



Transitional Issues University of Durham 2010

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Agenda

- Introduction
- Recruitment, Skills & Careers
- Transitional Tools
- Problem Solving
- Things You May Not Have Seen
- AOB

Recruitment and Careers

Progression – students to graduate careers

School / College
(14-16), (16-19)



Recruitment

HE – Universities
Russell Group,
Pre-1992,
Post - 1992



Recruitment

Graduate Employment
& Research Training

Broad range of subjects GCSE (or equivalent).
(incl. compulsory maths):
Selection of GCE A-level subjects (or equivalent)

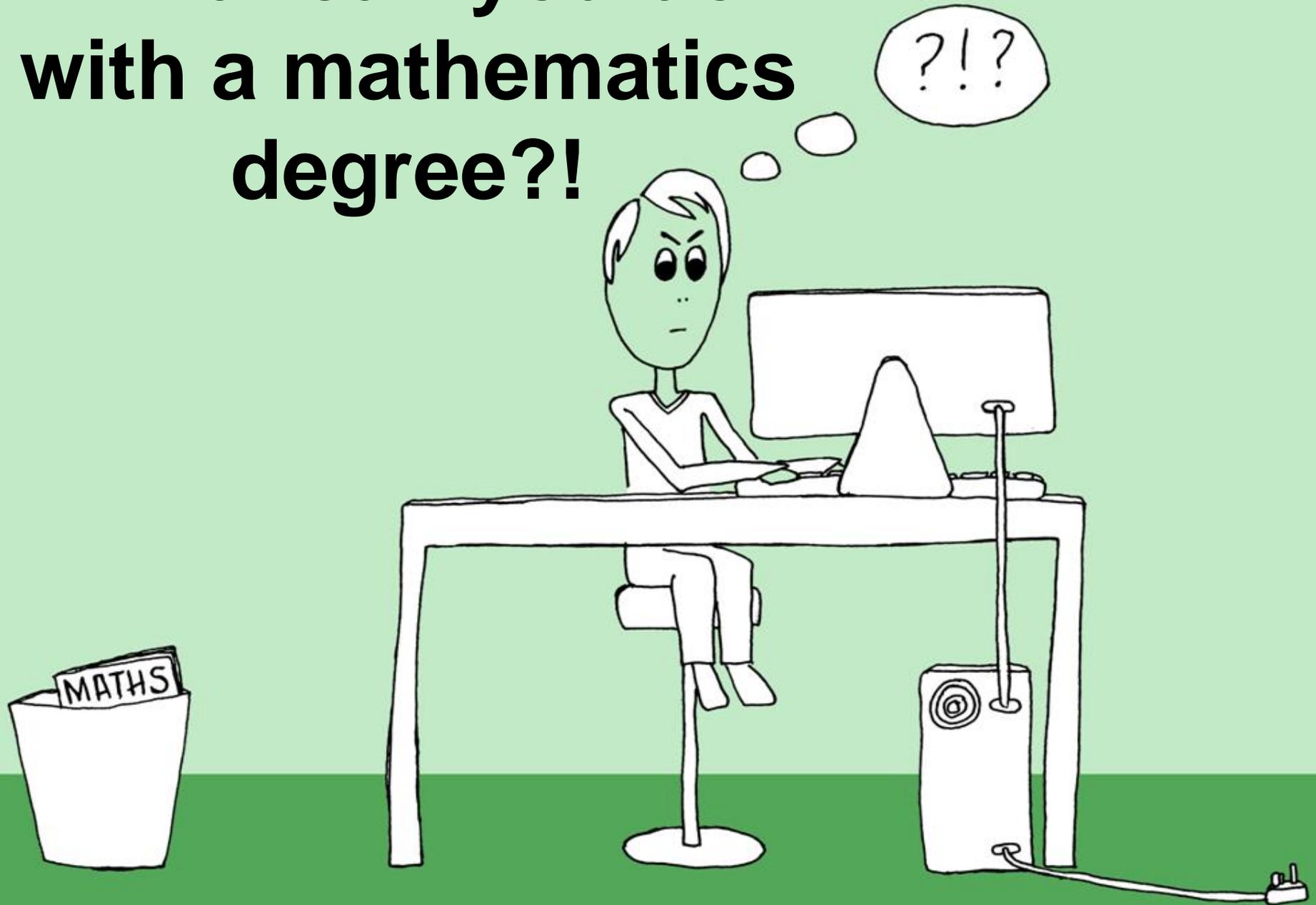
Interface concerns – ‘Mathematics problem’?

