning methods engage students directly in thinking and problem solving activities. There is less emphasis on passive transmission of information, and more on engaging students in manipulating, applying, analyzing, and evaluating ideas. Active learning in lecture-based courses can include such methods as partner and small-group discussions, demonstrations, debates, concept questions, and feedback from students about what they are learning. Active learning is considered experiential when students take on roles that simulate professional engineering practice, for example, design-implement projects, simulations, and case studies.

Rationale

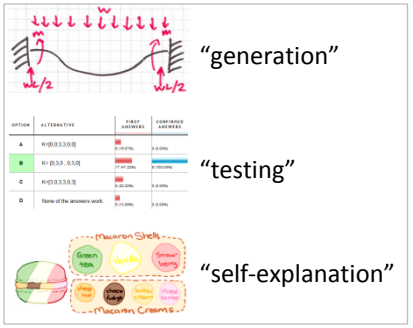
By engaging students in thinking about concepts, particularly new ideas, and requiring them to make an overt response, students not only learn more, they recognize for themselves what and how they learn. This process helps to increase students' motivation to achieve program learning outcomes and form habits of lifelong learning. With active learning methods, instructors can help students make connections among key concepts and facilitate the application of this knowledge to new settings.

Reflections on student-generated questions

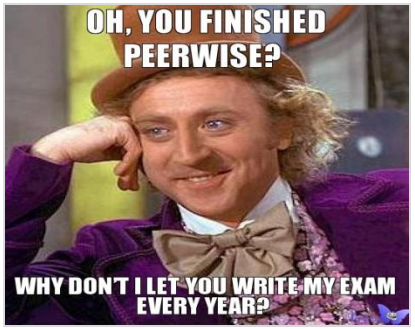
Overview



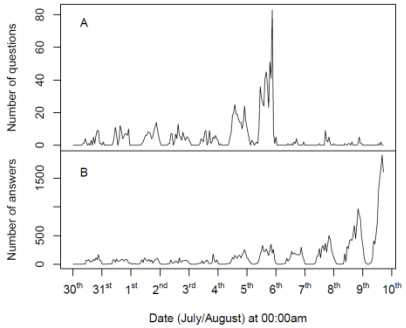
Technology



Motivation



Challenges



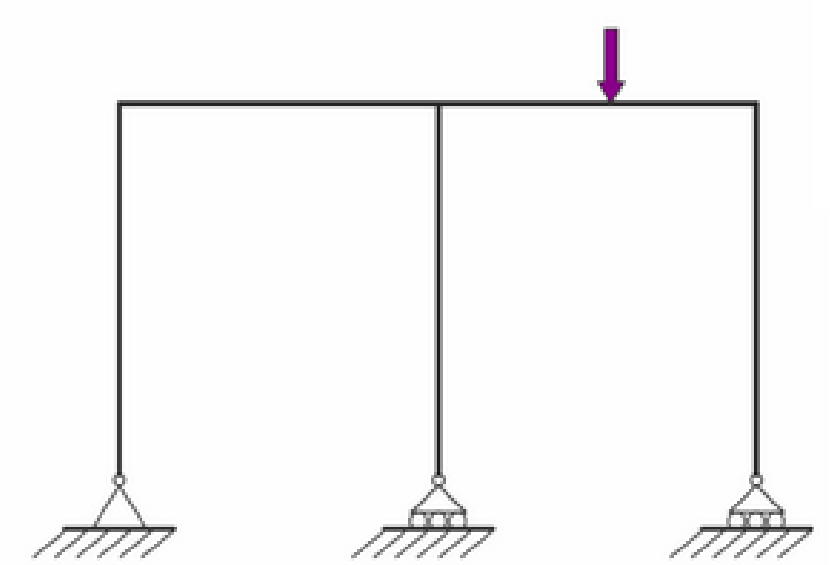
Evaluation

What is a “student-generated question”?

A student creates:

the question stem

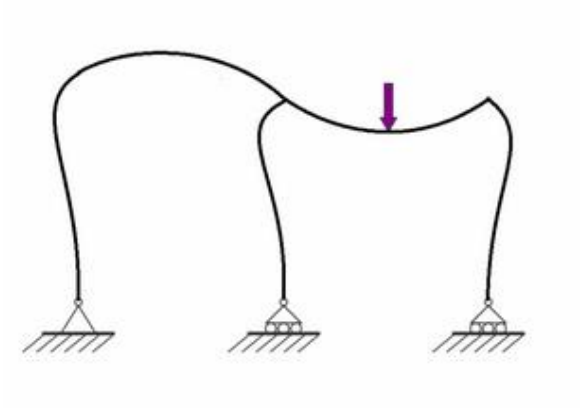
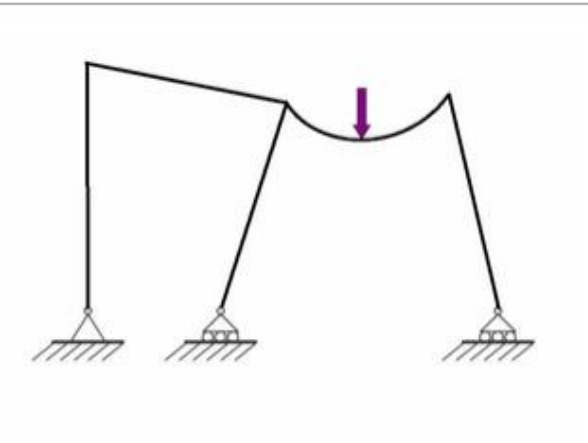
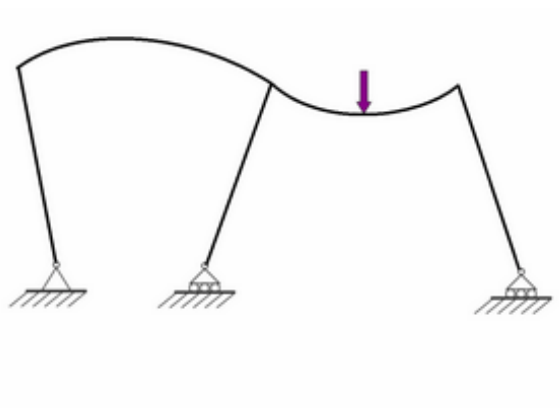
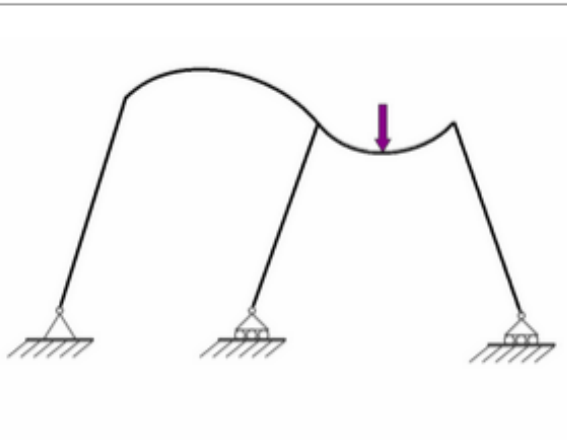
A frame structure consisting of 3 columns, connected by beams, are supported by a pin support (left), a roller support (middle), and another roller support (middle). The frame is subjected to a downward load, which is placed on the beam, between the middle and right columns.



Ignoring self weight, **determine the deflected shape** the load causes to the structure:

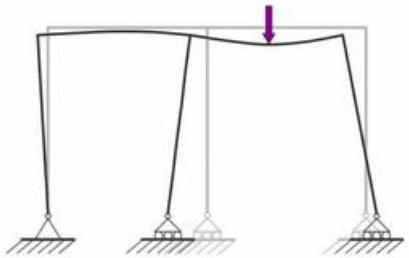
A student creates:

a set of answer options

A	
B	
C	
D	
E	None of the above.

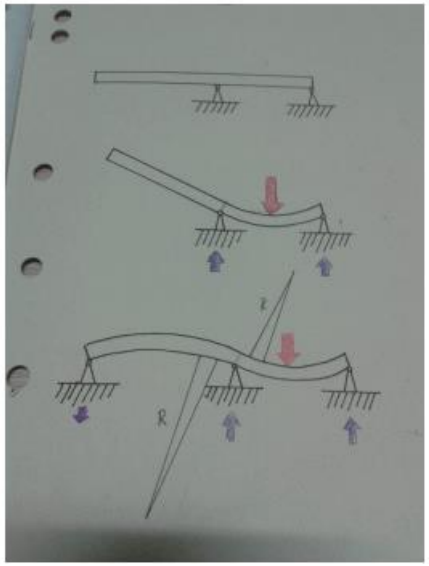
A student creates:

an explanation of the answer



Correct answer is: **C**

Option A: a pin and roller support does not produce moments, so the columns near the support **should not** be rigid while the rest of the columns are bent. The roller supports **should have** slid horizontally (hence *roller* support), as they cannot produce horizontal forces to counteract the result of the deflection (with the columns being right angled with the beam). They can only produce vertical forces. And a pin support can only produce vertical and horizontal forces, no moments.



Option B: Incorrect - due to the left beam *not being deflected.* using the figure I have drawn, we can see that on the second beam produces a "smile" deflection shape due to the load, and the portion of the beam on the left does not deflect and is parallel to the tangent of the deflected portion of the beam at the left support. *BUT* using a 3 support beam, the left side is now held down by a pin support, so the left portion is now deflected, is a "frown" shape. Translating this to the frame deflection, the left portion **should have** have a "frown" deflection, but rather, it is not deflected so it is incorrect.

Option C: correct! Again, using the figure I have drawn, we can clearly see that the beam at the top follows the correct deflection. Now, for the orientation of the columns. Using the analogy of the simple 3-support beam example in my drawing, we can see that the deflection on the left portion produces a "frown" shape, meaning that the *centre of deflection* is at the **bottom** of the beam, meaning that the left and middle supports should be **closer** than in the initial set-up (the middle support can move horizontally). While on the right portion, it produces a "smile" shape, meaning that the *centre of deflection* is **above** the beam, meaning that the middle and right supports should be **farther apart** than in the intial set-up (the middle and right support can move horizontally). Hence C is correct

Option D: Incorrect. Almost correct **except** the positioning of the left support and the orientation of the left column. As I have discussed The support should be closer together (as the rolling support can move horizontally), and that the left and middle column should point towards the centre of deflection. However the left and middle support are of the same distance and the left column is not pointing towards the centre of deflection, so it is incorrect.

Option E: Incorrect. Because Option C is correct, meaning there **IS** an answer above E, making the statement false, thus incorrect.

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CDIO European Regional Meeting 2015

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Reputation score 10081
Questioning: 691
Answering: 14695
Rating: 10605

Answer score 15629

Your questions

view »

You are currently contributing **21** questions
You have deleted **0** of your questions
There is **1** new comment about your questions view...

Answered questions

view »

You have answered **1359** questions (of these, **7** have been deleted by the author)
You have written **745** comments about these questions
There are new replies to **3** comments you have written view...

