



Encouraging students to practice
basic mathematics:
The problems of a non-accredited course

Hazel Corradi

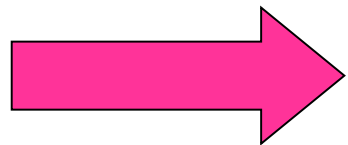
Department of Biology and
Biochemistry

Overview

- Background to Maths Workshop
- The initial challenge
- What I tried to improve
- Current thoughts

Background to Maths Workshop

- Intake of ~60 Biochemists and Molecular Cell Biologists (MCBs)
- No requirement for A level maths, and some MCBs do not have A level Chemistry



Wide range of mathematics ability

- Run a weekly workshop

The beginning...

Factoring

Expanding brackets

Trackets should be expanded in the following way:
For an expression of the form $a(x + b)$, the expanded version is $ax + ab$. (i.e. multiply the term inside the bracket by everything inside the bracket (e.g. $2(x + 3) = 2x + 6$) (remember $x + 3$ is $x + 3$)
For an expression of the form $(x + a)(x + b)$, the expanded version is $x^2 + (a + b)x + ab$, so other words everything in the first bracket should be multiplied by everything in the second.

Example:
Expand $(2x + 3)(x - 1)$
 $(2x + 3)(x - 1)$
 $= 2x^2 - 2x + 3x - 3$
 $= 2x^2 + x - 3$

Factoring

Factoring is the reverse of expanding brackets, so it is putting $2x^2 + x - 3$ into the form $(2x + 3)(x - 1)$. This is an important way of solving quadratic equations.
The first step of factoring an expression is to 'take out' any common factors which the terms have. So if you were asked to factorise $x^2 + x$, since x goes into both terms, you would write $x(x + 1)$.

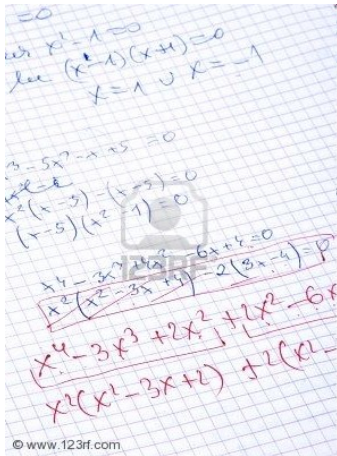
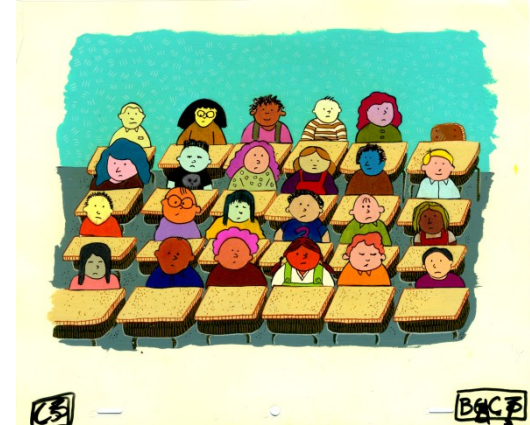
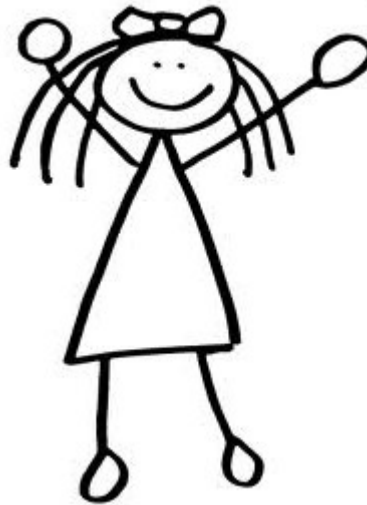
Factoring Quadratics

There is no simple method of factoring a quadratic expression. One way, however, is as follows:

Example:
Factorise $2x^2 - 2x + 3$
 $2x^2 - 2x + 3 = 0$ Since the 2's has been split up into two numbers whose multiple is 24, 24 was chosen because that is the product of 12 and 3, the other two numbers!
The first two terms, $2x^2$ and $-2x$, divide by 2x, so take out the factor of 2x.
 $2x^2 - 2x + 3 = 0$ becomes $2x(x - 1) + 3 = 0$
(Now, make the last two expressions look like the expression in the bracket)
 $2x(x - 1) + 3(x - 1)$
The answer is $(2x + 3)(x - 1)$

