

# Final Year Undergraduate research project OR a “Capstone Experience” Do we need to re-think?

Dave Lewis

[d.i.lewis@leeds.ac.uk](mailto:d.i.lewis@leeds.ac.uk)

 [@lewisd99](https://twitter.com/lewisd99)



# Thank you

---



UNIVERSITY OF LEEDS



LEEDS INSTITUTE *for*  
TEACHING EXCELLENCE



**Biosciences:** J Allen (Salford); S Bailey (Bath); R Bevan (Newcastle); D Bevitt (Newcastle); C Chalmers (Napier); A Coney (Bham); G Lace-Costigan (Salford); N Freestone (Kingston); M Hardy (Bradford); M Hejmadi(Bath); J Horrocks (Abertay); D Johnson (USW); I Kay (MMU); [L Kindred](#) (Leeds); L Lione (Herts); J Lodge (Bham); S McClean (Ulster); [R McCaw](#) (Leeds); A Muellar (UEA); [E Muir](#) (Leeds); [C Palfrey](#) (Leeds); S O'Hara (Salford); R Shiner (Wolv); D Skingsley (Staffs); R Stubbington (NTU); I Turner (Derby); K Yeoman (UEA).

**Leeds:** H Atherton (FMH); K Bacon (Geog); A Bruning-Richardson (Med); [M Cordingley](#) (FBS); [A Cuncliffe](#) (FBS); S Gorman (MAPS), B Henson (Eng); S Hodgkinson (Geog); V Honeyman (ESSL); N Jackson (LUBS); V Manville (Env); J McKinnon (PCI); J Mellor (Med); [C Morley](#) (FBS); C Pask (MAPS); J Peacock (Geog); S Petzold (SMLC); J Robinson (LUBS); N Vasudev (Med); E Venn (Music); K Watkins (FAHC); C Watkins (Design); [K Wilcockson](#) (FBS).

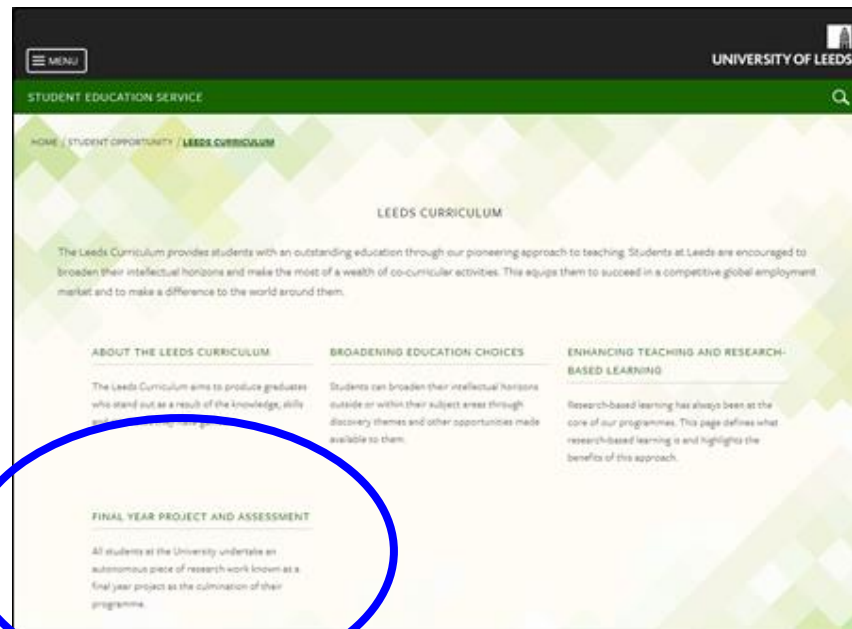
**Elon Univ. (USA):** J Bean (Akron); C Beaudoin (Grand Valley State); C Van Zile-Tamsen (Buffalo); T von der Heidt (Southern Cross, Aust.).

