SEFI Deans' Meeting
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Engineering Attractiveness

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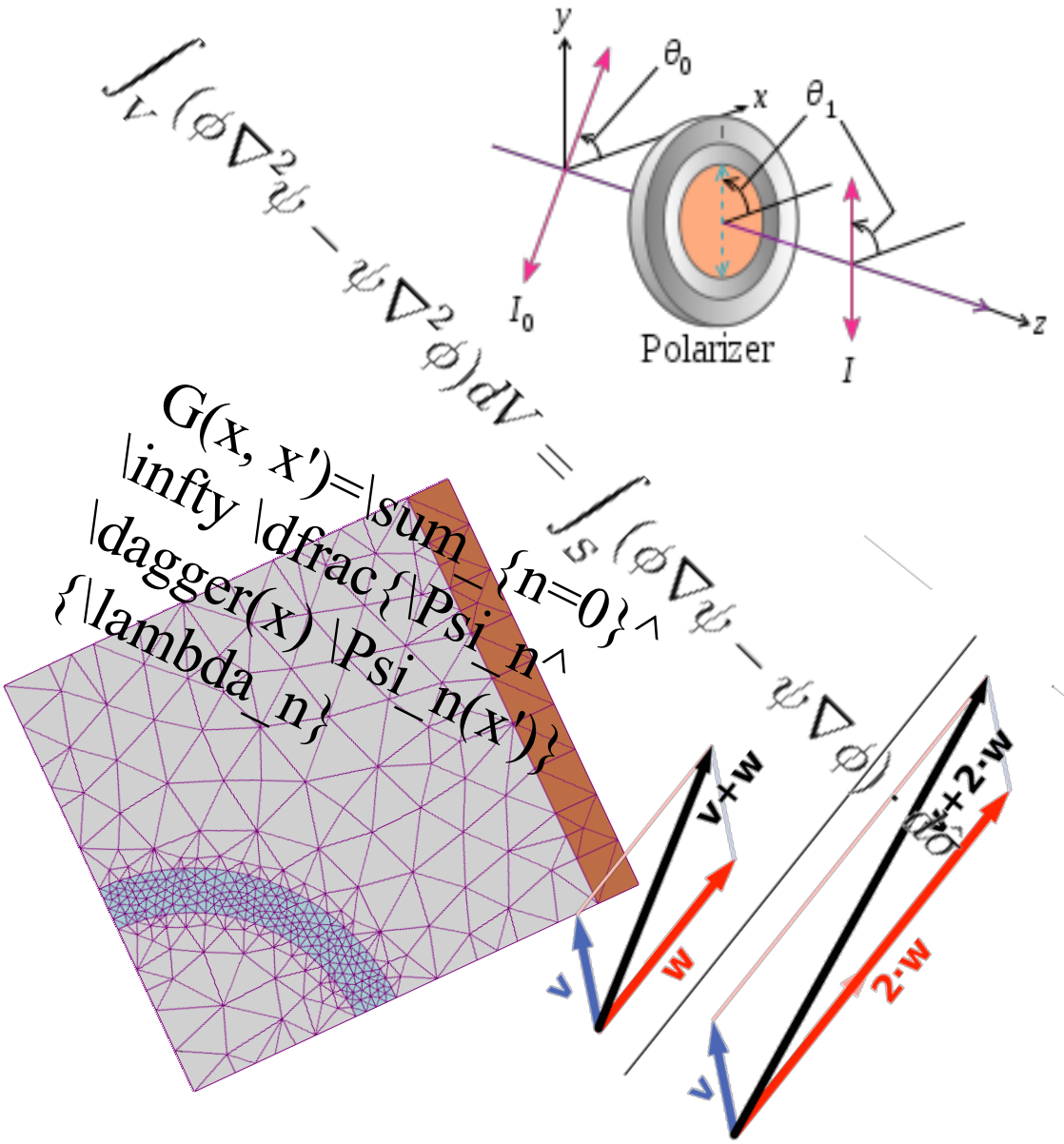

Outline

- Introduction
- Issues in Engineering Attractiveness
- Student perceptions – a survey
- Reflection