Unanswered questions

view »

There are currently **959** unanswered questions you may answer
You are following **1** question author
There are **3** unanswered questions by authors you are following view...

View leaderboards View my badges Provide feedback

Click to view	Preview	Question created (sort)	Number of answers (sort)	Author's answer popular?	Help requests (sort)	Most recent comment (sort)	Number of comments	Difficulty rating (sort)	Overall rating (sort)
1 »	What does this function do? function [a] = Calc(...	9:14pm, 31 Jul	201	yes	1	8:53pm, 29 Oct	28	very hard	1.42
2 »	What does the following script do? x = 500; A = ...	7:52pm, 02 Aug	318	yes	0	5:20pm, 09 Aug	26	hard	3.44
3 »	On your engineering adventures, you come across a dungeon and while ...	4:05pm, 05 Aug	159	no	0	10:52pm, 25 Oct	25	hard	3.22
4 »	The comic book store is throwing a Superheros party to celebrate the ...	1:40pm, 04 Aug	163	yes	0	3:00pm, 21 Aug	23	medium / hard	3.31
5 »	Many of you may be familar to the game BattleShipA BattleShip board ...	7:02am, 05 Aug	266	yes	0	8:54pm, 23 Aug	22	very easy	3.52
6 »	Which one of the following pieces of code generates an infinite loop?	10:05am, 30 Jul	170	yes	0	12:20pm, 19 Aug	22	easy	3.06
7 »	The Fibonacci sequence is a sequence of integers in which each number ...	5:27pm, 30 Jul	118	yes	0	3:26pm, 09 Aug	22	hard	3.06
	...ler has a 10% chance of getting invited to the ...	5:59pm, 04 Aug	93	yes	0	4:21pm, 09 Aug	21	easy / medium	3.26
	...we want to test to see whether a number (b) is two ...	12:51pm, 08 Aug	268	no	0	11:00pm, 23 Aug	20	medium	3.47
	...st brother's birthday party is tonight. Your badass ...	12:52pm, 04 Aug	219	no	0	12:01am, 10 Aug	20	medium	3.39

Written: 9:24pm, 10 Aug — Author has: 4599 points and 19 badges
Good question and explained very well. :) (by: crou427 [crou427])
Written: 5:53pm, 11 Aug — Reply written by question author
Thank you :) (by: dsub042 [dsub042])
Add a reply to this comment

Written: 1:15am, 17 Aug — Author has: 3252 points and 17 badges
I really like this question. I forgot about the roller part at first but then I realized it. Thanks. (by: csan236 [csan236])
Reply to this comment

Written: 11:55pm, 17 Aug — Author has: 2428 points and 12 badges
Very good question, something that i feel would help is adding a grid behind the image or the ghost of the original as in the answer it appears like the beam stretches between the left and middle column. Like in your explanation that image looks right (by: mhof838 [mhof838])
Written: 11:27pm, 21 Aug — Author has: 2973 points and 19 badges
Agree, it probably has stretched due its properties El (by: jbro002 [jbro002])
Add a reply to this comment

Written: 3:28pm, 17 Aug — Author has: 4365 points and 19 badges
Good question and in-depth explanations. (by: dgov422 [dgov422])
Reply to this comment

Written: 9:11pm, 17 Aug — Author has: 2910 points and 15 badges
very nice, glad to see a frame question and answer it correctly. (by: csch695 [csch695])
Reply to this comment

✓ CORRECT

✓ Your answer agrees with the answer suggested by the au

✓ AGREE WITH AUTHOR

✓ Your answer agrees with the answer suggested by the author, but is not the most popular answer

✗ INCORRECT

✗ Your answer is different from the answer suggested by the author, which is also the most popular answer

✓ MOST POPULAR ANSWER

✓ Your answer is the most popular answer, but is different from the answer suggested by the author

...nts in Strings" "Advanced Graphics" analogies "angles and degrees in MATLAB" "arrays MATLAB linspace" "art students" Badgers badsleeves "badsleeves out" "basic ...olean "Boolean variables" "Boring questions" calculator Candy Case cats "Cell Arrays" ...ocatenation code "coding etiquette" "colon operator" colour command commands ...ditionals "Controlling 1D plots" "course book" cube debugger debugging "display ...science" "equations solving" "Eulers Method" "evil genius" expressions "Extending Arrays" fclose fid figure "File IO" Filenames files "Flags of the world" "Flow Charts" "Flowchart elements" Flowcharts fopen "for loops" formatting fprintf fscanf Fun Function "function files" "function outputs" functions "Game of Thrones" "Gangnam Style" "good programming" "graph plotting" graphics Graphing "grey scale image" "Harry Potter" help heroes Histograms hulk "i like dogs" "if statements" images "Infinite loop" "infinite loops" inputs integer Jetpacks "Joyful Jarrod" Juggling "Justin Bieber" lasagna "law students" Length linspace lists Load "loading variables" "LORD MCCAULEY" Madagascar martians "MAT files" MATLAB Matrix Meshgrid "Mickey Mouse" mole-people money Monique movie movie2avi "multiple conditions" naming "Naming Functions" "naming variables" "nested for loops" num2str "Numerical Intergration" "oceanographic expedition" Olympics "one dimensional arrays" Open "opening and closing files" operators optimisation "Order of Operations" output pi picture Pirates plots plotting pokemon poppins potato precedence "prime numbers" "Problem Solving" "Programming Style" project pseudocode psuedocode pugs "quiver plot" "Quiver plots" random "random numbers" "Raymond the engineer" "reading files" "reading from files" Recursion "relational operators" rgb richard "Rob the Bank" "Robot attacking the university" script "Script Files" "script naming" "single quotes" Slenderman slides "smart indenting" sonic sparta "Special array function" "Special Characters" specifier specifiers sprintf sscanf "Star Wars" starwars strcmp strcmpi strfind "string compare" "String Formatting" stringfind strings strncmp strncmpi submatrices subplot "subplot comman" subplots Subranges "Subranges of 2D arrays" substrings "Super-intelligent monkeys" "suppressing outputs" "surf command" surfaces Swagger "symbols and colours for graphs" Syntax "tongue twisters" "Transposed Arrays" Tui Turtles uint8 Unicode unicon unicorns unicycles "Variable Types" variables vectors waterbombs "while and for loops" "while loop" "while loops" Writing "Writing to files" xkcd Yeh

Most "answered" question contributor

Total number of answers to all questions contributed by a single user

RANK	TOTAL NUMBER OF ANSWERS
1	403
2	365
3	245
4	143
5	142

Total number of answers to all questions you have contributed

403

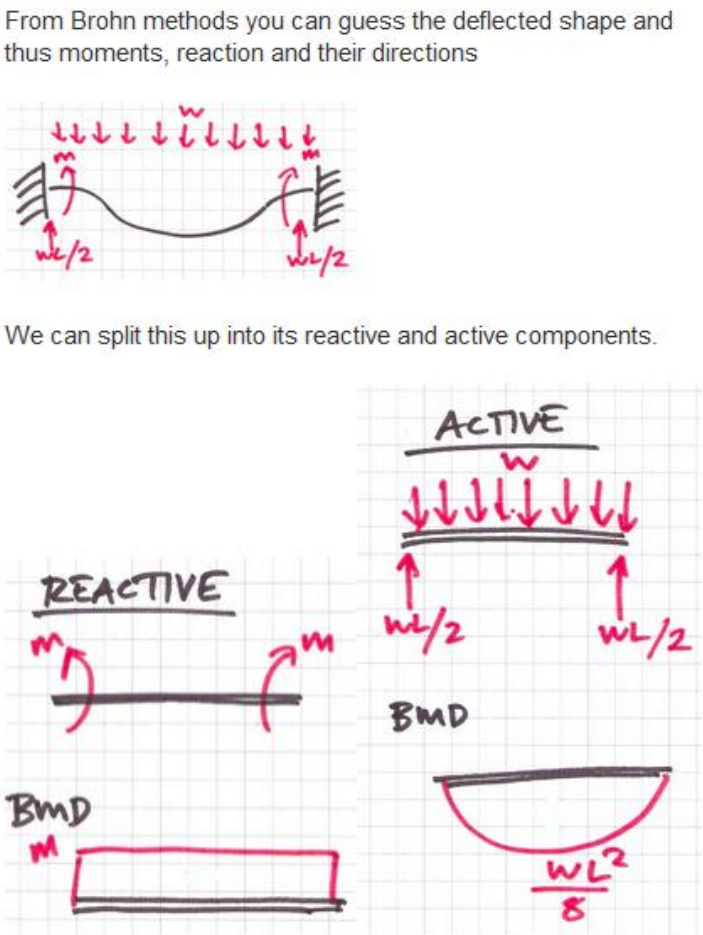
You are logged in as **paul**. Logout

Reputation score 1232
Questioning: 72
Answering: 182
Rating: 14

Answer score 29

Motivation

"Active" engagement with the course material

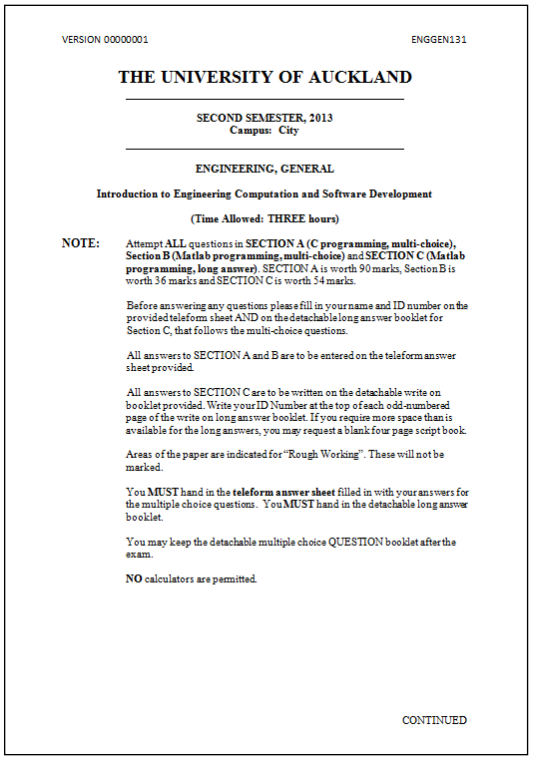


"You don't really understand how much or how little you know about a concept until you try to devise a good, original question about it"

"The aspect I found truly useful was the creation of questions, which reinforced much of [my] understanding while also actively making me clarify and solidify my thought processes (especially the explanation parts)"

Student feedback

Motivation



VERSION 00000001 ENGGEN131

THE UNIVERSITY OF AUCKLAND

SECOND SEMESTER, 2013
Campus: City

ENGINEERING, GENERAL

Introduction to Engineering Computation and Software Development

(Time Allowed: THREE hours)

NOTE: Attempt **ALL** questions in **SECTION A (C programming, multi-choice), Section B (Matlab programming, multi-choice)** and **SECTION C (Matlab programming, long answer)**. SECTION A is worth 90 marks, Section B is worth 36 marks and SECTION C is worth 54 marks.

