

How to Engage First-year Students with Different Levels of Mathematical Skills in learning Engineering Mathematics using Technology: A Case Study

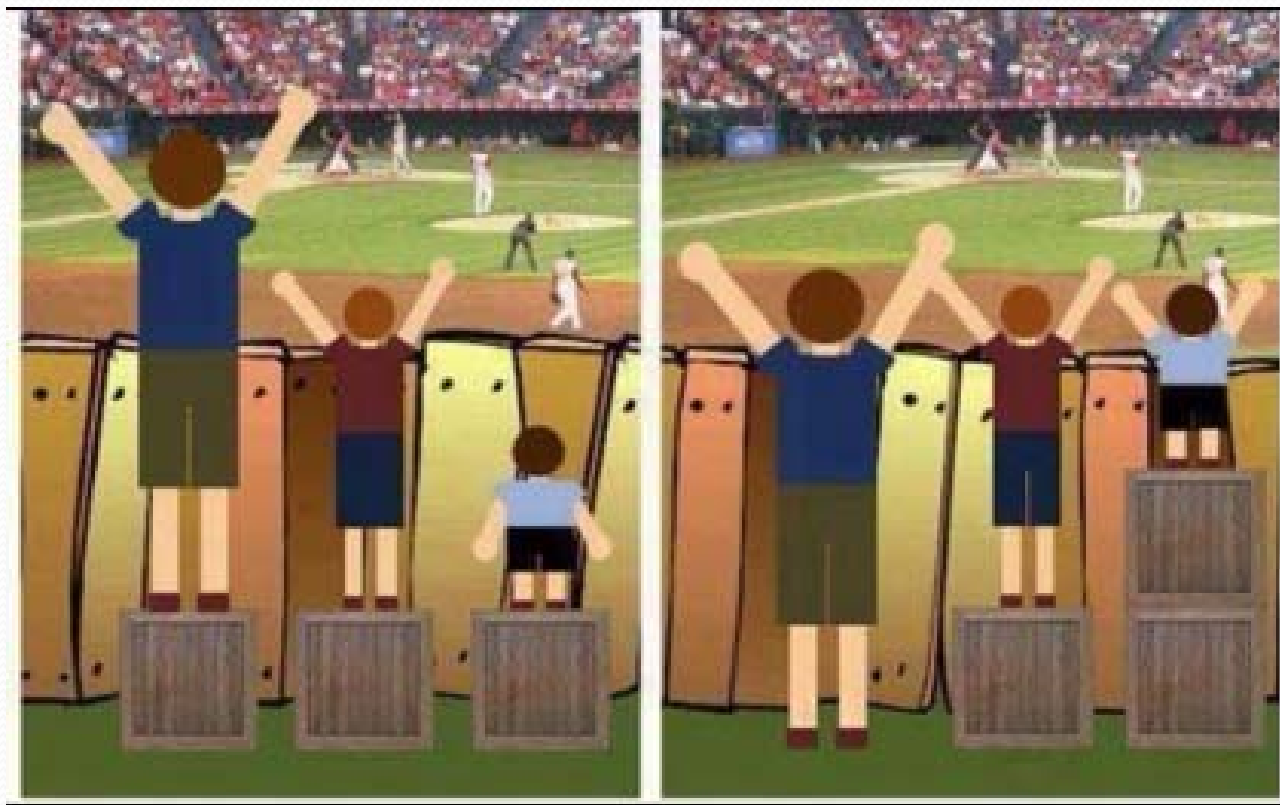


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How the new generation learns?