UG: Subject specific, Student Experience
PG: Taught specialist courses (typically more
vocationally orientated);

Interface concerns – ‘Employability skills gap’?

Graduate career progression
PhD study & training

**What can you do
with a mathematics
degree?!**



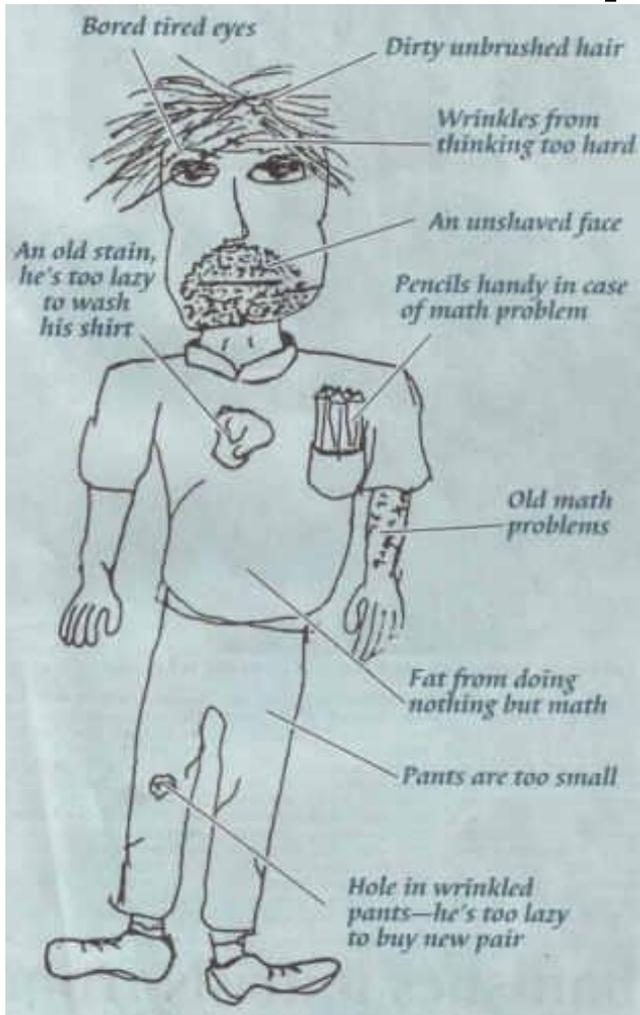
Firstly, some facts (2004)!

- 61% of Mathematics UK graduates entered employment in a wide range of work sectors
- Some 23% of graduates went into further study compared to all graduates 14%
- Most popular employment was business and finance (29%)
- About 12% of graduates entered Teaching
- Maths graduates earn more over a lifetime. A study has identified a graduate will earn ~£150k extra; a mathematics graduate ~ £225k

More interesting facts!

- Over 70% of all jobs require maths
- On average maths graduates earn more than any other profession
- Many degrees require maths including statistics, physics, engineering, economics, chemistry, medicine, IT, computer games, computer science, social-science, psychology, fashion design, business studies, accountancy, actuarial studies, electronics, aeronautics, cryptography..
- Without maths we would have no TV, mobile phones, Internet, credit cards, computer games, CDs, Radar, aeroplanes, DNA profiling, ...
- Maths is vital working out your mortgage payments, APR calculations, family budget
- Florence Nightingale was a mathematician (well a statistician!)