Before answering any questions please fill in your name and ID number on the provided teleform sheet AND on the detachable long answer booklet for Section C, that follows the multi-choice questions.

All answers to SECTION A and B are to be entered on the teleform answer sheet provided.

All answers to SECTION C are to be written on the detachable write on booklet provided. Write your ID Number at the top of each odd-numbered page of the write on long answer booklet. If you require more space than is available for the long answers, you may request a blank four page script book.

Areas of the paper are indicated for "Rough Working". These will not be marked.

You **MUST** hand in the **teleform answer sheet** filled in with your answers for the multiple choice questions. You **MUST** hand in the detachable long answer booklet.

You may keep the detachable multiple choice QUESTION booklet after the exam.

NO calculators are permitted.

CONTINUED

"Can we have the answers to last year's exam?"

- High stakes exams
- Exam preparation strategies
  - Re-reading coursebook and lecture notes
  - Highlighting/underlining
  - Creating summaries
  - Forming mental imagery of text materials
  - Self-explanation
  - **Practice testing**

OPTION	ALTERNATIVE	FIRST ANSWERS	CONFIRMED ANSWERS
A	K=[0,0;3,3;0,0]	6 (16.67%)	0 (0.00%)
B	K= [0,3,0 ; 0,3,0]	17 (47.22%)	8 (100.00%)
C	K=[3,0,3;3,0,3]	8 (22.22%)	0 (0.00%)
D	None of the answers work.	5 (13.89%)	0 (0.00%)

social comparison = powerful feedback

Dunlosky, "**Strengthening the student toolbox**", *American Educator*, 37(3):12-21, 2013

There is a macaron vending machine which sells macarons of the following varieties of combinations. There are 3 different flavours of macaron shells which are *green-tea*, *vanilla*, and *strawberry*. There are 4 different flavours of creams which are *chestnut*, *chocolate fudge*, *buttercream*, and *mixed berries*.

This macaron vending machine does not let you choose which combination you want to get. The following graph shows the outcomes of different combinations of macarons the machine has every 251 macarons.

Flavours for Macaron fillings	Flavours for Macaron shells			Total
	Green Tea	Vanilla	Strawberry	
Chestnut cream	20	7	0	27
Chocolate fudge	13	31	44	88
Buttercream	15	37	22	74
Mixed Berries	3	21	38	62
Total	51	96	104	251

Jared came to the vending machine to buy himself a macaron. Answer in 2 decimal places and find the possibilities of Jared getting a macaron he wants **if**:

a) Jared wants the macaron to have some sort of berries flavour in it (either with the *strawberry flavoured shells* or *mixed berries cream* or *both*).

b) Jared is happy with anything as long as the macaron does not have *buttercream*.

c) Jared is fine with anything other than the combinations of *green-tea flavoured shells* with any cream except *chestnut cream*.

d) Jared is fussy and only wants *vanilla flavoured shells* with *chocolate fudge*.

A
a) 0.51
b) 0.71
c) 0.88
d) 0.12

B
a) 0.66
b) 0.71
c) 0.88
d) 0.12

C
a) 0.66
b) 0.71
c) 0.88
d) 0.61

D
a) 0.51
b) 0.71
c) 0.80
d) 0.12

E
a) 0.51
b) 0.29
c) 0.88
d) 0.61

How did you go? I hope you enjoyed my question! Congratulations to those who chose the correct answer, which is **Option A**!! ((((=^0ω0^=)// *clap*clap

With questions like this, it is important to read carefully and correctly identify the requirements.
I will be going through the working out for all 4 cases.
I will be using the equation: $Pr(E) = \frac{n(E)}{n(\epsilon)}$,
which means: the probability of an event = the number of the event in ratio to the total number in the sample space.
In the case of a macaron vending machine, the sample space is always 251.

Part A
a) Jared wants the macaron to have *some sort of berries flavour* in it (either with the ***strawberry flavoured shells*** or ***mixed berries cream*** or ***both***).

Jared doesn't mind what the filling is as long as the shells are *strawberry flavoured*.
Jared doesn't mind what the shells are as long as the filling is *mixed berries cream*.
Either way, Jared will be happy; and of course, Jared will certainly be happy if he got *strawberry macaron shells with mixed berries cream*.

The highlighted area bellow shows macarons Jared will be happy with.

Flavours for Macaron fillings	Flavours for Macaron shells			
	Green Tea	Vanilla	Strawberry	Total
Chestnut cream	20	7	0	27
Chocolate fudge	13	31	44	88
Buttercream	15	37	22	74
Mixed Berries	3	21	38	62
Total	51	96	104	251

There are 104 macarons with *strawberry flavoured shells* and 62 macarons with *mixed berries cream*.
There are 38 macarons with both *strawberry flavoured shells and mixed berries cream* (This is the overlap).
$n(E) = 104 + 62 - 38$
$n(E) = 128$

$Pr(E) = \frac{n(E)}{n(\epsilon)}$
$Pr(E) = \frac{128}{251}$
$Pr(E) \approx 0.51 (2d.p.)$

if you chose **Option B** or **Option C**, you might have forgotten about the overlap of *strawberry flavoured shells and mixed berries cream*.

Part B
b) Jared is happy with anything as long as the macaron *does not* have ***buttercream***.

The only thing Jared cares is if the macaron has buttercream or not.
Jared is happy as long as the fillings are *chestnut cream*, *chocolate fudge*, or *mixed berries cream*.
Jared is happy with any shells for his macaron.

The highlighted area bellow shows macarons Jared will be happy with.

Flavours for Macaron fillings	Flavours for Macaron shells			
	Green Tea	Vanilla	Strawberry	Total
Chestnut cream	20	7	0	27
Chocolate fudge	13	31	44	88
Buttercream	15	37	22	74
Mixed Berries	3	21	38	62
Total	51	96	104	251

There are 74 macarons with *buttercream filling* which Jared does not want.
$n(E) = 251 - 74$
$n(E) = 177$

$Pr(E) = \frac{n(E)}{n(\epsilon)}$
$Pr(E) = \frac{177}{251}$
$Pr(E) = 0.71 (2d.p.)$

if you chose **Option E**, you might have misread the case, and thought Jared only wanted macarons with buttercream, while in fact, Jared wanted the complimentary, macarons without buttercream.

Part C
c) Jared is fine with *anything other than* the combinations of ***green-tea flavoured shells*** with any cream *except* ***chestnut cream***.

Jared is fine with any macaron as long as the shells are either *vanilla flavoured* or *strawberry flavoured*.
Jared is also fine with another type of macaron which has *green-tea flavoured shells with chetnut cream*, and Jared does not like any other fillings with *green-tea flavoured shells*.

The highlighted area bellow shows macarons Jared will be happy with.

Flavours for Macaron fillings	Flavours for Macaron shells			
	Green Tea	Vanilla	Strawberry	Total
Chestnut cream	20	7	0	27
Chocolate fudge	13	31	44	88
Buttercream	15	37	22	74
Mixed Berries	3	21	38	62
Total	51	96	104	251

There are 96 macarons with *vanilla flavouredshells* and 104 macarons with *strawberry flavoured shells*.
There are 20 macarons that are *green-tea flavoured shells with chestnut cream*.
$n(E) = 96 + 104 + 20$
$n(E) = 220$

$Pr(E) = \frac{n(E)}{n(\epsilon)}$
$Pr(E) = \frac{220}{251}$
$Pr(E) \approx 0.88 (2d.p.)$

If you have chosen **Option D**, you might have missed the bit that Jared doesn't mind getting *green-tea flavoured shells with chestnut cream*.

Part D
d) Jared is fussy and *only* wants ***vanilla flavoured shells*** with ***chocolate fudge***.

This is fairly straight forward. Jared only wants to have *vanilla flavoured shells with chocolate fudge filling* and nothing else.

The highlighted area bellow shows macarons Jared will be happy with.

Flavours for Macaron fillings	Flavours for Macaron shells			
	Green Tea	Vanilla	Strawberry	Total
Chestnut cream	20	7	0	27
Chocolate fudge	13	31	44	88
Buttercream	15	37	22	74
Mixed Berries	3	21	38	62
Total	51	96	104	251

There are 31 macarons that are *vanilla flavoured shells with chocolate fudge filling*.
$n(E) = 31$

$Pr(E) = \frac{n(E)}{n(\epsilon)}$
$Pr(E) = \frac{31}{251}$
$Pr(E) \approx 0.12 (2d.p.)$

If you chose **Option C** or **Option E**, you have misinterpreted the question and thought Jared wants any macaron as long as it has *vanilla flavoured shells* or *chocolate fudge*.

These are the 11 different macarons the vending machine offer. Which would you want?

Motivation

Written: 4:35pm, 08 Mar — Author has: 6383 points and 11 badges

★★★★

Lipopolysaccharides are only ONE component of gram -ve bacterial cellwalls.

Written: 7:56pm, 08 Mar — Reply written by question author

Yes however it is the permeability of LPS which causes crystal violet to stain 'negative' which is what distinguishes the two generic types of bacteria.

Written: 2:05pm, 09 Mar — Author has: 6084 points and 13 badges

The thick cell walls of gram positive bacteria are what trap the violet stain, in gram negative bacteria the violet stain washes out in the alcohol rinse and they are stained a different colour, usually pink.

Written: 2:45pm, 09 Mar — Reply written by question author

So what came first the chicken or the egg? Is it the LACK of peptidoglycan trapping crystal violet in or is it the pemeability of ADDITIONAL LPS layer, allowing crystal violet out, which distinguishes gram -ve bacteria.

Written: 9:23pm, 24 Mar — Author has: 441 points and 6 badges

Gram-negative bacteria still have cell walls of peptidoglycan, though much thinner than Gram-positive bacteria. A thinner cell wall would still get stained by the crystal violet and really have nothing to do with how they are distinguished using a Gram stain. The outer membrane of Gram-negative bacteria are not permeable to crystal violet, that's why the crystal violet does not stain their cell walls and how they can be distinguished from Gram-positive bacteria. Not sure what you mean by the outer membrane "allowing crystal violet out."?

Written: 12:40pm, 30 Mar — Reply written by question author

LECTURE 6, at 14min 30s, just to clarify: **Gram positive** bacteria are positive due to more peptidoglycan, a protein in their cell wall which is impermeable to crystal violet => stained purple.
Gram negative bacteria have lipopolysaccharide outer layer in addtion to petidoglycan (although much less) which comprises its cell wall, it is **permeable to crystal violet** thus allowing it to be rinsed from wall => pink.

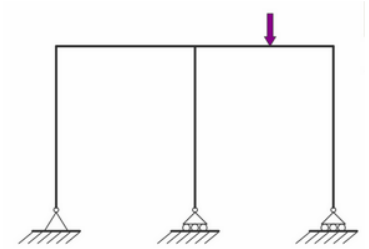
Add a reply to this comment

Motivation

The “generation” effect:

- Individuals remember information better if they take an active role in producing it, rather than if it is provided to them [Slamecka & Graf, 1978]

A frame structure consisting of 3 columns, connected by beams, are supported by a pin support (left), a roller support (middle), and another roller support (middle). The frame is subjected to a downward load, which is placed on the beam, between the middle and right columns.