Students having very diverse backgrounds in Maths



Students having very diverse backgrounds in Maths- Examples

$$\frac{(x+1)3x^2 - x^3 \times 1}{(x+1)^2}$$

$$\frac{3x^2 - x^3}{(x+1)^2}$$

$$\frac{2x^3(x+1) - (3x^3 + 3x^2 - x^3)}{(x+1)^2}$$

$$= \frac{x^2(2x+3) - (3x+3-x)}{(x+1)^2}$$

$$= \frac{x^2(3x+3-x)}{(x+1)^2}$$

$$= \frac{1}{x^2} (2x^2 - x^3) = \frac{1}{x^2} 2x^2 = \frac{2x}{x^2}$$

$$\frac{x^2 + 2x + 1}{x^2}$$

$$\frac{x+3-x}{x^2}$$
~~$$\frac{2x+1}{x^2}$$~~

Students having very diverse backgrounds in Maths- Examples

$$y = \frac{x^3}{x+1} \left(\frac{u}{v} \right) = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$$

$$u = x^3 \quad \frac{du}{dx} = 3x^2$$

$$v = x+1 \quad \frac{dv}{dx} = 1$$

$$\frac{(x+1)(3x^2) - (x^3 \times 1)}{(x+1)^2}$$

$$\frac{3x^3 + 3x^2 - x^3}{(x+1)(x+1)}$$

$$x^2(3x+3-x)$$

$$y = \frac{x^3}{x+1}$$

$$\frac{(x+1)(3x^2) - (x^3)(1)}{(x+1)^2}$$

$$\frac{3x^3 + 3x^2 - x^3}{(x+1)^2}$$

$$\frac{2x^3 + 3x^2}{(x+1)^2}$$

Wrong!

$$\frac{dy}{dx} = \frac{6x^2}{(x+1)^2}$$

$$y = \frac{x^3}{x+1}$$

$$u = x^3, \quad u' = 3x^2$$

$$v = x+1, \quad v' = 1$$

$$\frac{d}{dx} = \frac{v u' - u v'}{v^2}$$

$$y = e^x \cos x$$

$$= (e^x)(-\sin x) + (e^x)(\cos x)$$

$$= -e^x \sin x + e^x \cos x$$

$$= e^x (\sin x + \cos x)$$

$$= e^x (1) ?$$

$$= e^{3x}$$

$$\left(\frac{1}{4} \right)$$

$$\frac{(x^3)(1)}{(x+1)^2}$$

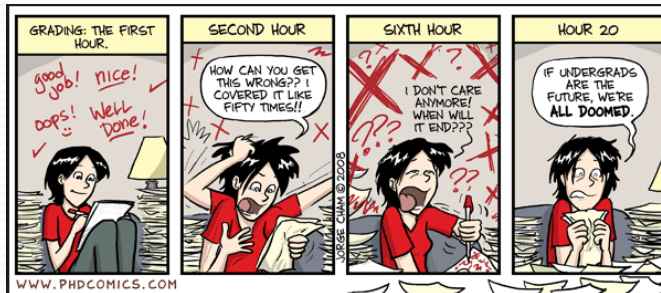
$$\frac{x^3 - x^3}{(x+1)^2}$$

$$= 2x+3$$

Wrong!

up to here ✓

Methods adopted for giving feedback



Marking by lectures



Peer assessment

Interactive assessment and feedback tool

Use of technology can save time



Courses Taught	Course Leading (%)	Students	Credits	Proportion Whole Class Teaching	Proportion Small Group Teaching (Seminar / Tutorial)	Proportion Assessment	Taught Period.	Proportion of whole class teaching allocated to small group Teaching	Total Points
[MATH1062] Mathematics 1A/1B (BSc)	100%	19	30	100.00%	100.00%	100.00%	T1-T3	100%	118
[MATH0027] Mathematics 1A/1B (BEng)	100%	35	30	100.00%	100.00%	100.00%	T1-T3	100%	158
[MATH1062] Mathematics 1A/1B (BSc)	100%	19	30	100.00%	100.00%	20.00%	T1-T3	100%	87
[MATH0027] Mathematics 1A/1B (BEng)	100%	35	30	100.00%	100.00%	20.00%	T1-T3	100%	100

MyMathlab

Summative?

Homework: Formative Assignment (FA)1-Matrices

Ex. Score: 0 of 1 pt HW Score: 0% (0 of 17 pts) 1 of 17 complete

Give the size of the following matrix: $\begin{pmatrix} 4 & 1 \\ 8 & 3 \end{pmatrix}$

Size of the given matrix = 2 x 3 .