Perceptions



- An old stain, he's too lazy to wash his shirt;
 - Bored, tired eyes;
 - Dirty, unbrushed hair;
 - Wrinkles from thinking too hard;
 - An unshaved face;
 - Pencils handy in case of maths problem;
 - Old maths problems;
 - Fat from doing nothing but maths;
 - Pants are too small;
 - Hole in wrinkled pants – he's too lazy to buy a new pair.
- Berry et al (2000)**

So why hire a mathematician?

Some student responses:

- Teaching and tutoring;
- Doing taxes;
- Working in a bank or shop;
- ‘to do hard sums’.

Berry et al (2000)

Changing Perceptions



more maths grads
multiplying opportunities



- [Website](#)
- [Resources](#)
- [Videos](#)
- Moremathsgrads in a box

- [Website](#)

Careers Advice



- [Website](#)

- [Website](#)

Careers Advice



- [Website](#)

- [Website](#)



Skills

Employability and skills

- *“a set of achievements – skills, understandings and personal attributes – that make graduates more likely to gain employment and be successful in their chosen occupations.”*

Engineering Subject Centre

Examples

- **Communication:** Ability to express oral and written ideas clearly, convincingly and concisely.
- **Leadership:** Ability to motivate; achieve goals; show initiative.

STEM skills

- *“Science is a way of thinking much more than it is a body of knowledge.”*

Carl Sagan

- *“In science one tries to tell people, in such a way as to be understood by everyone, something that no one ever knew before.”*

Paul Dirac

Employer demand for STEM

“Businesses from all sectors want STEM Skills – nine out of ten (92%) firms employ STEM skilled people, valuing their analytical capabilities and problem solving skills...given a choice, four out of ten employers prefer STEM degrees over any other subject.”

CBI Education and Skills Survey (2009)

Employability uncovered

“70% of employers agree that degree results alone are not the best measure of employment potential”.

Graduates in the Eyes of Employers (2002)

“Based on a survey of 200 employers (including BMW Group, Logica and PricewaterhouseCoopers), verbal communication is the quality that most employers seek in graduate recruits. This is followed by enthusiasm and written communication skills. Problem-solving ability, numeracy, business awareness and team work are also rated highly”.

From Learning to Earning (2002)

Mathematics in the workplace

“The qualities that distinguish [these] mathematicians from other scientists and engineers are seen by their managers as falling into two broad categories:

- highly developed skills in abstraction, analysis of underlying structures, and logical thinking;
- expertise with the best tools for formulating and solving problems”.

The SIAM Report on Mathematics in Industry (1995)

The Graduate View

- “...students tell us that they share concerns with employers – particularly about employability....”

**Higher Education at Work - High Skills: High Value (DIUS, 2008)
based upon information from National Student Forum (2008)**

- More UK graduates say they feel less prepared for their jobs after graduation and say that they receive more employer-supported training in order to carry out their roles.

Referenced in Brennan et al (2001) and Brennan & Tang (2008)

National Student Survey

Responses for Mathematical Science

	2005			2006		
	Scale mean	Standard deviation	Number of responses	Scale mean	Standard deviation	Number of responses
Teaching and Learning	3.93	0.62	1,530	3.91	0.66	1,626
Assessment and Feedback	3.66	0.76	1,501	3.69	0.74	1,591
Academic Support	3.96	0.80	1,521	3.95	0.78	1,599
Organisation and Management	4.02	0.75	1,496	4.02	0.75	1,602
Learning Resources	4.23	0.68	1,241	4.26	0.71	1,310
Personal Development	3.70	0.87	1,486	3.69	0.86	1,596
Overall Satisfaction	4.17	0.84	1,531	4.11	0.85	1,631

Adapted from Surridge (2006)

Personal Development

	2005 (All)	2006 (All)	2008 (Mathematics)
19. The course has helped me present myself with confidence	3.92	3.93	3.73
20. My communication skills have improved	4.08	4.08	3.75
21. As a result of the course, I feel confident in tackling unfamiliar problems.	3.94	3.95	3.96

The typical graduate?

- Ready to Contribute
- Customer Focus
- Global Perspective
- Ethics
- Continuous Learning
- Communication Skills
- Quantitative Skills
- Adaptability
- Deadlines and Budgets
- Teamwork
- Cross-Functional Thinking

Red Poling, [then] CEO of Ford Motor Company, on qualities they look for in a new employee or an effective member of a corporate workforce.