Example:
Factorise $x^2 + 2x - 8$
We need to split the 2x into two numbers which multiply to give -8. This has to be 4 and -2.
 $x^2 + 2x - 8 = 0$
 $(x + 4)(x - 2) = 0$

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2-11



SAMIS student & applicant management information system

15th November 2010

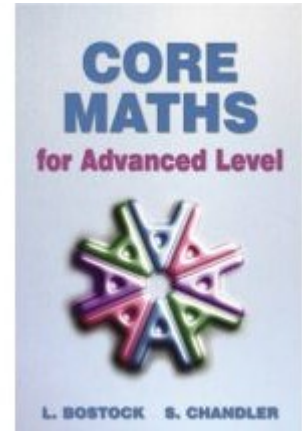
Staff Home Student Home Evaluation PDP Data Input

Staff Look-up Screens

- [Student look-up](#)
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Staff Actions

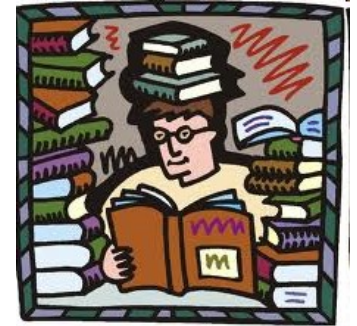
- [Enter module marks](#)



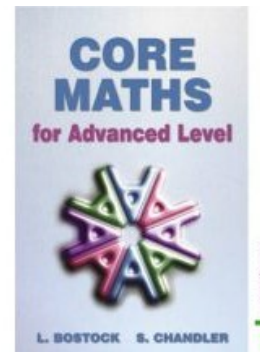
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Outcomes...

Who attended?



What I taught



Outcome



What I did...

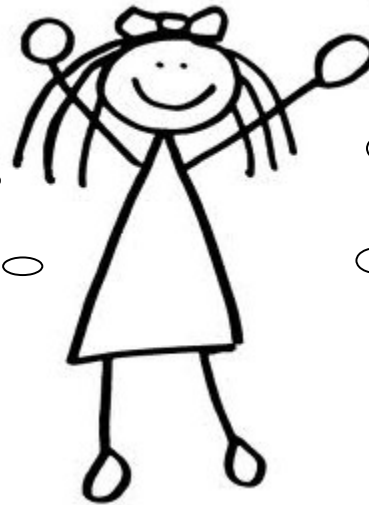
Student
motivation

Setting
learning
outcomes

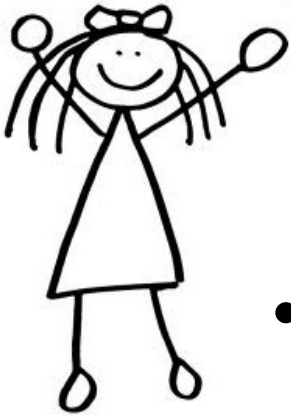
Managing
different
standards

Monitoring
student
engagement

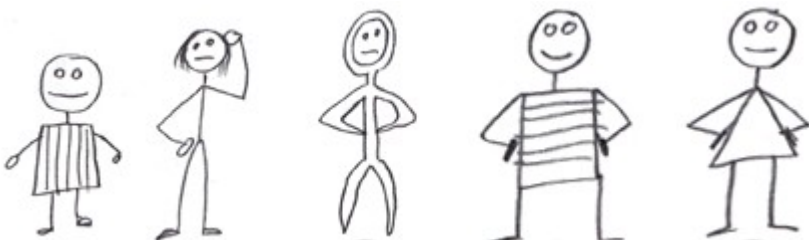
Assessment



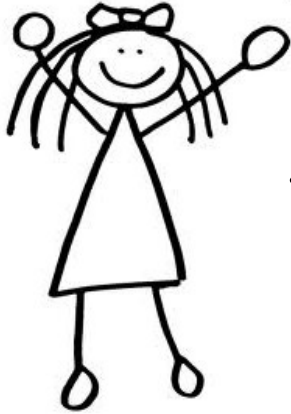
Setting learning outcomes



- What maths is required for the course?
- How should it be taught?
- Use of Moodle?