Ignoring self weight, **determine the deflected shape** the load causes to the structure:

Slamecka and Graf. "**The generation effect: Delineation of a phenomenon**". Journal of Experimental Psychology, 4:592-604, 1978.

Roediger et al. "**Retrieval practice (testing) effect**" In *Encyclopedia of the Mind*, Sage Publishing Co., pages 660-661, 2013.

Chi et al. “**Self-explanations: How students study and use examples in learning to solve problems**" *Cognitive Science*, 13(2):145-182, 1989.

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The “testing” effect:

- Being tested on previously studied material is more beneficial to long-term retention than either not being tested or even restudying the material [Roediger, 2013]

OPTION	ALTERNATIVE	FIRST ANSWERS	CONFIRMED ANSWERS
A	K=[0,0;3,3;0,0]	6 (16.67%)	0 (0.00%)
B	K= [0,3,0 ; 0,3,0]	17 (47.22%)	8 (100.00%)
C	K=[3,0,3;3,0,3]	8 (22.22%)	0 (0.00%)
D	None of the answers work.	5 (13.89%)	0 (0.00%)

Slamecka and Graf. "**The generation effect: Delineation of a phenomenon**". Journal of Experimental Psychology, 4:592-604, 1978.

Roediger et al. "**Retrieval practice (testing) effect**" In *Encyclopedia of the Mind*, Sage Publishing Co., pages 660-661, 2013.

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- Students who explain instructional materials to themselves learn better and make more accurate self-assessments [Chi, 1989]

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All supported by multiple classroom studies

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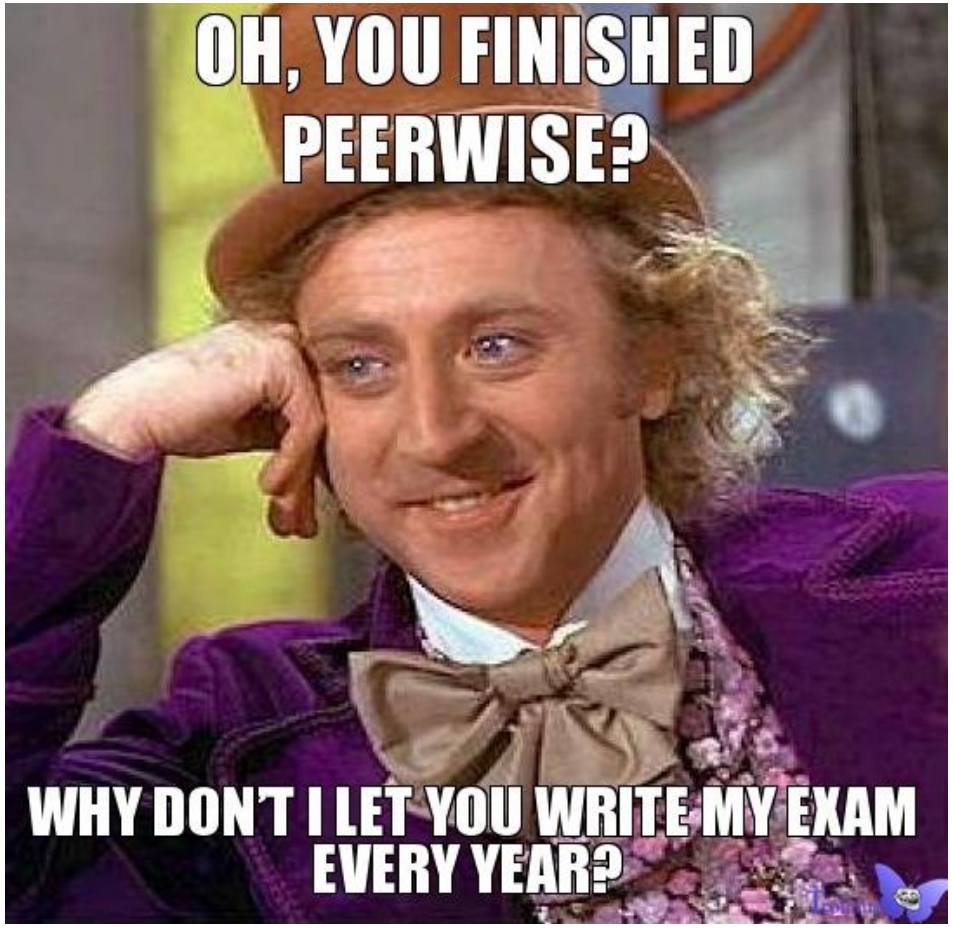
Roediger et al. "**Retrieval practice (testing) effect**" In *Encyclopedia of the Mind*, Sage Publishing Co., pages 660-661, 2013.

Chi et al. “**Self-explanations: How students study and use examples in learning to solve problems**" *Cognitive Science*, 13(2):145-182, 1989.

Challenges

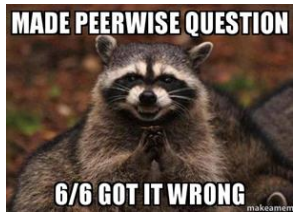
Not perfect



Challenges

Not perfect

“Trick” questions



A function has been written:

```
function [r] = Calculation (a,b,c)

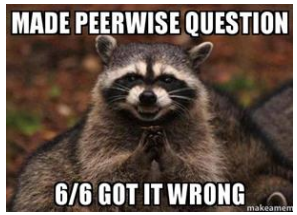
r = (a + b) / c;

if (r > 10)
    disp ('The number is greater than 10');
elseif (r == 10)
    disp (The number is 10');
else
    disp ('The number is less than 10');
end
```

What will be displayed when the function is run if the input values are:

a = 5
b = 7
c = 2

OPTION	ALTERNATIVE	FIRST ANSWERS	CONFIRMED ANSWERS
A	The number is greater than 10	1 (9.09%)	0
B	The number is 10	1 (9.09%)	0
C	The number is less than 10	8 (72.73%)	0
D	None of the above	1 (9.09%)	0



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    disp (The number is 10');
else
    disp ('The number is less than 10');
end

Wha
the
inpu

a =
b =
c =
```

Written: 6:11pm, 04 Aug — Author has: 2206 points and 12 badges

★★★

In a hurry and in the font its in it is hard to spot the mistake, good one

Reply to this comment

Written: 10:01pm, 04 Aug — Author has: 10080 points and 15 badges

Nice one :)

Reply to this comment

Written: 7:30pm, 05 Aug — Author has: 1852 points and 1 badges

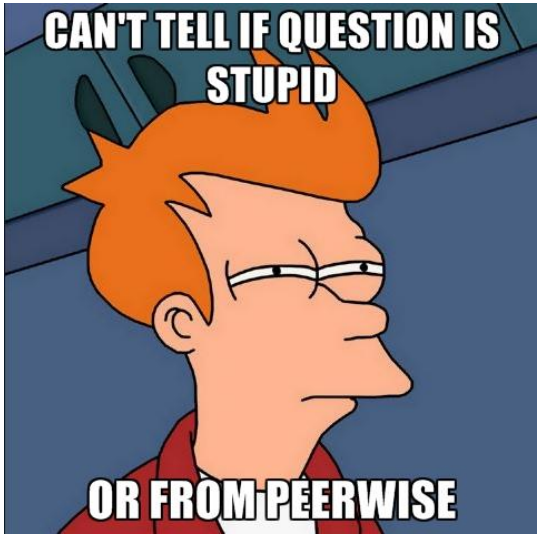
Good question

Reply to this comment

Challenges

Not perfect

“Trick” questions



Poor questions

How must this mathematical equation be written in Matlab?

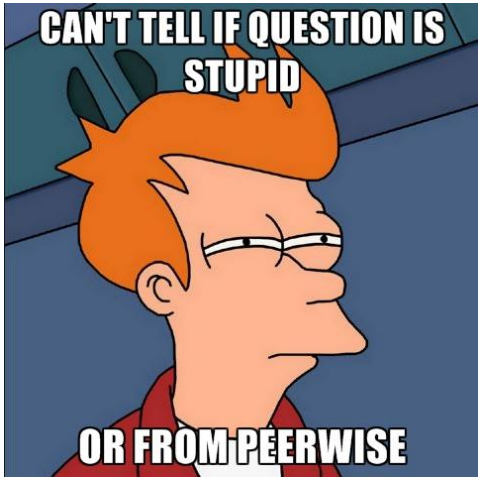
$(3 \times 7^2) \div 2$

OPTION	ALTERNATIVE	FIRST ANSWERS	CONFIRMED ANSWERS
A	(3 * 7^2) / 2	7 (70.00%)	1 (50.00%)
B	(3 × 7 * 2) / 2	0 (0.00%)	0 (0.00%)
C	(3 * 7^2) / 2	3 (30.00%)	1 (50.00%)
D	(3 * 7^2) ÷ 2	0 (0.00%)	0 (0.00%)

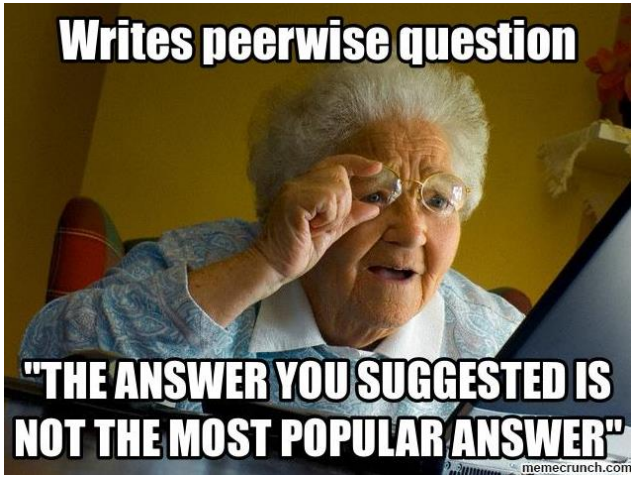
Challenges

Not perfect

“Trick” questions

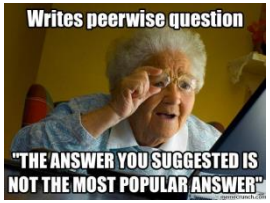


Poor questions



Wrong answers

Challenges



Question

Which of the following pieces of code would correctly find the minimum value from a set of three variables, a, b and c?

B