Lifetime challenges of engineering attractiveness

- Pre-university time
- Transition to university level studies
- Maintaining enthusiasm
- Graduation & start of a working life
- A lifetime career

Lifetime challenges of attractiveness

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Time also precludes covering issues of attractiveness for staff

Lifetime challenges of attractiveness

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The problem of image (UK)

THE SUNDAY TIMES
thesundaytimes.co.uk/environment
22.01.12
9

An engineer at work on the Pelamis wave energy device

Pre-university time

- Technical triumphs of society taken for granted
- Shortage of role models – competition from media or sport
- Construction toys and chemistry sets have lost appeal
- Making basic radios, repairing cars no longer easy or satisfying
- Many less challenging subjects taught in schools than maths or sciences
- School laboratory facilities expensive and H&S requirements inhibit activities
- Shortage of knowledgeable or inspiring subject teachers, very few having had any exposure to engineering
- In the UK the new fee structure may also have an impact on university entrances

Lifetime challenges of attractiveness

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Transition to university

Amongst the challenges that have to be faced by faculty in developing a student cohort are:

- Capturing the idealism of youth – ‘engineers make the world for humanity’;
- Recognising the change of teaching style and the expectations;
- Establishing secure fundamentals;
- Developing an understanding of the ‘bigger picture’ – the diversity of engineering;
- Developing an enthusiasm to be an engineer.

Transition to university - responses

- Endeavour to establish a secure and stimulating start;
- Communicate the change of teaching style and the expectations;
- Include incidental detail into tuition – engineers are also people!
- Use of variety of approaches to established fundamentals – small groups;
- In addition to core lectures create opportunities to be exposed to the ‘bigger picture’, guest lectures etc., etc.;
- Develop an enthusiasm to be an engineer – conviction – help students with inappropriate expectations;.

Lifetime challenges of attractiveness

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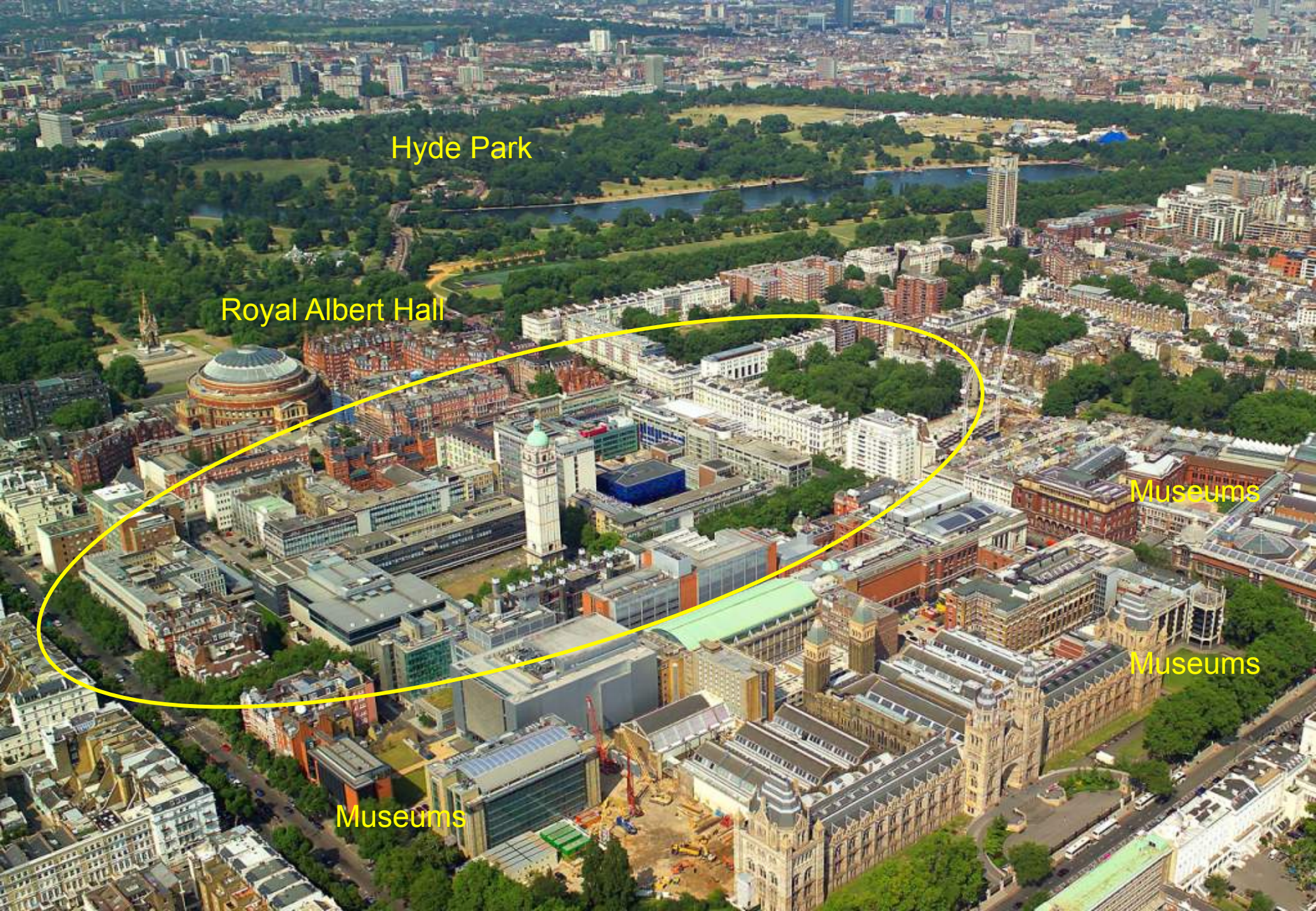
Maintaining enthusiasm (a)