Monitoring student engagement



SAMiS student & applicant
management
information system

15th November 2010

[Staff Home](#) [Student Home](#) [Evaluation](#) [PDP Data input](#) [PC](#)

Staff Look-up Screens

[Student look-up](#)

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Staff Actions

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Mr A Morgan	1.16	7.26	11
Mr A Morgan	7.02 2	7.19 1	6
Mr A Morgan	1.02	1.01	5
Mr A Morgan	7.17	7.17	6
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Mr A Morgan	100.16	100.16	6

moodle



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Managing different standards



Transposition and fractions

1. Simplify:

a, $\frac{9xy}{3x}$ b, $\frac{7}{49x+7y}$ c, $\frac{7ab}{a^2b^2+9ab}$ d, $\frac{x+4}{2x+8}$

2. Simplify:

a, $\frac{1}{3} \times \frac{z}{2}$ b, $\frac{3}{x} \div \frac{1}{2}$ c, $\frac{1}{x+1} \times \frac{2x+2}{x+3}$ d, $\frac{3}{x} - \frac{5}{3x} + \frac{4}{5x}$

3. Make x the subject of the formula

a, $y = \frac{13}{x+18}$ b, $y = \frac{13}{x} + 18$ c, $y = \frac{7+x}{14}$ d, $s = ut + \frac{1}{2}xt^2$

4. Show that $v_{max} = \frac{[S]}{1 + \frac{[S]}{K_x}}$ is equivalent to $v_{max} = \frac{[S]}{K_x + [S]}$

5. Show that $\frac{v}{v_{max}} = \frac{[S]}{K_m + [S]}$ is equivalent to the Lineweaver-burk reciprocal plot
 $\frac{1}{v} = \frac{K_m}{v_{max}} \frac{1}{[S]} + \frac{1}{v_{max}}$

6. For the chemical reaction: $A + 2B \Rightarrow AB^2$, the initial concentrations of A and B are $a = [A]$ and $b = [B]$.

The rate of the reaction is given by $R(x) = k(a - x)(b - 2x)^2$.

Multiply out the bracket and write the equation as a polynomial, grouping the powers of x together.

7. The speed of an enzymatic reaction is described by the Michaelis-Menten equation:

$$v = \frac{ax}{k+x}$$

where v is the velocity of the reaction, x is the concentration of the substrate, a is the maximum reaction velocity and k is the substrate concentration at half the maximum velocity.

- Show that when $x = k$, the velocity of the reaction is half the maximum velocity.
- Show that an 81-fold change in the substrate concentration is needed to change the velocity from 10% to 90%, regardless of the value of k .



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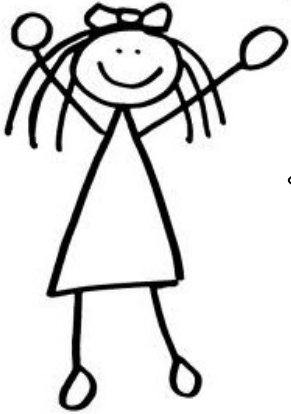
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Motivating students



5. Show that $\frac{v}{V_{max}} = \frac{[S]}{K_m + [S]}$ is equivalent to the Lineweaver-burk reciprocal plot
$$\frac{1}{v} = \frac{K_m}{V_{max}} \frac{1}{[S]} + \frac{1}{V_{max}}$$

3

State the value of x for $\log_2 64 = x$

Marks: 1

Choose one answer.

- a. Confident
- b. Fairly confident
- c. Not sure
- d. No idea

4

Marks: --/1

Simplify $\frac{e^3}{e^{-1}}$ and write the final power of e as the answer.

Answer:

Submit



Exam design

4

Marks: --/1

Simplify $\frac{e^3}{e^{-1}}$ and write the final power of e as the answer.