Good Practice

- **Project work** – opportunities for undergraduates to undertake some project work during their programme.
- **Group projects** – working with their peers on a mathematical project helps students develop an awareness of team roles and dynamics and provides experience of peer assessment.
- **Enquiry based learning** – covers a whole range of activities where the learning is student led. It encourages research skills, independent learning and the ability to solve new and unfamiliar problems.

Good Practice

- **Personal Development Plans** – allow students to reflect on their learning and skills development and devise action plans for effective study. They help students deal with time management and provide advice for developing graduate skills.
- **Peer mentoring and Peer Assisted Learning** – e.g. pair first year students with more experienced undergraduates to provide academic and pastoral support.
- **Work-based experience** – provides students with opportunities to develop organisational awareness, adapt to new situations and understand the relevance of mathematics to real-life situations.
- **Employer involvement**

A word of caution

- Although five of the six companies surveyed indicated their high priority for graduates having the necessary mathematical skills...only one specifically recruited mathematical sciences graduates. Physics, Engineering & Economics graduates may also possess these same skills!

A Review of Careers for mathematics and Statistics Graduates: the employers' perspective (2007)

- *'A haphazard approach will not be sufficient. Systematic and explicit attention is needed so that the development and transfer of [the] distinctive skills that the study of mathematics fosters is given the priority it deserves'.*

Peter Kahn, MathSkills (1998)

The Transition to University

Resources & Publications

- Facts, Formulae and Information Leaflets:
 - Pure Mathematics
 - ‘More’ Facts & Formulae
 - Mechanics
 - Probability & Statistics
 - Maths for Computer Science
- (~21,000 distributed in 2007/2008)



Resources & Publications

- Refresher Guides

- Algebra
- Calculus
- Numeracy

The image shows a page from a 'mathcentre' document titled 'A Calculus Refresher', version 1.1, dated March 2003. The page contains several calculus problems. Problem 4 asks to show that $\int \frac{8x-7}{4x^2-7x+2} dx = \ln|4x^2-7x+2| + c$ using the substitution $u = 4x^2 - 7x + 2$. Problem 5 discusses a general rule for integrals of the form $\frac{\text{derivative of denominator}}{\text{denominator}}$, where the integral is the logarithm of the denominator. Problem 6 asks to use the technique of Question 5 with a linearity rule to find integrals like $\int \frac{x}{x^2-7} dx$.

4. By means of the substitution $u = 4x^2 - 7x + 2$ show that

$$\int \frac{8x-7}{4x^2-7x+2} dx = \ln|4x^2-7x+2| + c$$

5. The result of the previous exercise is a particular case of a more general rule with which you should become familiar: when the integrand takes the form

$$\frac{\text{derivative of denominator}}{\text{denominator}}$$

the integral is the logarithm of the denominator. Use this rule to find the following integrals, checking each example by making an appropriate substitution.

(a) $\int \frac{1}{x+1} dx$ (b) $\int \frac{1}{x-3} dx$ (c) $\int \frac{3}{3x+4} dx$ (d) $\int \frac{2}{2x+1} dx$

6. Use the technique of Question 5 together with a linearity rule to find the following integrals. For example, to find $\int \frac{x}{x^2-7} dx$ we note that the numerator can be made equal to the derivative of the denominator as follows:

$$\int \frac{x}{x^2-7} dx = \frac{1}{2} \int \frac{2x}{x^2-7} dx = \frac{1}{2} \ln|x^2-7| + c.$$

(a) $\int \frac{x}{x^2+1} dx$ (b) $\int \frac{\sin 3\theta}{1+\cos 3\theta} d\theta$ (c) $\int \frac{3e^{2x}}{1+e^{2x}} dx$

Mathematics Support

- [Mathcentre](http://www.mathcentre.ac.uk) (www.mathcentre.ac.uk)
- [Mathtutor](http://www.mathtutor.ac.uk) (www.mathtutor.ac.uk)