- Engineers are humans - give the subject humanity – responsibility – ethics.
- Relate to worldly problems, develop an understanding of the ‘bigger picture’;
- The challenge of enthusiasm vs knowledge to meet requirements of exam, of grade etc.;
- Are the learning platforms sufficiently diverse?
- Opportunities for team working, cohort building etc.

Maintaining enthusiasm (b)

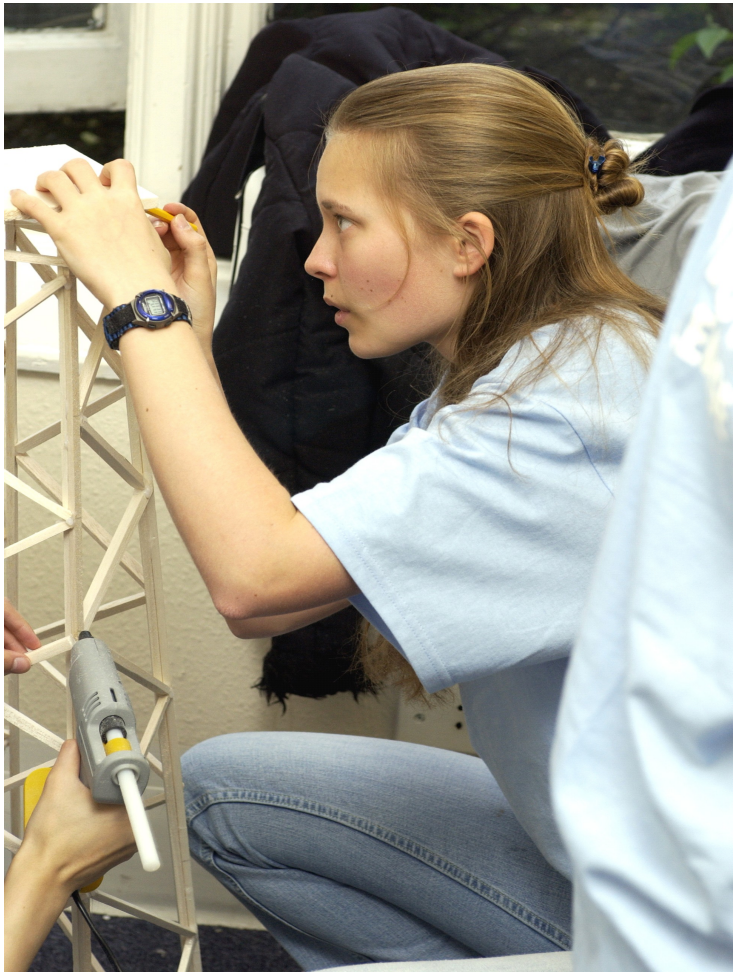
- Diverse pathways – but a coherent body of knowledge
- Experiences beyond the lecture theatre, laboratory etc.
- Students must be challenged, stretched, but also today - supported
- Maintaining enthusiasm to be an engineer.
- Establishing the capacity to motivate, assess and develop one's own skills independently
- Establish the basis for lifelong learning