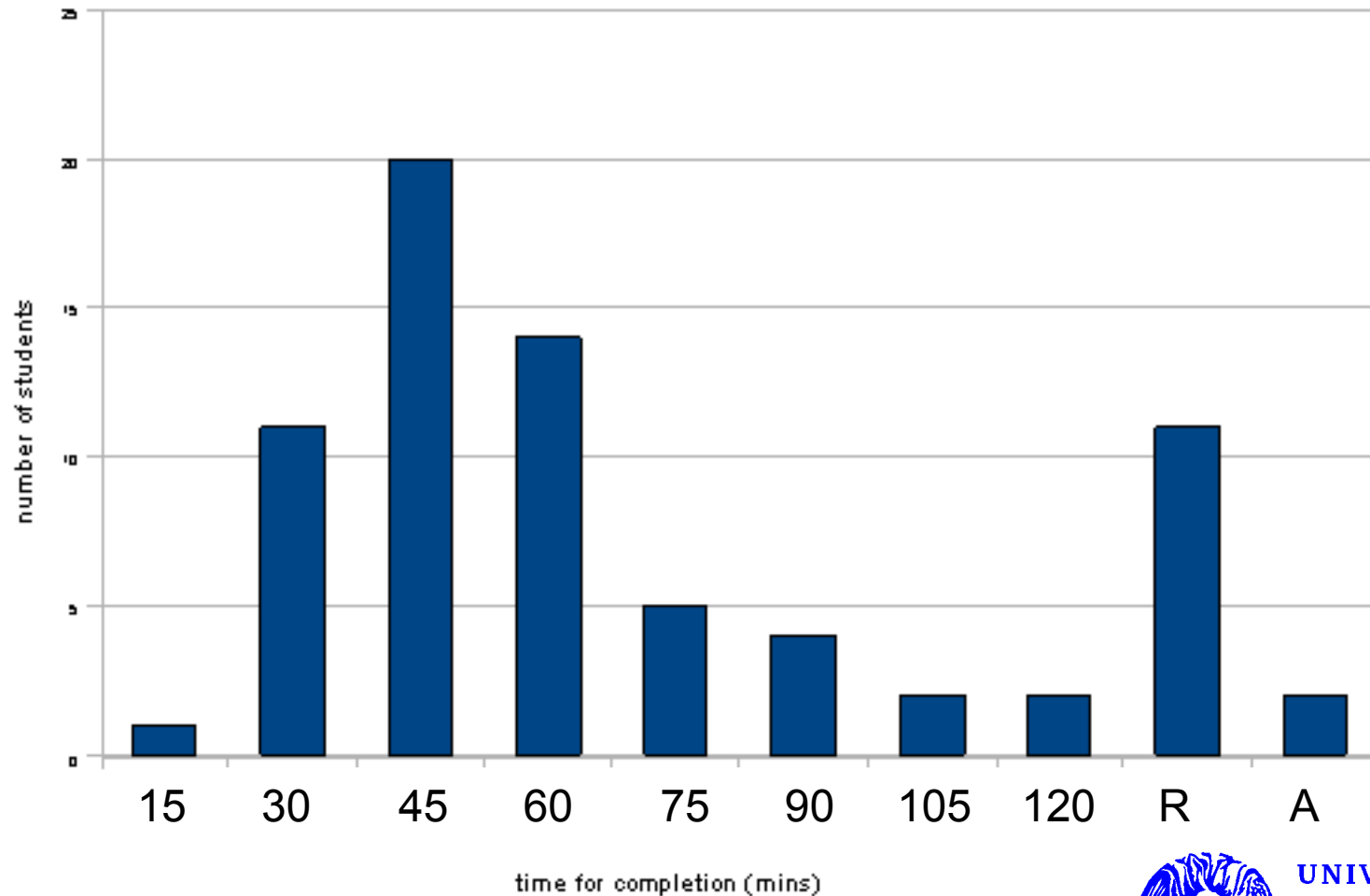
Answer:

Submit

- Required mark = 100%
- Repeat questions until they are correct

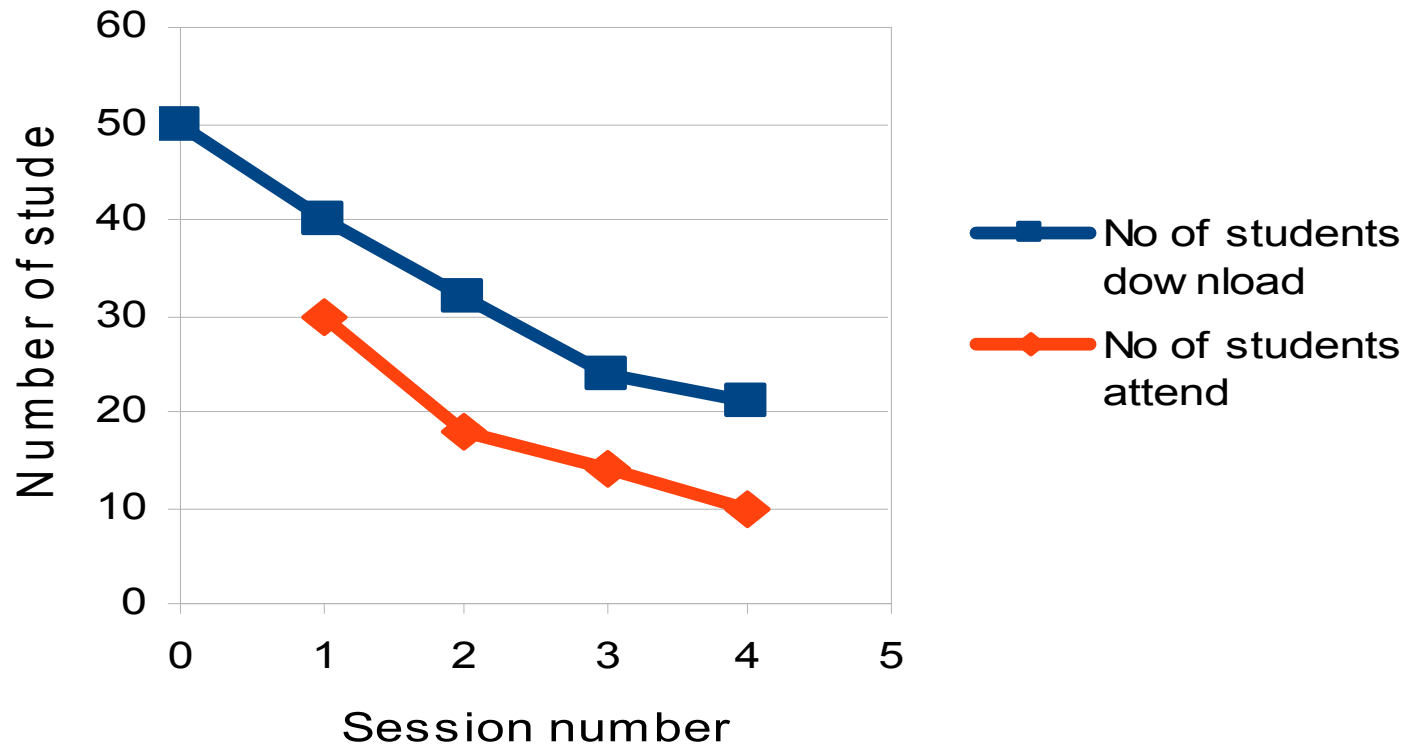
- Need correct answers
- Password and IP protected
- Calculators and attendance slips
- Room booking and timetables
- Requesting and training invigilators
- Monitoring finishing times