```
M = a;
if (b < M)
    M = b;
elseif (c < M)
    M = c;
end

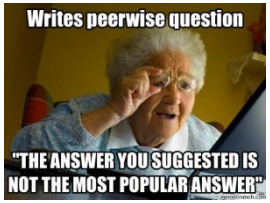
disp (M)
```

OPTION	ALTERNATIVE	FIRST ANSWERS	CONFIRMED ANSWERS
A	M = a; if (b < M) M = b; else (c < M) M = c; end disp (M)	9 (16.36%)	0
B	M = a; if (b < M) M = b; elseif (c < M) M = c; end disp (M)	13 (23.64%)	0
C	if (b < M) M = b; else (c < M) M = c; end disp (M)	2 (3.64%)	0

D	M = a;
	if (b < M)
	b = M;
	elseif (c < M)
	c = M;
	end
	
	disp (M)
		6 (10.91%)	0

E	None of the above.	25 (45.45%)	0

Challenges



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Which of the following pieces of code would correctly find the minimum value from a set of three variables, a, b and c?

B

```
M = a;
if (b < M)
   M = b;
elseif (c < M)
   M = c;
end

disp (M)
```

Written: 8:47pm, 08 Aug — Author has: 1548 points and 7 badges

What happens if C is less than B, and B is less than A?

Reply to this comment

Written: 12:18pm, 09 Aug — Author has: 2773 points and 3 badges

if you want make B correct you should use if instead of elseif:

```
M = a;
if (b < M)
   M = b;
end;
if (c < M)   % <== if 'elseif' is used, and b<M, your script wouldn't
                   exam the relationship between c and M
   M = c;
end