A student survey at Imperial College London


Hyde Park
Royal Albert Hall
Museums
Museums
Museums

Imperial's target graduate profile

- Outstanding technical expertise in the engineering sciences as well as their field of specialism
- Ability to use their expertise to identify, analyse, synthesise and design solutions to engineering problems
- Ability to capitalise on their expertise to innovate and create new ideas, products and services



and in addition will …….

- Have potential to take on international leadership roles in academia, industry and the wider community
- Have capacity to operate effectively in a team and communicate professionally and effectively to a range of audiences
- Understand the roles and responsibilities of an engineer in the local national or global arena
- Be inspired by the benefits of their engineering education and its continuation to the benefit of society

To be achieved through…..

- On-going curriculum changes
- Recognition, support and encouragement for outstanding teaching
- Further engineering teaching and learning support
- Development of world-class facilities and infrastructure

Specifically…

- Greater experiential project work: inter-departmental projects, industrial projects, internships, **real-world projects**
- Professional skills embedded in technical subjects
- Faculty-wide development of flag-ship programmes
- Greater flexibility in the curriculum
- Improving undergraduate recruitment
- Resource centre (course strategy / development; teaching celebrations; new and best practices)

But……. what do students think?

- Factors which influence motivation and career decisions?
- a desire for change in course content and learning experience?

We tried to find out…..!

The study

- Questionnaire: embracing closed and open ended questions
  - pre-university career influences
  - criteria for university selection
  - attitudes and motivation towards engineering studies
  - student career and life aspirations
  - preferred course content
  - transferable skills needs
- cross-faculty (7 departments); embracing 4 years and involving 2330 students, achieving a (77% return rate) and including 108 alumni

The questionnaire

background

- {General: year of study; course; gender; age; category of registration (UK, EU, Overseas); type of school (single or mixed sex); gap year taken.}
- At what age did you decide to study engineering?

pre-University influences and life aspirations

- Who most influenced your aspirations to study engineering?
  Options: friends; parents; siblings; school / teacher; media; clubs or societies
- Please indicate whether either you mother or father is an engineer / scientist / mathematician.
- What would you most like to have achieved in life?
  Options: invented something new; made a difference to the world; financial security; travelled / seen the world; respect from friends / family / peers
- Did you feel at the time that a degree would help attain these achievements? (yes / no)
- Why did you decide to study engineering?
  Options: desire to make a difference to the world; enjoyment of maths / physics; enjoyment of hands-on work; financial reward; pioneer or explore new technologies; range of career options on graduation; specific interest in engineering projects

criteria for University selection

- What measure of quality would you most care about when choosing a University to study engineering?
  Options: research excellence; position in league tables; teaching excellence; highly paid future employment; future employment in chosen field; quality of facilities; satisfaction of current students
- Why did you choose Imperial College London to study engineering?
  Options: research excellence; position in league tables; quality of the course content; reputation of Imperial College; reputation of department / faculty; good job prospects on graduation