2009-2010 Student test performance

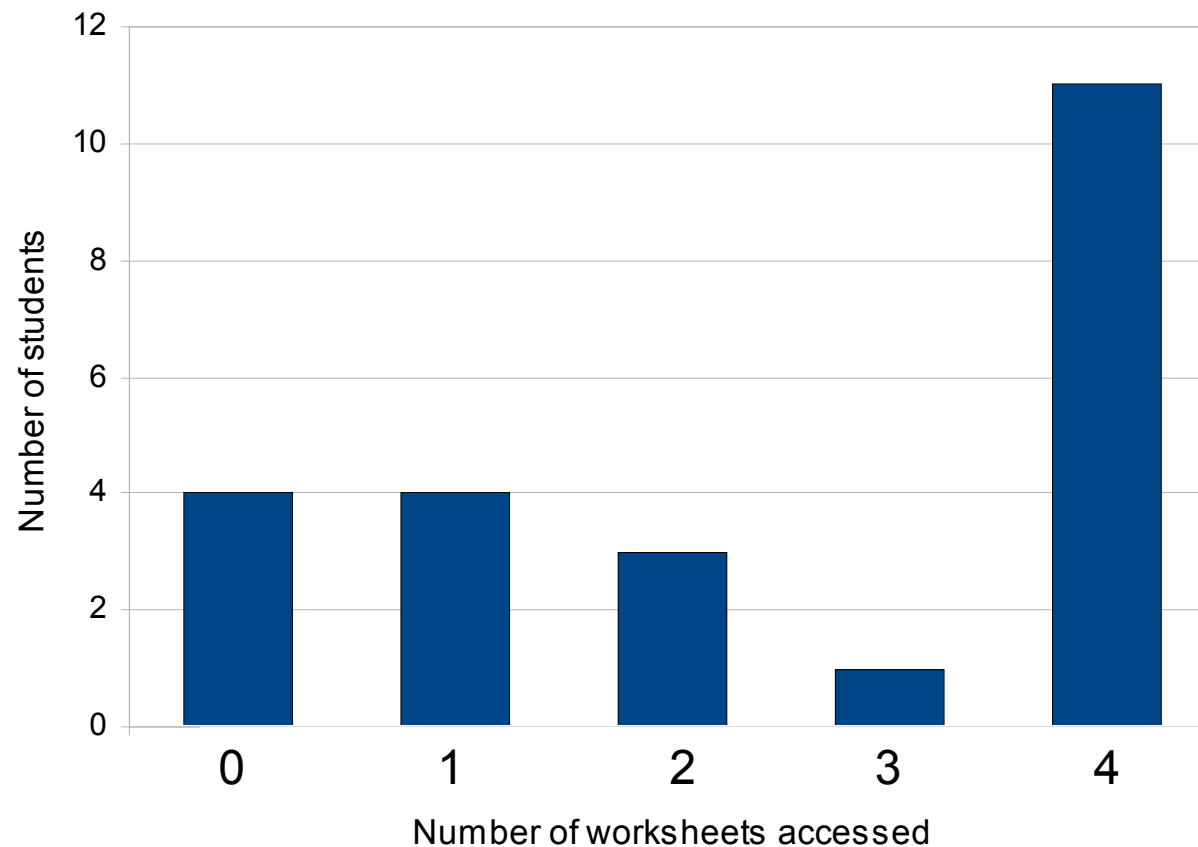


How is it going now?

Usage of Maths Workshop



Number of worksheets accessed by students without A level maths with low evaluation scores



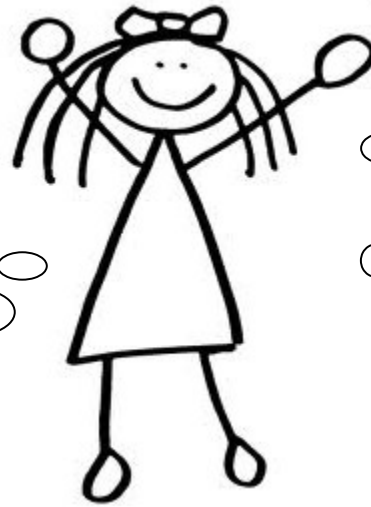
Current thoughts

What do I do about those students who haven't engaged?

What do I do about those students who have very low ability?

Should I provide more examples and worksheets?

Should I make the exam harder?



A bit of research

- Survey the students on their opinion
- Survey the staff on maths requirements for later courses
- Read some books, look for available resources
 - New textbooks
 - Online

Plan

- Be more enthusiastic
- Linking the material to biochemistry
- Providing more resources online
- Reintroducing preliminary assessment
- Introducing informal assessment and group work

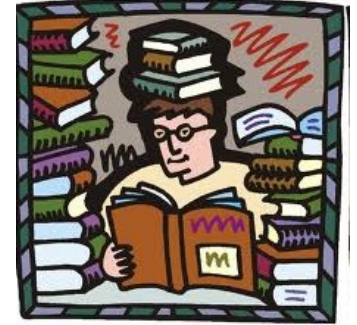
Student test performance

- 59 out of 70 completed the test within 2 hours.
- 9 out of 11 failures did not have A or AS level maths
- 4 out of the 11 were MCBs.

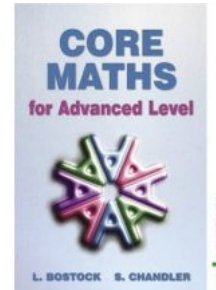
1

What I did...

Who attended?



What I taught



Outcome



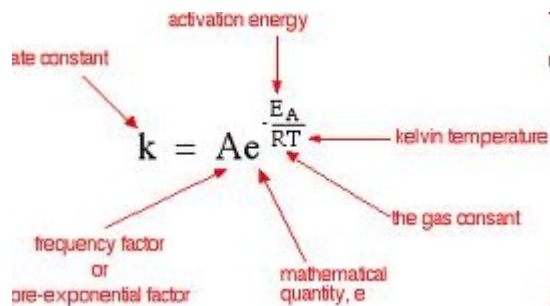
2

What I did...

Who attended?



What I taught



Outcome



3

What I did...

Who attended?



What I taught

Outcome