Help Me Solve This
Textbook
Calculator
Print

Help Me Solve This
Textbook
Calculator
Print

Sorry, that's not correct.

The size of a matrix is given by its number of rows and number of columns, in that order.

Done

Help Me Solve This

Give the size of the following matrix: $\begin{pmatrix} 4 & 2 & 2 & 3 & 3 \end{pmatrix}$

We refer to the size of a matrix by giving its number of rows and number of columns, in that order.

Press Continue to see more.

2 parts remaining

Continue Close

PEARSON Welcome

Page 483 160%

A **matrix** is a rectangular array of numbers or expressions etc. For example,

$$\begin{pmatrix} 3 & 1 & 9 \\ 0 & -6 & 2 \end{pmatrix}, \begin{pmatrix} \alpha & \beta \\ \gamma & \delta \end{pmatrix}, \begin{pmatrix} 3 - \lambda \\ 7 \end{pmatrix}$$

are all matrices. Note that the plural of matrix is matrices. We often denote a matrix by a capital letter, for example

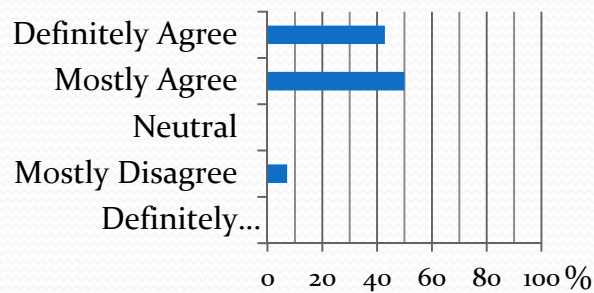
$$A = \begin{pmatrix} 4 & 1 \\ 3 & 6 \\ -1 & 0 \end{pmatrix}, B = \begin{pmatrix} 1 & 0 & -1 \\ 6 & 1 & 4 \end{pmatrix}$$

The **size** of a matrix is given by the number of rows and the number of columns. The matrix A has three rows and two columns and so is described as a 3 by 2 matrix.

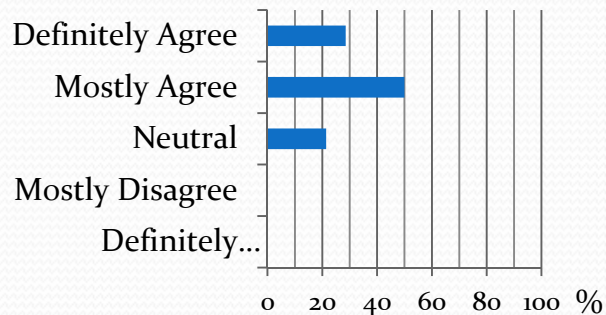
online assessment tool- Survey



Do you think My Mathlab allows you to learn Mathematics Flexibly?



Does MyMathlab help you to learn independently?



What do you like most about MyMathlab?

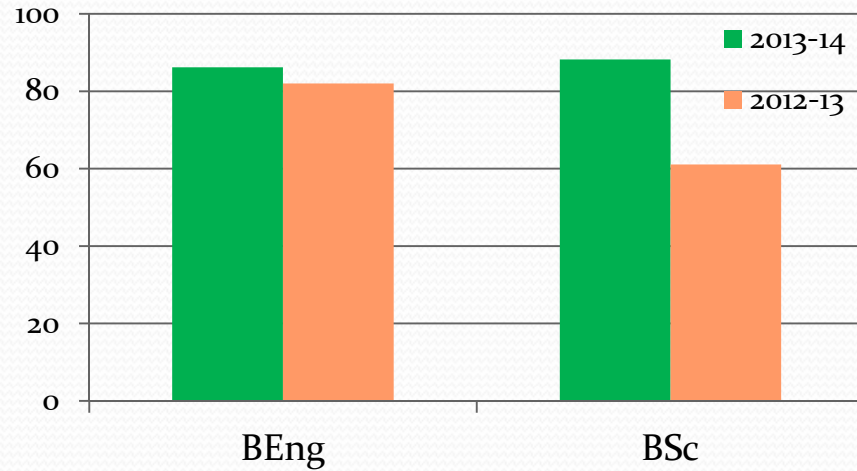
- Instant Feedback
- Regular assignments that let me learn on weekly basis
- Gaining confidence that I can learn myself
- Ability to learn A-level topics that I had not learnt before