# Why offer research projects?



UNIVERSITY OF LEEDS

- QAA
- Accrediting Bodies
- Institutional





# What is their educational purpose?

Staff (437):



**Develop experimental and technical skills**  
**Develop understanding of research process**  
**Opportunity for independent learning**  
**Gain research experience**  
**Develop employability skills**  
**Develop research skills**  
**Critical thinking**

Inform career choices  
Opportunity to undertake research in an area of interest to themselves  
Personal and professional development  
Assessment of their knowledge understanding and skills  
Enhance employability  
Opportunity to showcase knowledge skills and understanding  
Creative problem solving  
Gain new knowledge and understanding  
Express educational experience  
Create new knowledge and understanding  
Build on previous knowledge understanding and skills  
Develop confidence  
Apply previous knowledge understanding and skills  
Have responsibility to own learning

## Research Intensive

- Gain research experience
- Provide an insight into career in research
- Develop an understanding of the research process
- Inform career choices

## Research & Teaching

- Undertake research in area of interest
- Gain new knowledge & understanding
- Opportunity for independent learning
- Critical thinking
- Develop ethical awareness & responsibility

# Students have different expectations!



UNIVERSITY OF LEEDS

## 2<sup>nd</sup> Yr Bioscience (989):



### Level 2

- Gain new knowledge & understanding (3>4>2)
- Research into an area of interest
- Develop employability skills
- Enhance employability
- Gain relevant real-life work experience
- Inform career choices

### Level 3

- Build on previous knowledge, understanding & skills (3>4>2)
- Gain research experience
- Develop expt. & technical skills
- Publication

# Discipline specificity?



UNIVERSITY OF LEEDS

## 2<sup>nd</sup> Yr Bioscience (1516):



## 2<sup>nd</sup> Yr Media & Communications:



# Traditional research projects @Leeds



UNIVERSITY OF LEEDS

- Individual lab-based
- Critical reviews
- Team-based laboratory
- Bioinformatics/Big data
- Computational & computer modelling