disp (M)
```

Reply to this comment

Written: 12:26am, 05 Aug — Author has: 2736 points and 14 badges

Should there be a comma there:
disp(['The area is of the rectangle is: ', num2str(area)])

Written: 10:58am, 05 Aug — Reply written by question author

Yes, Thank you. I have edited the question.

Add a reply to this comment

Written: 5:02pm, 07 Aug — Author has: 227 points and 6 badges

Isn't the 3rd column the one starting with 1, and the 4th column the one starting with 4..? surely this would be the case if the same logic that defined row 2 &3 as italicized numbers 1 and 3 respectively is applied?

Written: 5:37pm, 07 Aug — Reply written by question author

Yes, thank you for pointing that out. It was my bad as I had done it in a hurry.
I shall change it now :)

Add a reply to this comment

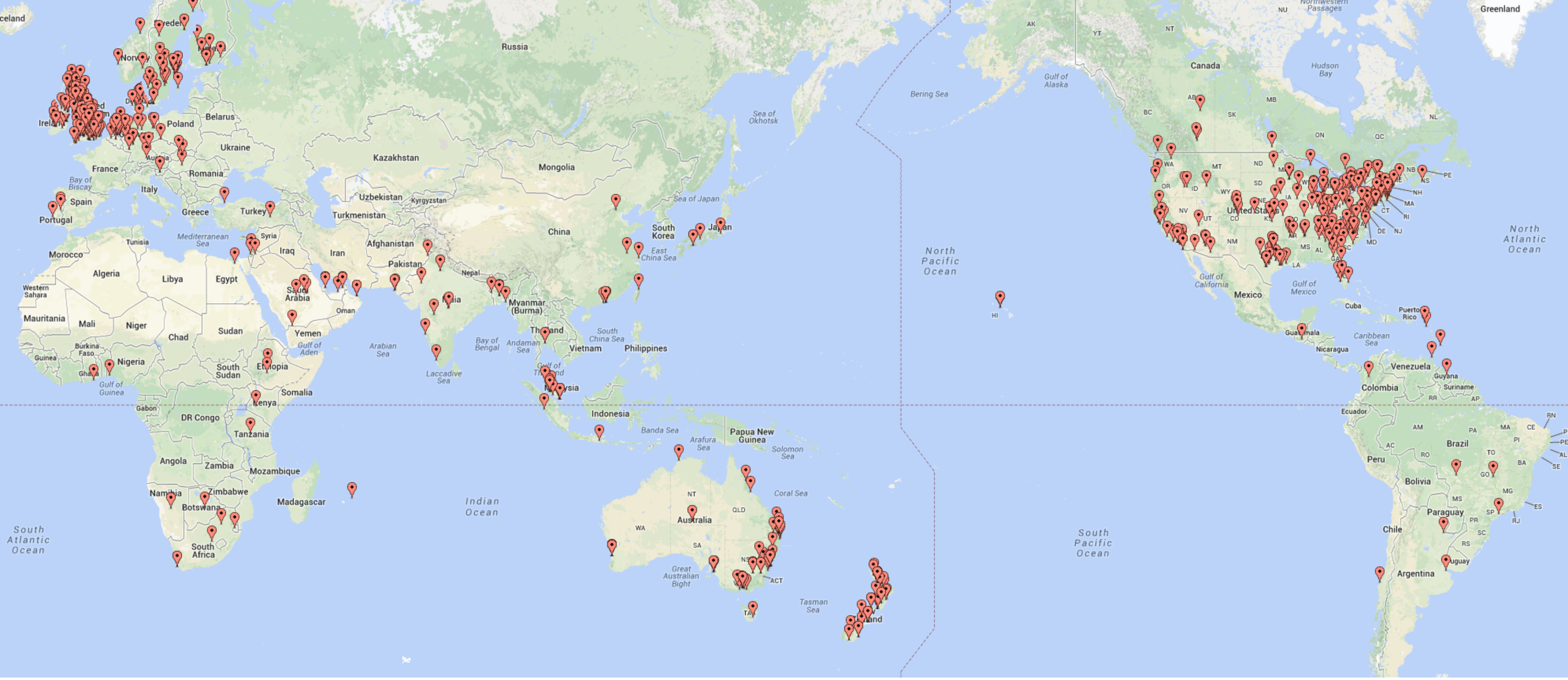
Written: 6:53pm, 07 Aug — Author has: 2985 points and 13 badges

I thought for a function the outputs are surrounded by square brackets? eg. [k] = CelciusToKelvin(c)

Written: 6:58pm, 07 Aug — Reply written by question author

yes you are right. even i didnt notice. i will change it. thank you for pointing out!

Add a reply to this comment



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Greenland
Kazakhstan
Mongolia
China
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South Korea
Ukraine
Belarus
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Romania
Greece
Turkey
Syria
Iraq
Iran
Afghanistan
Pakistan
Uzbekistan
Turkmenistan
Nepal
Myanmar (Burma)
Thailand
Vietnam
Philippines
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Algeria
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Sudan
South Sudan
Nigeria
Mauritania
Western Sahara
Ethiopia
Somalia
Kenya
Tanzania
DR Congo
Gabon
Angola
Zambia
Mozambique
Zimbabwe
Namibia
Botswana
South Africa
Madagascar
Saudi Arabia
Yemen
Oman
Indian Ocean
North Pacific Ocean
South Pacific Ocean
North Atlantic Ocean
South Atlantic Ocean
Mexico
Cuba
Guatemala
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Colombia
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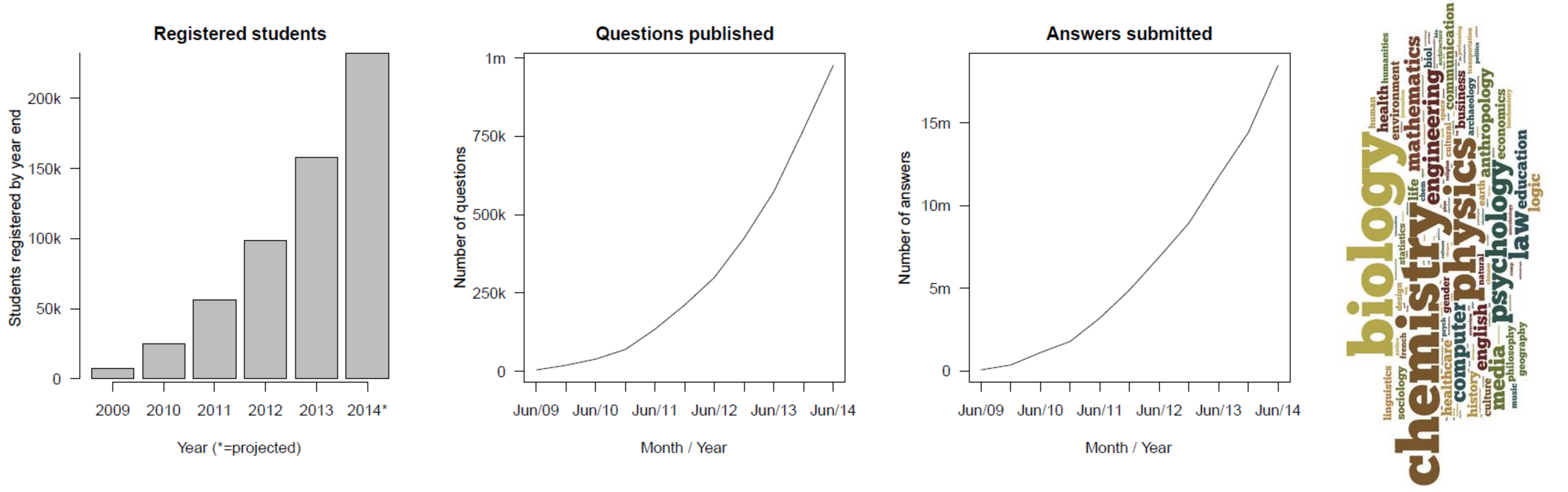
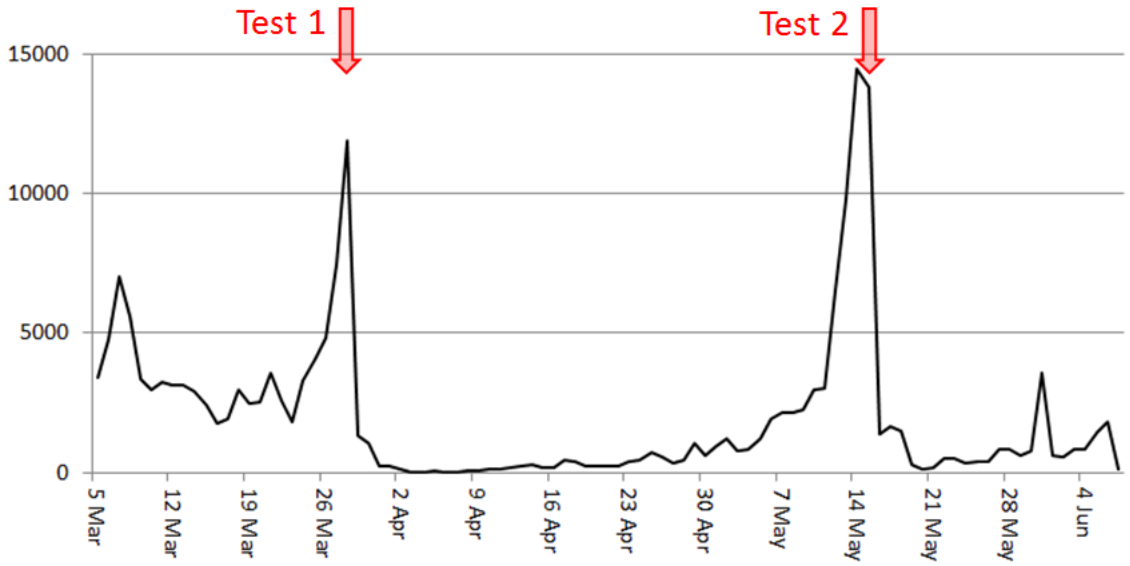


Registered students
Students registered by year end
0
50k
100k
150k
200k
2009
2010
2011
2012
2013
2014*
Year (*=projected)
Questions published
Number of questions
0
250k
500k
750k
1m
Jun/09
Jun/10
Jun/11
Jun/12
Jun/13
Jun/14
Month / Year
Answers submitted
Number of answers
0
5m
10m
15m
Jun/09
Jun/10
Jun/11
Jun/12
Jun/13
Jun/14
Month / Year
biology
chemistry
physics
psychology
mathematics
engineering
law
education
media
computer
english
history
health
environment
anthropology
economics
communication
business
logic

A genuine review resource

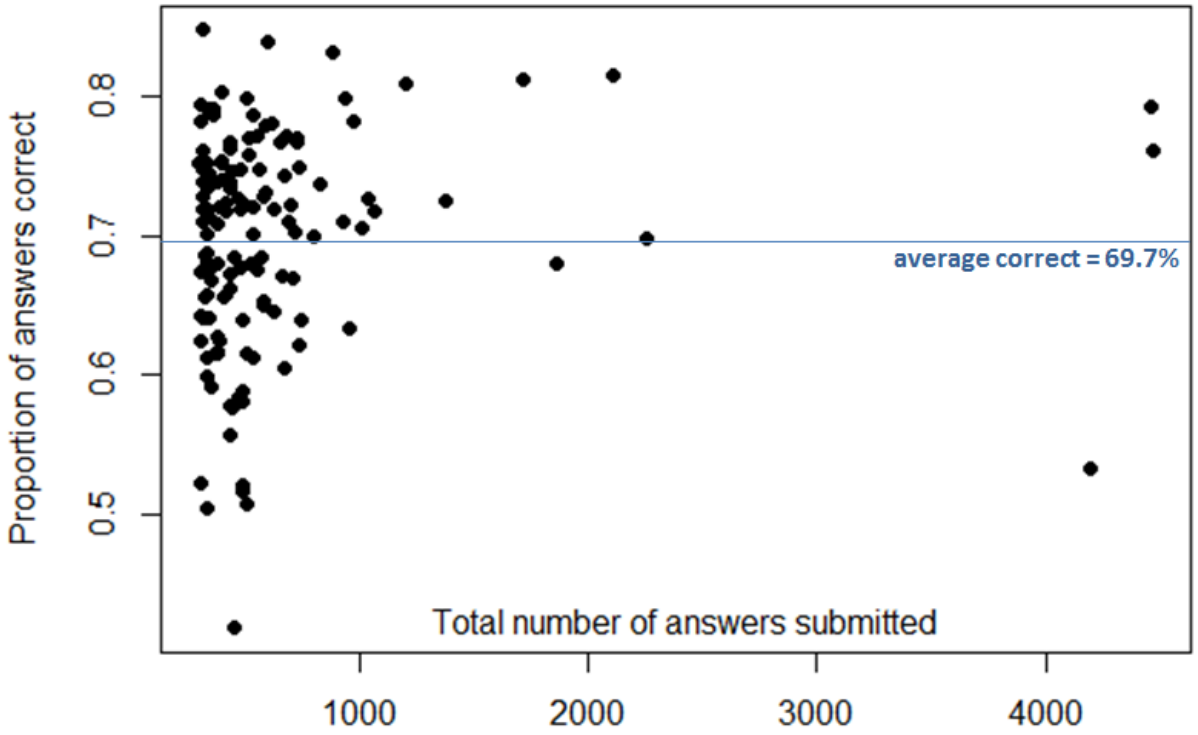
- use of repository to prepare for summative exams, even when voluntary

A typical large course (n = 1,031)



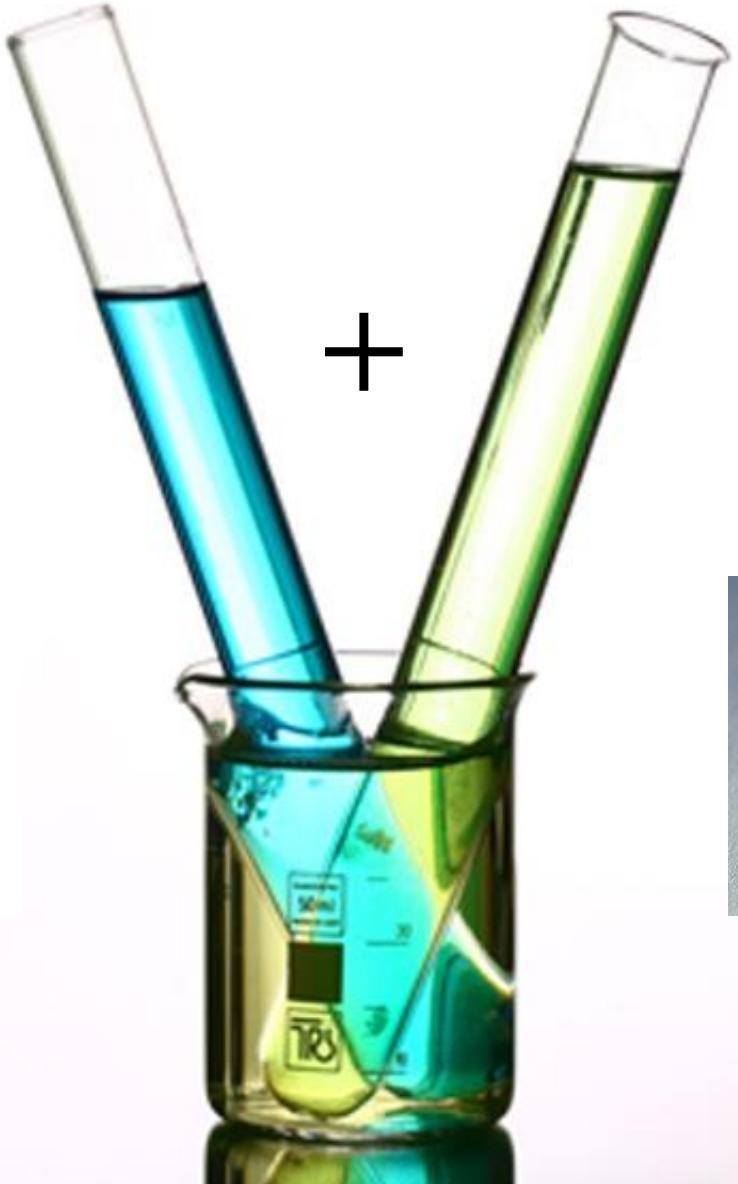
High accuracy, even amongst the most active students

- 136 students submitted > 300 answers
- 86,430 out of 188,590 total answers



Evaluation

How good are the student authored questions?



Do students learn by authoring questions?

What proportion of questions are “good”?

We know that at least some are!

Physics 1A

The University of Edinburgh

(Part 1)

Jack Sparrow (mass 65kg) has to flee from his ship to the land because he knows that he will be attacked by the Flying Dutchman. He stands on top of mast 1, point A. The rope he is holding is tied to mast 2 at the same height as Jack Sparrow, which is 25m above the sea. He drops himself and lets the rope go at the lowest point, point B, where he starts a free fall as shown in figure 1 and 2. Assume that there is no friction involved. The rope is 10m long, the gravitational acceleration is 9,8m/s² and the distance to the land is 70m.

How far away from mast 2 will Jack Sparrow hit the water?

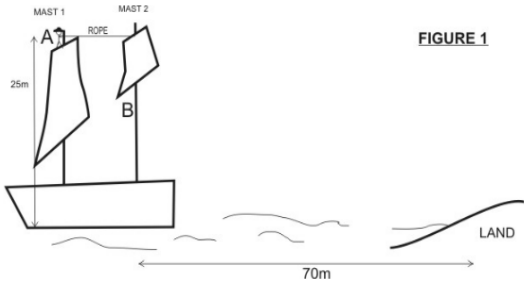