PEER Assessment

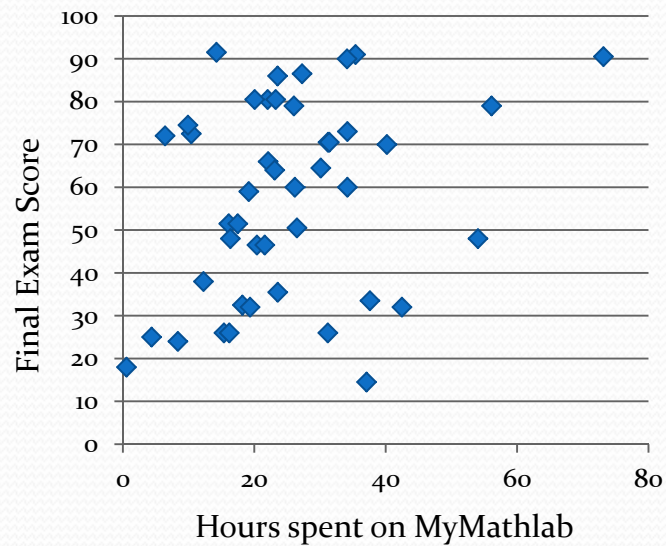
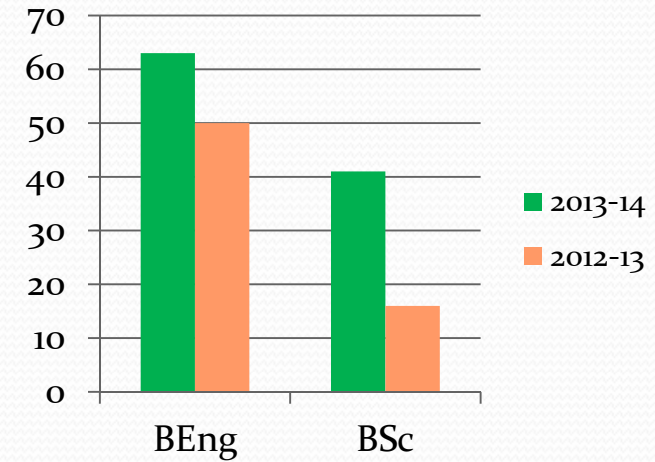


Statistics

Pass rate



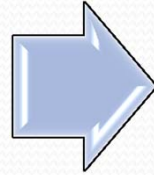
Percentage of students achieving more than 60% in the final exam



- The final exam mark of BEng students showed a correlation of 0.39 (p-value=0.037) with the time they spent using MyMathlab.

Conclusions

Technologies



Engagement



Confident Useful Time saver
Happy



MyMathLab Global

References

- A comprehensive guide which includes many case studies. Available at <http://www.jisc.ac.uk/media/documents/publications/enhancinglearningthroughtechnology.pdf>
- Croft, A., 2010. Mathematics for Engineers: Mymathlab Global Pack. Prentice-Hall.
- Donovan, D., Loch, B., 2013. Closing the feedback loop: engaging students in large first-year mathematics test revision sessions using pen-enabled screens. *International Journal of Mathematical Education in Science and Technology* 44, 1–13.
- Higher Education Funding Council for England (2009) Enhancing learning and teaching through the use of technology: A revised approach to HEFCE's strategy for e-learning. Available from: http://www.hefce.ac.uk/pubs/hefce/2009/09_12/09_12.pdf [23 May 2011].
- Kirkwood, Adrian and Price, Linda (2011). Enhancing learning and teaching through technology: a guide to evidence-based practice for academics. Higher Education Academy, York, UK.
- Race, P., 2010. Making learning happen: a guide for post-compulsory education. Sage.



THANK YOU!