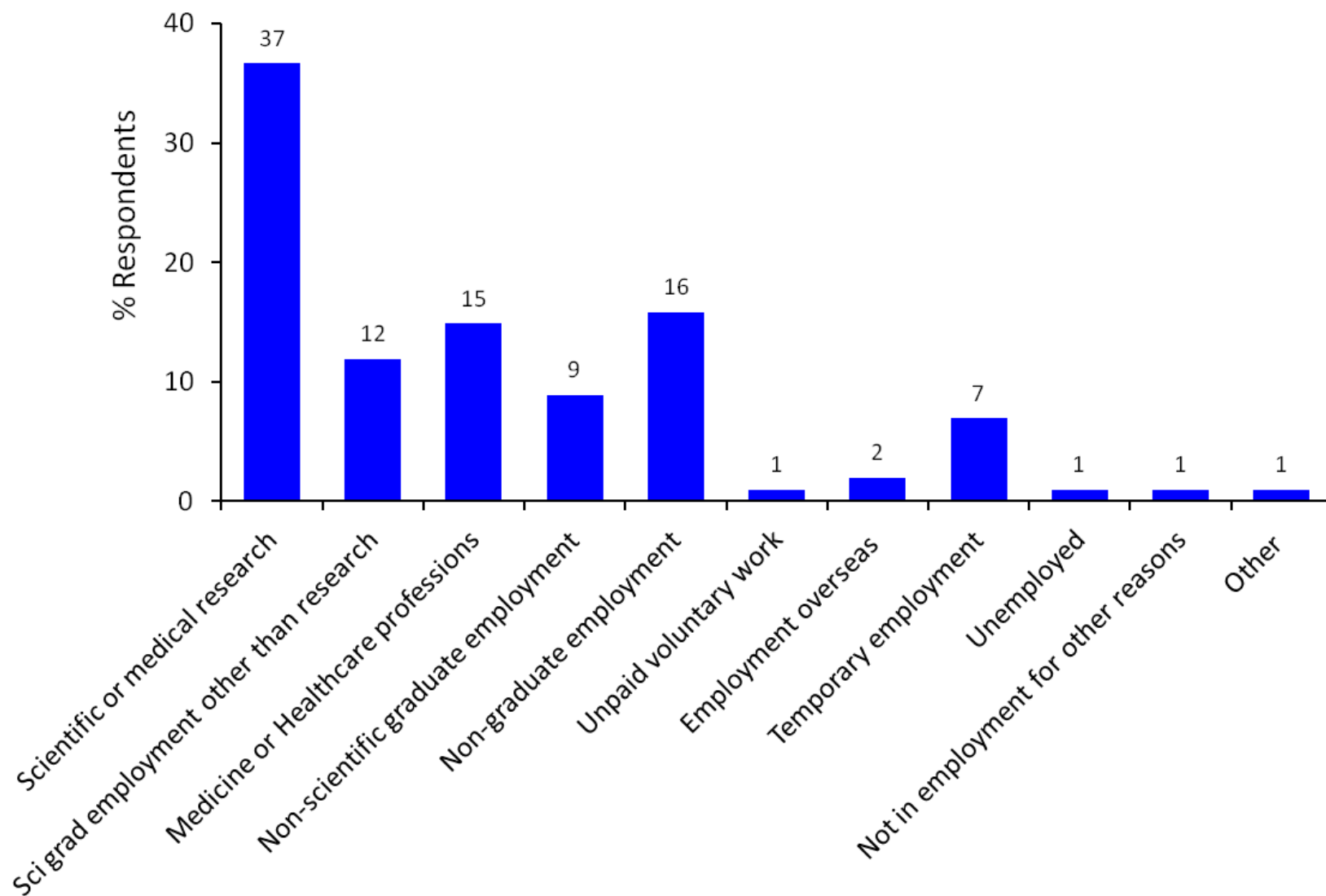


*“Dreading my final year project since I started university, thought of having to do a “traditional” lab project terrified me.”*

# Bioscience graduate career destinations



UNIVERSITY OF LEEDS





# Research project or Capstone Experience?

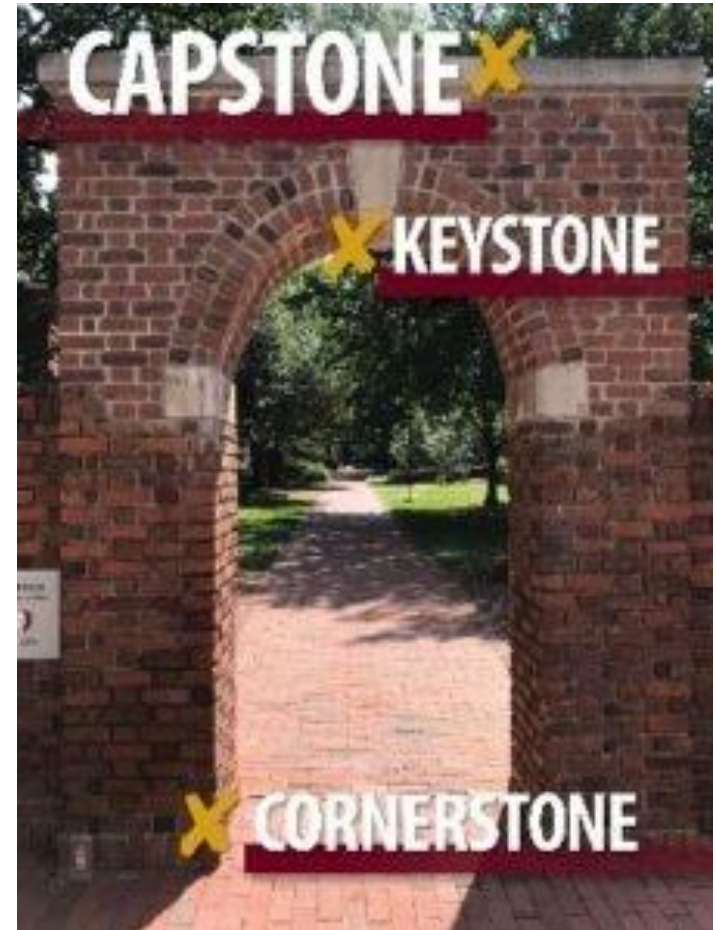
---



UNIVERSITY OF LEEDS

*“Culminating experience(s) in which students are expected to **integrate**, **extend**, **critique** and **apply knowledge, skills** and **understanding** gained in earlier years to **a problem**”*

*“Opportunity to **showcase** knowledge, skills and understanding”*



# What constitutes a Capstone Experience?



UNIVERSITY OF LEEDS



Workplace Co-operative

Prototype

Oral Histories

Enterprise

Portfolio

Student challenge

Students in Schools

Translation

Media Product

Reflective Case studies

Students as Partners

All honours degree students are expected to have some personal experience of the approach to, practice and evaluation of scientific research, such as a project/research based assignment..... Such work is **likely to include data collection and analysis** from, for example, laboratory, field or literature work.....It may sometimes be appropriate for students to work **outside the laboratory or field environment**, for example, in **education** or in the **public understanding** of science. However the research project is delivered, it is expected to include **an element of novelty** satisfied by work that is **hypothesis-driven** or which **leads to formation of an hypothesis**.