FIGURE 1

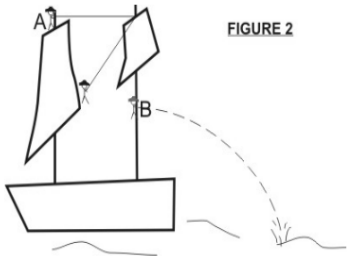
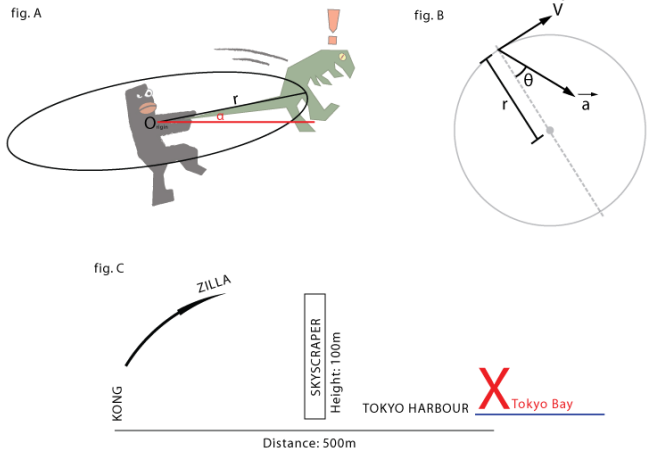


FIGURE 2



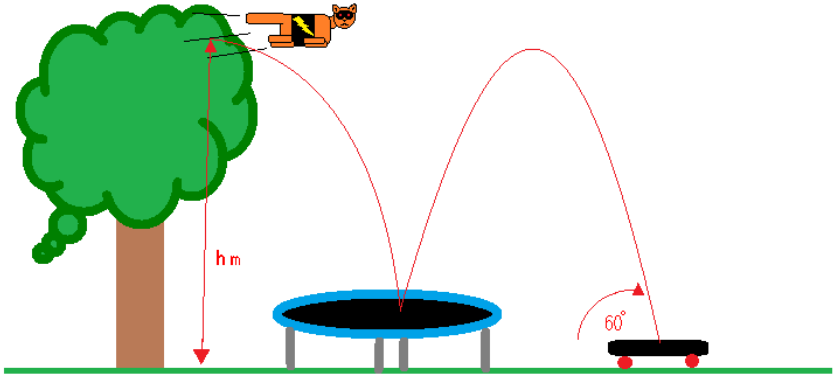
King Kong and Godzilla are slugging it out in downtown Tokyo, as they are prone to do on quiet Sunday evenings.

Kong quickly gains the upper hand and catches Godzilla by the tail, spinning him in a tilted circle of radius r meters, in a clockwise direction, at and angle of α degrees to the horizontal. (fig. A)

Figure B shows the acceleration and velocity vectors of this system when viewed from above the plane of the circle (NOT the horizontal plane), where vector a is a constant acceleration provided by Kong.

At a given instant, when Godzilla is exactly perpendicular to the vertical, the horizontal component of V is acting in the direction of Tokyo Harbour. At this instant, Kong releases his grip on Godzilla's tail, attempting to hurl him into the bay, 500m away, denoted on figure 3 by a big red X.

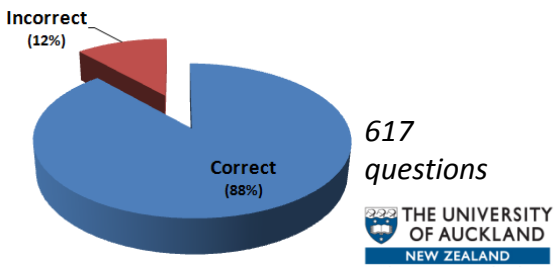
Arnold the Stunt Cat jumps horizontally out of the top of a tall tree height (h), onto the centre of a trampoline from the base of the tree. He is then sprung in a perfectly elastic bounce onto his skateboard which is in line with the tree and the trampoline.



Given that he lands at an angle of 60 (degrees) from the horizontal on his skateboard, with a component of vertical velocity of 10m/s. Find the Height of the tree which he jumped out of (h). Assume the whole system is perfectly frictionless and that g =10ms^{-2}.

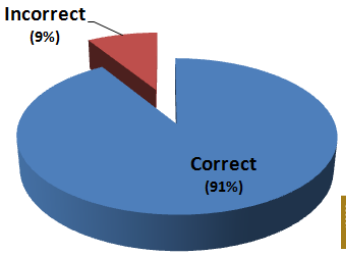
What proportion of questions are "good"?

Unscaffolded activity



617 questions

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND
Te Whare Wānanga o Tāmaki Makaurau



528 questions

Curtin University

- Around 1 in 10 questions **incorrect**
- Different institutions and subjects

Bates et al. "**Assessing the quality of a student-generated question repository**" *Phys Rev Special Topics, PER,* 10, 2014.
Bottomley et al. "**A Participatory Learning Approach to Biochemistry Using Student Authored and Evaluated Multiple-choice Questions"**, Biochem. Mol. Biol. Educ., Vol. 39, No. 5, pp. 352–361, 2011.
Purchase et al. "**The Quality of a PeerWise MCQ Repository"**. In Proceedings of ACE 2010, Vol. 103. ACS, Australia, pp. 137-146, 2010.

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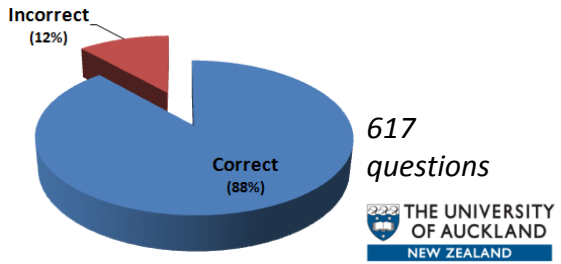
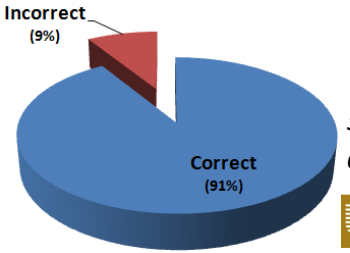
Unscaffolded activity



617 questions

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND
Te Whare Wānanga o Tāmaki Makaurau



528 questions

Curtin University

- Around 1 in 10 questions **incorrect**
- Different institutions and subjects

Scaffolded activity

Questions classified according to 6 categories:

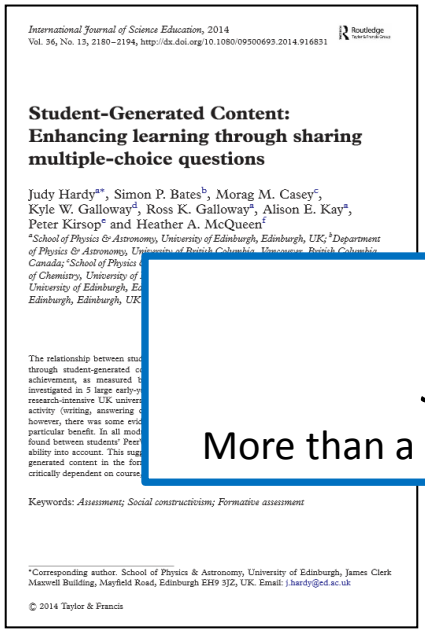
TABLE III. Criteria used to define high quality questions.

Measure	Criteria details
Taxonomy category	At least level 2 or higher (understand or above).
Explanation category	At least level 2 or higher (minimal or better).
Clearly worded question	Unambiguous vs unclear (binary measure).
Distractors	At least 2 feasible and plausible distractors.
Correctness	Most likely correct (binary measure).
Plagiarism	Not obviously plagiarized (binary measure).

- Around 1 in 20 questions **incorrect**
- Around 1 in 10 inadequate explanation
- Virtually no obvious plagiarism
- More than 75% beyond simple recall

Bates et al. "**Assessing the quality of a student-generated question repository**" *Phys Rev Special Topics, PER,* 10, 2014.
Bottomley et al. "**A Participatory Learning Approach to Biochemistry Using Student Authored and Evaluated Multiple-choice Questions"**, Biochem. Mol. Biol. Educ., Vol. 39, No. 5, pp. 352–361, 2011.
Purchase et al. "**The Quality of a PeerWise MCQ Repository"**. In Proceedings of ACE 2010, Vol. 103. ACS, Australia, pp. 137-146, 2010.

Do students learn by authoring questions?