current attitudes to Imperial College and the degree course

- Do you feel that you really know what an engineer is? (yes/no)
- In retrospect, do you think you really knew what an engineer was when you were selecting which courses to study at University? (yes/no)
- What do you see as a major drawback for studying engineering at Imperial College London?
  Options: cost of living in London; safety of living in London; lack of gender diversity in the College; lack of students studying non-scientific courses; quality of facilities such as labs, workshops and lecture theatres; lack of a common engineering course in the first-year; lack of specialism in the courses offered; course level too difficult; course level too easy
- What have been your impressions of Imperial College and your course?
- Which of the following areas would you prioritise for future course development?
  Options: engineering theory; lab projects; maths teaching; practical work; transferable skills (5-point grading of each)
- What transferable skills would you like to see developed as part of your course?
  Options: communication skills; engineering law / intellectual property; environment awareness; ethics; language training; management skills; teamwork and negotiation skills; presentation skills (5-point grading of each)
- Do you feel that your education is a major priority to the faculty, department and lecturing staff? (yes/no)
- How motivated do you feel towards your engineering studies? (10-point grading scale)
- If you became an engineer after graduation, how confident would you be with your engineering abilities? (low, medium, high)

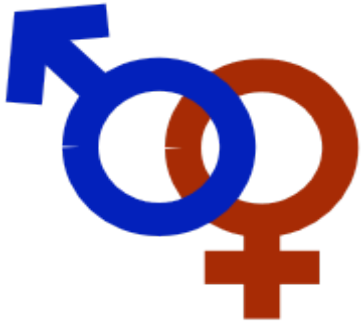
career plans

- Do you plan to become an engineer on graduation? (yes/no)
- What are your career plans after graduation?
- Are you aware of any barriers or reasons not to further your career in engineering after graduation?
- If you have any other comments about the course, or your experiences, please specify.

Pre-university life aspirations

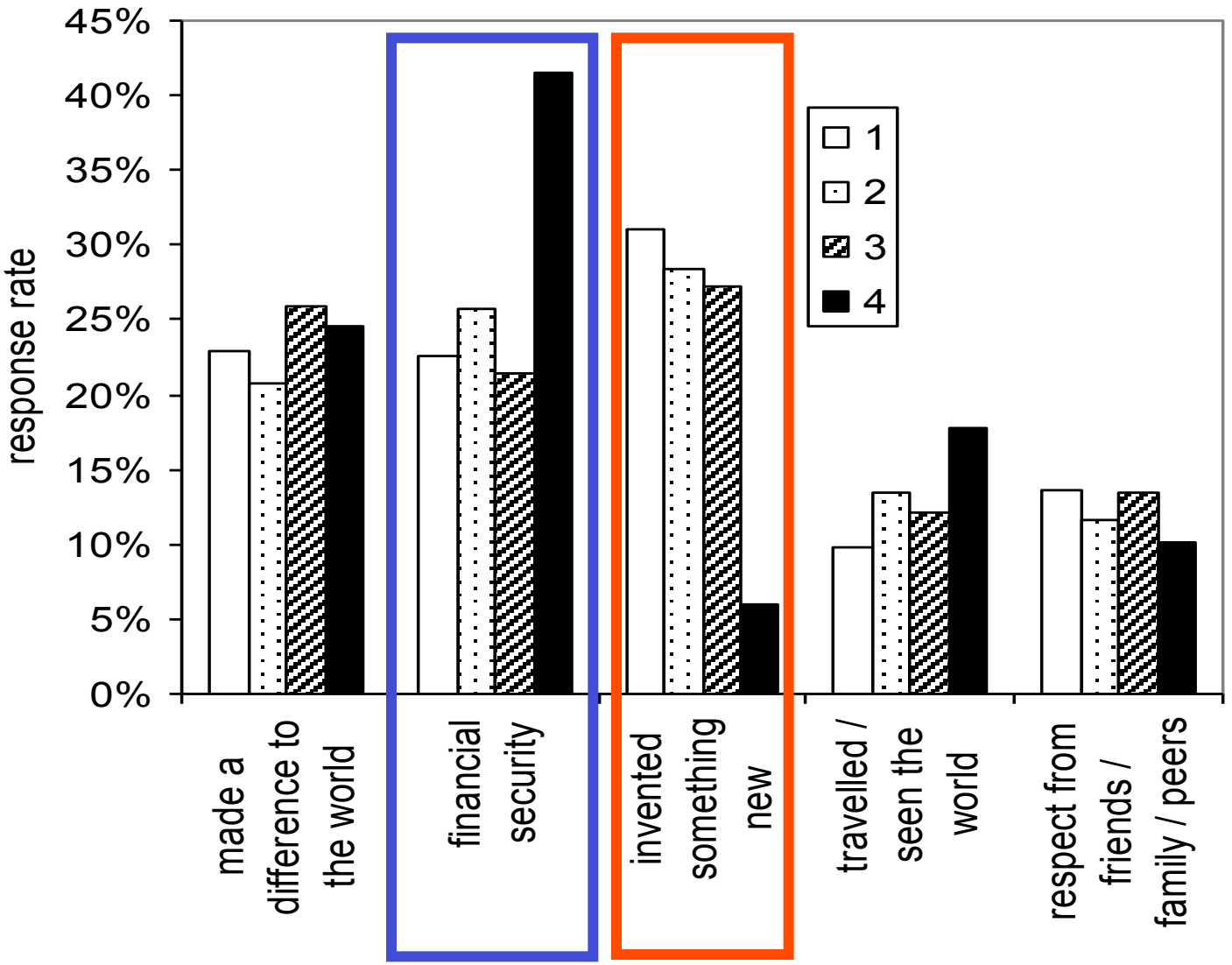
	aspiration (%)	relevance of degree (%)
invent something new	24.0	76.0
made a difference to the world	21.3	77.0
obtain financial security	20.5	51.0
travel / see the world	10.6	58.0
respect from friends / family / peers	10.6	57.0
other	13.0	--