## Criteria for accreditation

To achieve accreditation for a programme, HEIs will need to provide robust evidence in support of their application, which will be judged by peer review against the standard metrics listed below. The evidence should show how the intended learning outcomes are being achieved by all graduates through **appropriate assessment strategies**.

1. **A graduating level capstone experience which includes analysis, synthesis and critical evaluation, resulting in a defined output**
  - i. The capstone experience will **integrate** and **develop** the **skills** and **knowledge** gained in **earlier years**; bring **reflection** and focus to the whole of the degree experience; and provide students with the **opportunity to demonstrate** and **apply** the understanding and skills that they have developed.
  - ii. The capstone experience will be:
    - a. An extended piece of **enquiry-based** work, relevant to the degree, with a justified approach that effectively **communicates** its **outcomes**
    - b. Underpinned by a range of relevant sources, and will show recognition of health, safety, environmental and ethical considerations
    - c. **Contextualised**, and show recognition of the provisional nature of knowledge, **building to an appropriate conclusion**
    - d. Based on the processes of **critical thinking, synthesis, reflection and evaluation**.

# Non-traditional Bioscience Capstones



UNIVERSITY OF LEEDS

## Systematic Reviews

UNIVERSITY of York  
Centre for Reviews and Dissemination

PROSPERO International prospective register of systematic reviews

The most effective pharmacological treatment protocol using dipeptidyl-peptidase 4 inhibitors, thiazolidinedione, or sulphonyurea mono or polytherapy with or without insulin for controlling glycated haemoglobin (HbA1C) in patients with type 2 diabetes: a systematic review and meta-analysis

Ben Smith, Jessica Quimpo, Olivia Hoffmann

NHS  
National Institute for Health Research

BMSC3301  
Research project in Biomedical Sciences

**AN ANALYSIS OF THE UNDERSTANDING OF MOUSE SOCIAL STRUCTURE AMONGST RESEARCHERS MODELLING AUTISM**

Amy Grace Gawn  
201064310  
B.Sc. (Hons) Human Physiology in Relation to Medicine

## Surveys

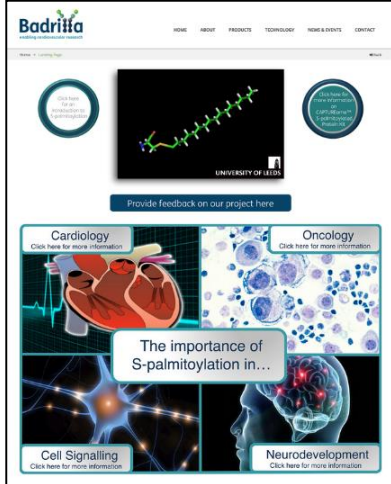


UNIVERSITY OF LEEDS

University of Leeds awarded £3.8m to tackle antibiotic resistance



## Scientific Writing

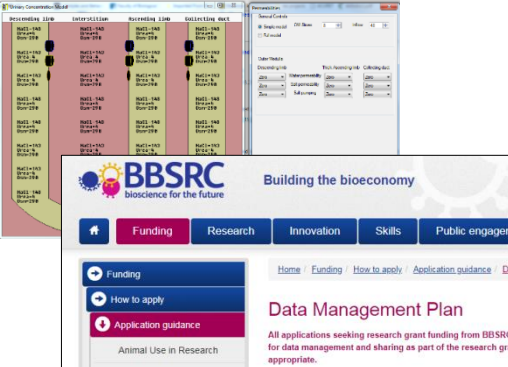


Badriita  
Building the bioeconomy

Cardiology  
Oncology  
Cell Signalling  
Neurodevelopment

The importance of S-palmitoylation in...

## Educational Development



BBSRC  
Building the bioeconomy  
bioscience for the future

Funding Research Innovation Skills Public engagement

Data Management Plan  
All applications seeking research grant funding from BBSRC for data management and sharing as part of the research grant appropriate.

## Science in Schools



Embryo Screening  
A slippery slope to designer babies

SLIPPERY SLOPE AHEAD

## Public Engagement



WHAT ARE THE SIDE EFFECTS OF STATINS?

DO THE BENEFITS OUTWEIGH THE RISKS?

Should I be taking statins?