International Journal of Science Education, 2014
Vol. 36, No. 13, 2180–2194, http://dx.doi.org/10.1080/09500693.2014.916831

Student-Generated Content: Enhancing learning through sharing multiple-choice questions

Judy Hardy[a*], Simon P. Bates[b], Morag M. Casey[c], Kyle W. Galloway[d], Ross K. Galloway[a], Alison E. Kay[a], Peter Kirsop[e] and Heather A. McQueen[f]

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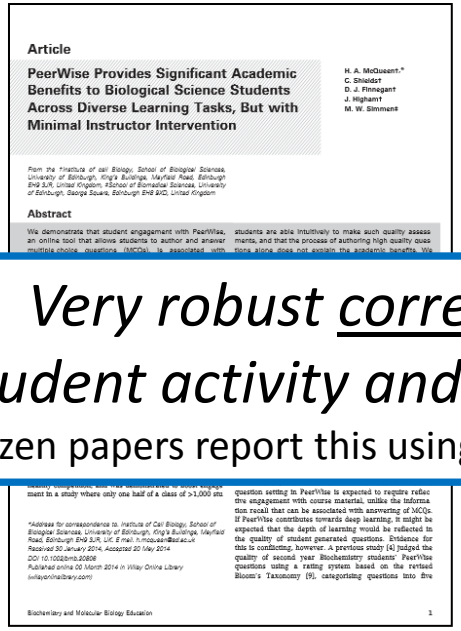
Keywords: *Assessment; Social constructivism; Formative assessment*

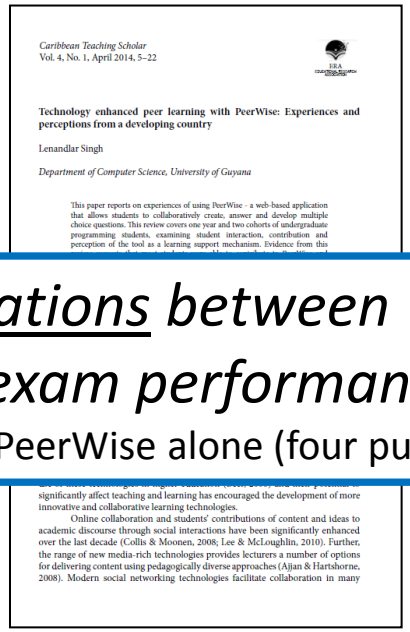


Article

PeerWise Provides Significant Academic Benefits to Biological Science Students Across Diverse Learning Tasks, But with Minimal Instructor Intervention

H. A. McQueen†,*
C. Shields†
D. J. Finnegan†
J. Higham†
M. W. Simmen‡

Abstract

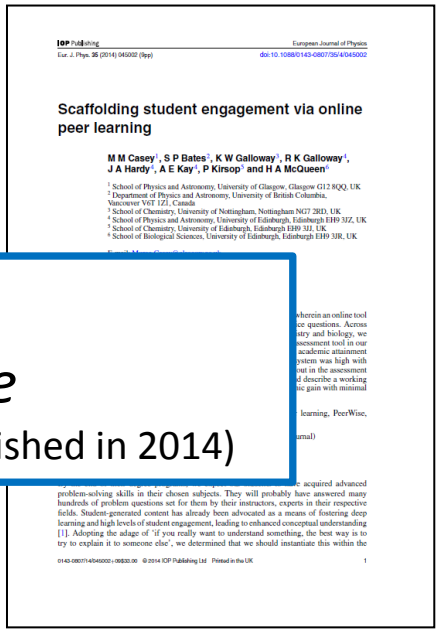


Caribbean Teaching Scholar
Vol. 4, No. 1, April 2014, 5–22

Technology enhanced peer learning with PeerWise: Experiences and perceptions from a developing country

Lenandlar Singh

Department of Computer Science, University of Guyana



Scaffolding student engagement via online peer learning

M M Casey[1], S P Bates[2], K W Galloway[3], R K Galloway[4], J A Hardy[4], A E Kay[4], P Kirsop[5] and H A McQueen[6]

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[6] School of Biological Sciences, University of Edinburgh, Edinburgh EH9 3JR, UK

Very robust correlations between student activity and exam performance

More than a dozen papers report this using PeerWise alone (four published in 2014)

J. Hardy, S. Bates, M. Casey, K. Galloway, R. Galloway, A. Kaya, P. Kirsope & H. McQueen. "**Student-Generated Content: Enhancing learning through sharing multiple-choice questions**", International Journal of Science Education, Vol. 36, Iss. 13, 2014

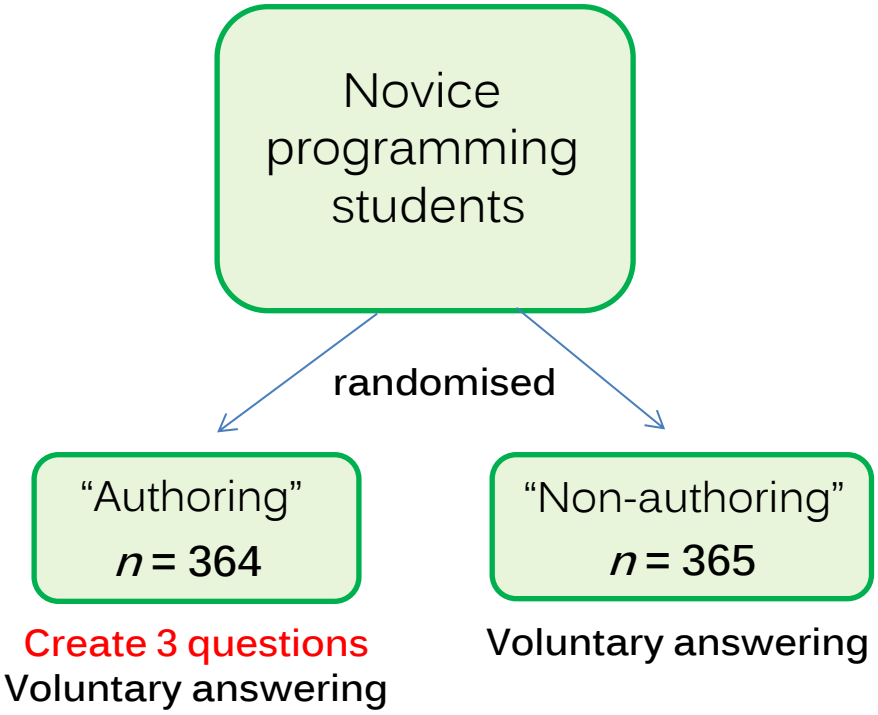
H. McQueen, C. Shields, D. Finnegan, J. Higham & M. Simmen. "**Peerwise provides significant academic benefits to biological science students across diverse learning tasks, but with minimal instructor intervention**", Biochem. Mol. Biol. Educ., 1-11, June 2014

L. Singh. "**Technology enhanced peer learning with PeerWise: Experiences and perceptions from a developing country**" In Caribbean Teaching Scholar, Vol. 4, No. 1, 5-22, April 2014

M. Casey, S. Bates, K. Galloway, R. Galloway, J. Hardy, A. Kay, P. Kirsop, H. McQueen. "**Scaffolding student engagement via online peer learning**". European Journal of Physics, Volume 35, Issue 4, 2014

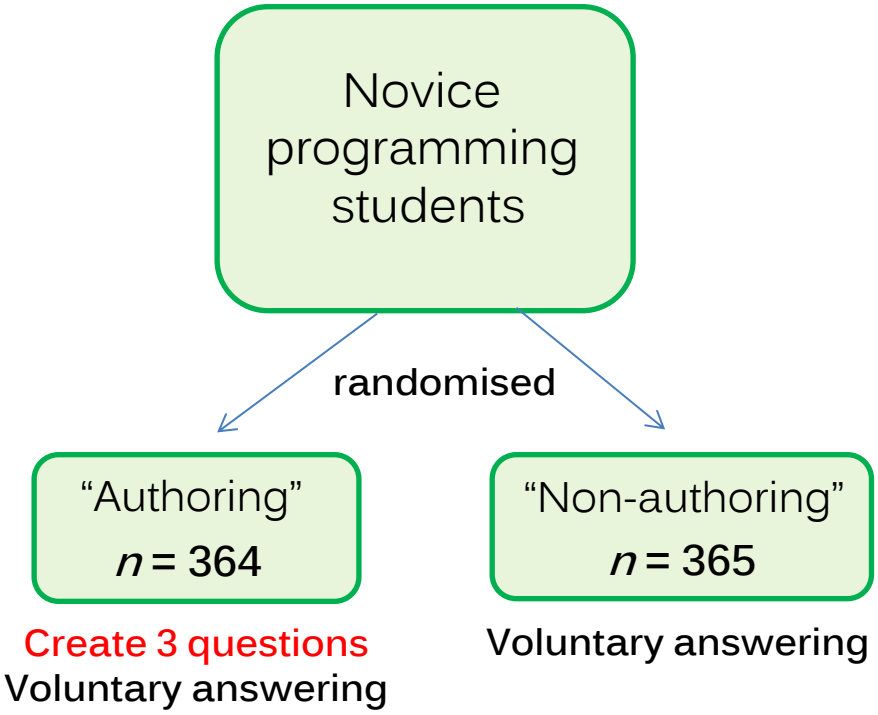
Do students learn by authoring questions?

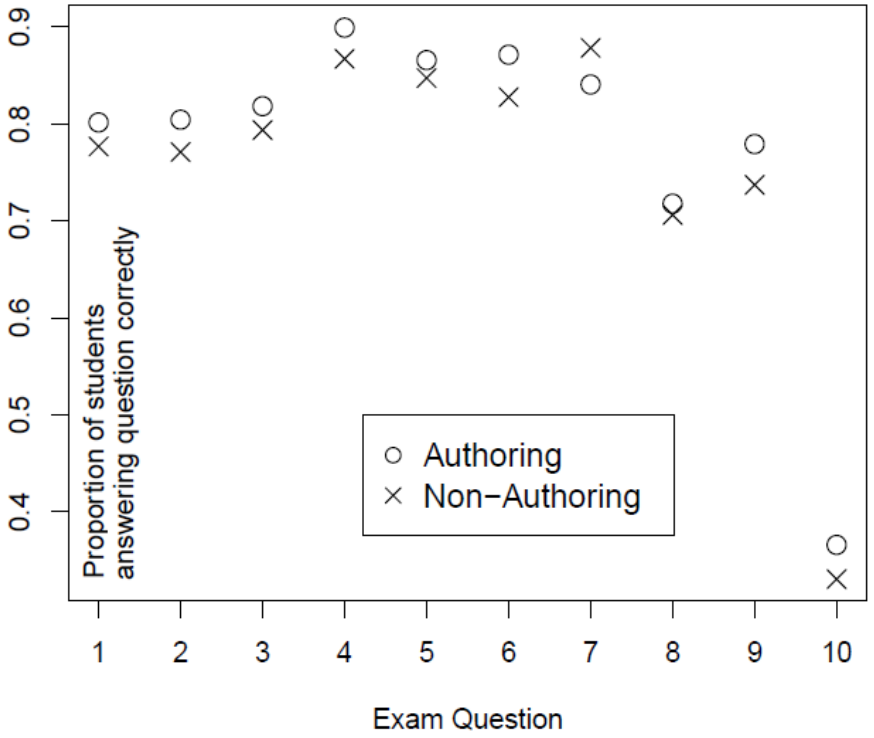
Only *experimental group* could author – all students could answer



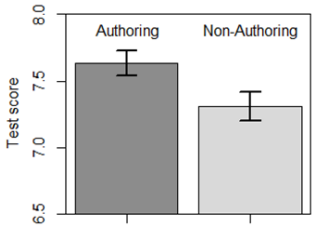
Performance on summative test by group

"Authoring" group performed significantly better (although a small effect size)



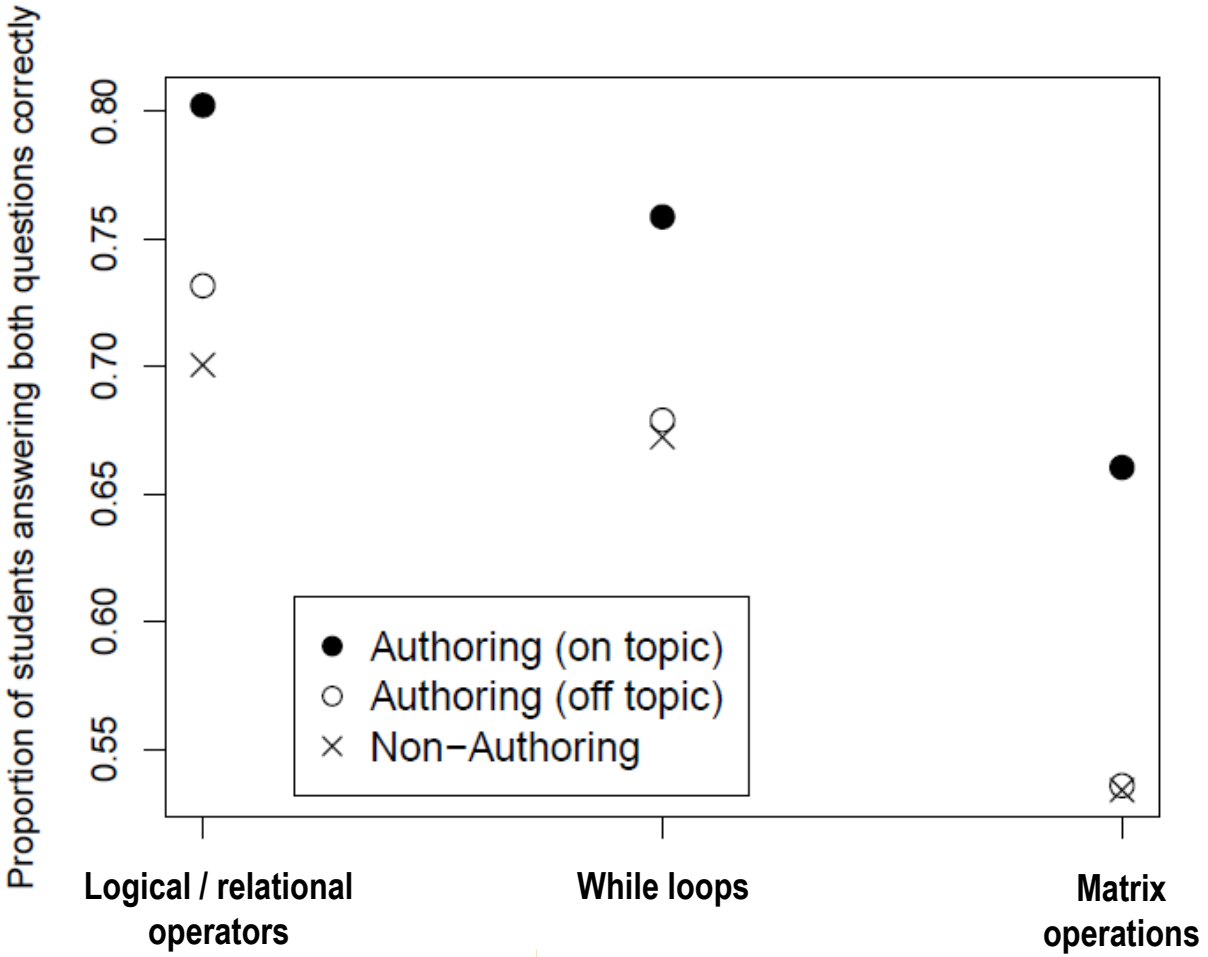


n	Authoring		Non-Authoring		p-value
	μ	σ	μ	σ	
729	7.64	1.84	7.31	2.10	0.0197
712	7.77	1.57	7.54	1.68	0.0360



Performance on related test items

- All 1139 questions were coded for topic
  - logical and relational operators
  - while loops
  - matrix manipulation
- Students authoring on a given topic much more likely to answer related test questions correctly



Denny, P. "**Generating Practice Questions as a Preparation Strategy for Introductory Programming Exams**", In Proc. 46th ACM Technical Symposium on Comp Sci Ed, SIGCSE'15 (to appear March 2015)

Conclusions

- PeerWise is a simple way to support a student-generated question activity
- Students value practice questions authored by their peers, answering them voluntarily prior to exams
- Students are capable of authoring a repository of relevant, high quality questions
- Generating and answering practice questions can be an effective learning strategy

Thank you

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