Pre-university aspirations

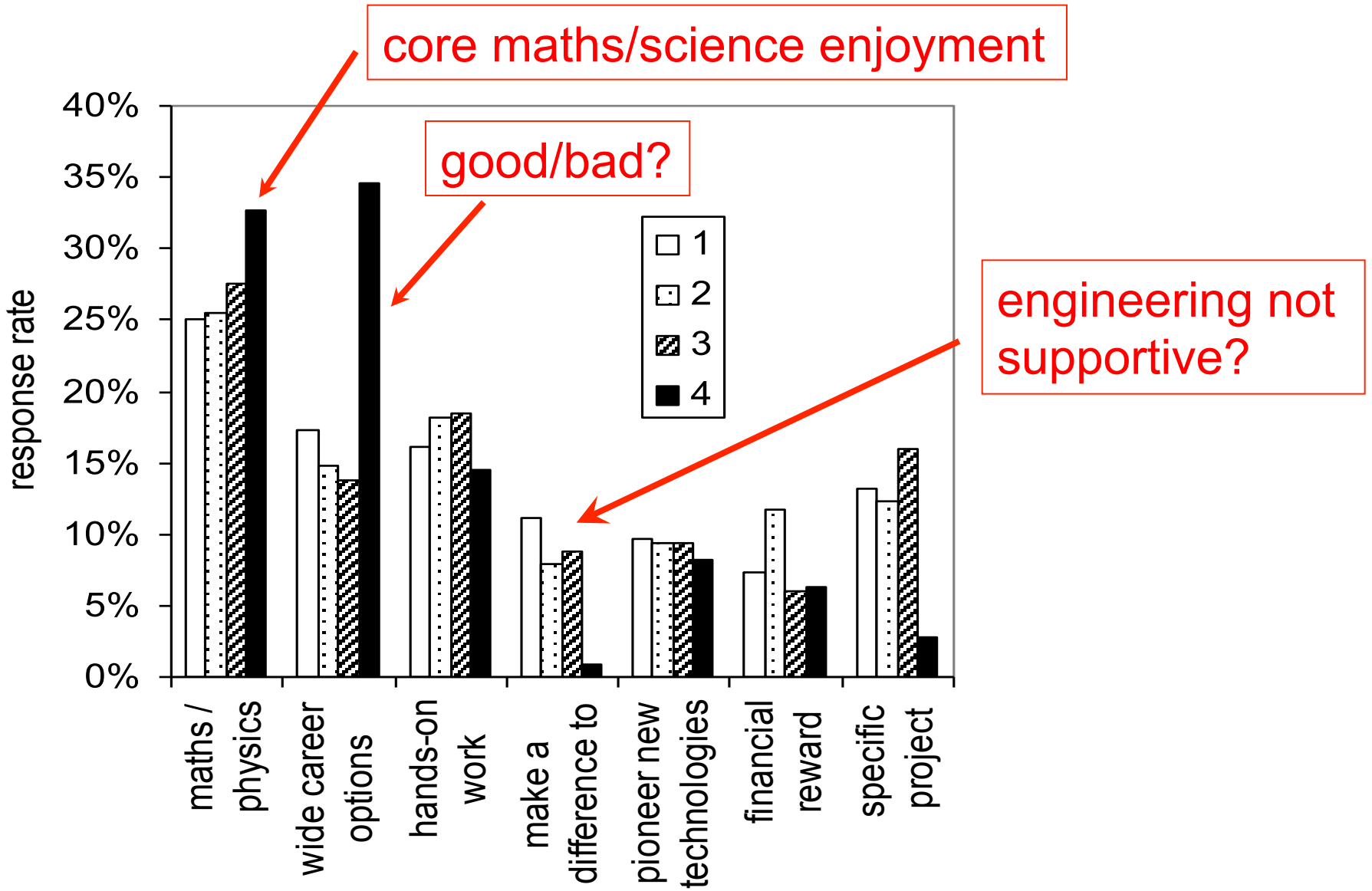


Gender differences	aspiration (%) male	female
Invent something new	29.3	18.5
Make a difference to the world	21.9	33.5
Achieve financial security	24.8	23.4

Life aspirations (shown by year of study)



Why engineering chosen?



Motivation for studies

Views on teachers; intentions to work as engineers

	1	2	3	4
self-rated motivation scores overall (male and female)	80.2	65.9	61.6	63.7
importance of their education to staff	87	79	76	67
intention to work as an engineer (%)	81	74	49	44

Top 4 barriers to an engineering career

(Based on 245 responses; qualitative data)

1. Pay / financial incentives (38%)
2. Subject boredom / low interest (17%)
3. Job prospects (9%)
4. Ability / job demand (8%)
5. Other issues (all <7%) included
   ‘prefer career in finance, undesirable job location, recruitment process, career progression, lack of job diversity’

Some of the lessons learnt…

- ✓ Greater experiential project work: e.g. industrial projects, real-world — making a difference, practical work
- ✓ Professional skills embedded in technical subjects — but explicit – basis, reflection
- ✓ Faculty-wide development of flag-ship programmes — practical, creative, meaningful
- ✓ Greater flexibility in the curriculum — e.g. communication (across disciplines)

Reflection on survey results

- Student survey can be helpful to understand issues as seen by them
- Challenging results generated - require further investigation
- Although some may be parochial to Imperial College London, others are of much wider concern

NAE's Grand Challenges (2008)


Make solar energy economical


Provide energy from fusion


Develop carbon sequestration methods


Manage the nitrogen cycle


Provide access to clean water


Restore and improve urban infrastructure


Advance health informatics


Engineer better medicines


Reverse-engineer the brain


Prevent nuclear terror


Secure cyberspace


Enhance virtual reality


Advance personalized learning


Engineer the tools of scientific discovery

But surely…..… there is something vital missing?

NAE's Missing Challenges

- To communicate the vital role that engineers have played in making the world as it is.
- To communicate the vital role that engineers will play in solving the problems that confront us all.
- To inspire in the young a sense of wonder of what has been achieved and what can be achieved
- To **attract** the brightest, most creative, most enthusiastic to want to become engineers

Reflection

- The roles of universities and the expectations of society have changed significantly
- Students are as they have been always, but their school education and society have changed
- Attractiveness has become a significant challenge for the engineering profession including its initial formation
- Academic institutions cannot address and solve all the problems, but will need to work constantly to improve those most appropriate to them.

Thank you for your attention

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