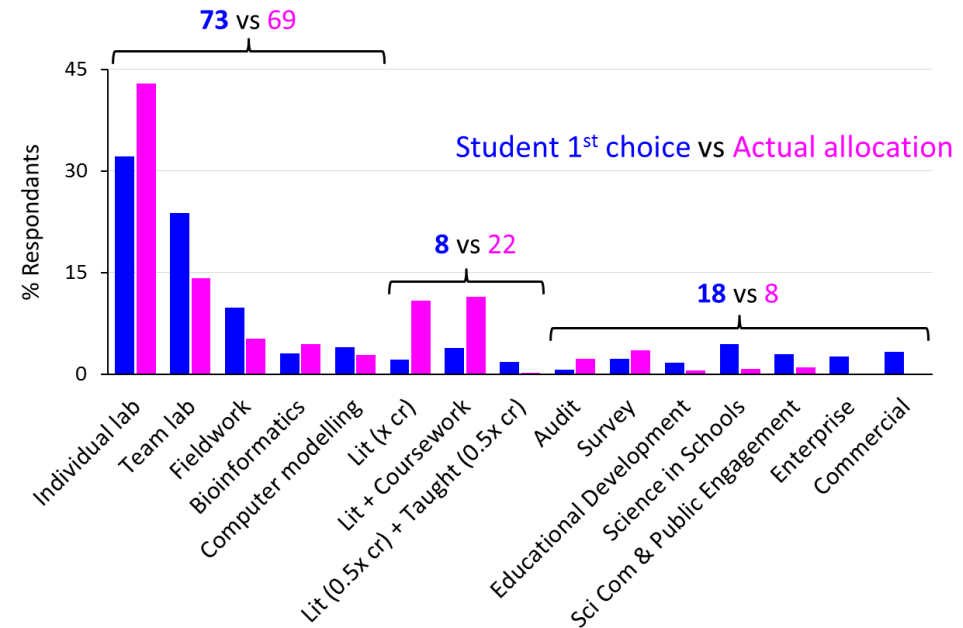
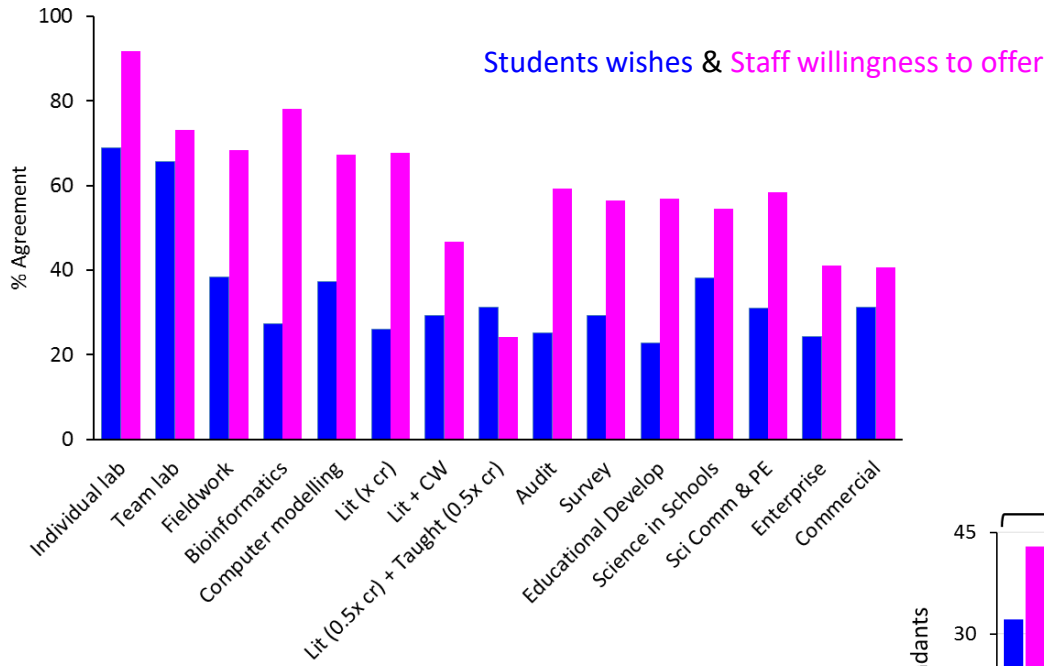
Save yourself the heartache!

WHO ARE STATINS PRESCRIBED TO?

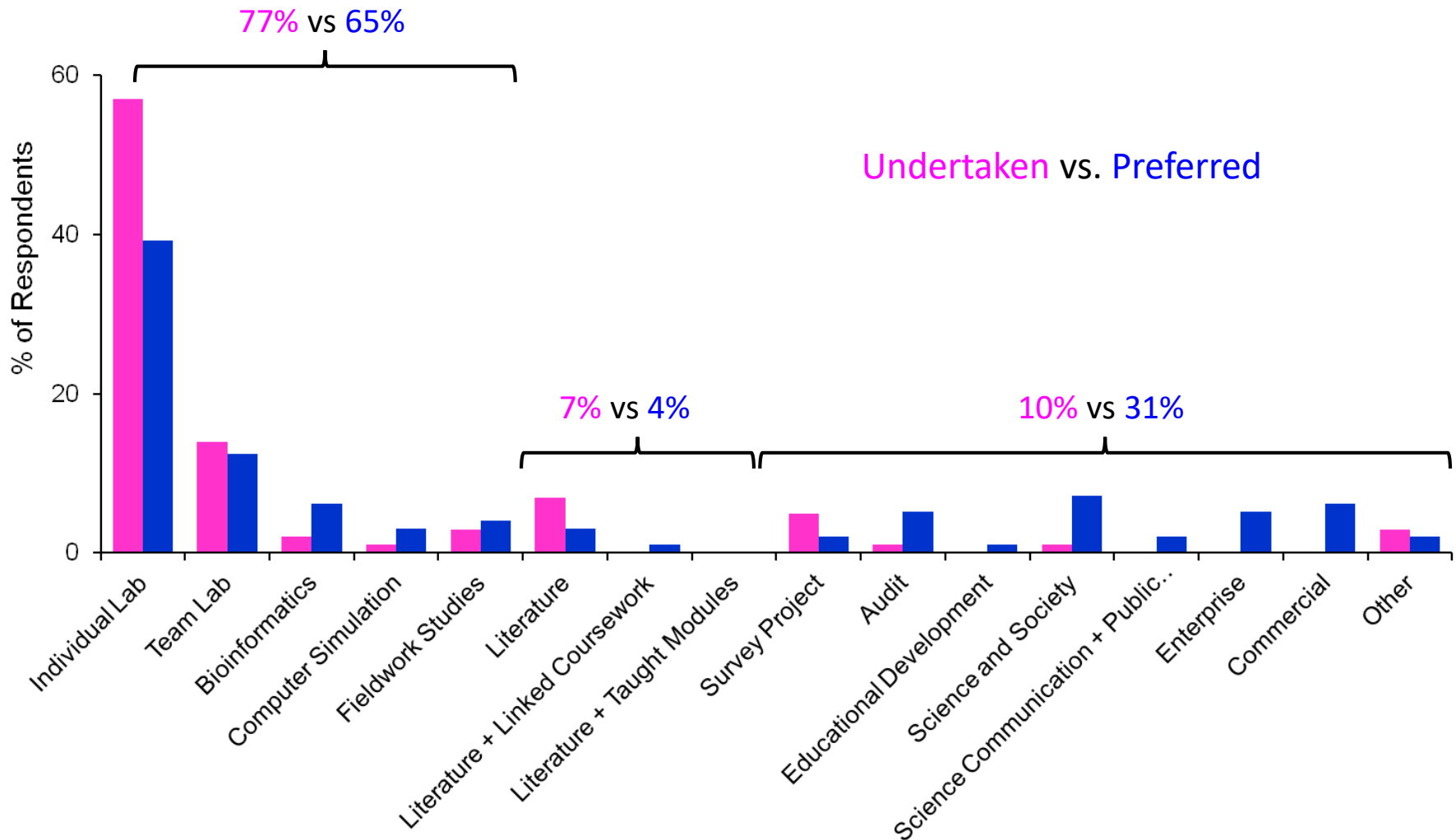
# Demand for non-traditional Capstones



UNIVERSITY OF LEEDS



# Opinions same one year post-graduation





**Enterprise**                      **Students in Schools**

**Citizenship**                      **Civic**                      **Public engagement**

**Oral histories**                      **Internship**

**Systematic Reviews**                      **Reflective Portfolio**                      **Community**

**Performance**                      **Translation**                      **Prototype**

**Grand Challenges**                      **Overseas Internship**

**Engineers without Borders**                      **Client partnership**

**Student Challenge**                      **Practice as Research**

**Consultancy**

**Community partnership**                      **Students as Partners**





- Large, team-based multi-laboratory
- More non-traditional
- Time “unlimited”
- Team-based systematic rather than individual critical reviews
- Grant proposals
- Commercial/Technical reports
- Rethinking assessments
  
- Interdisciplinary

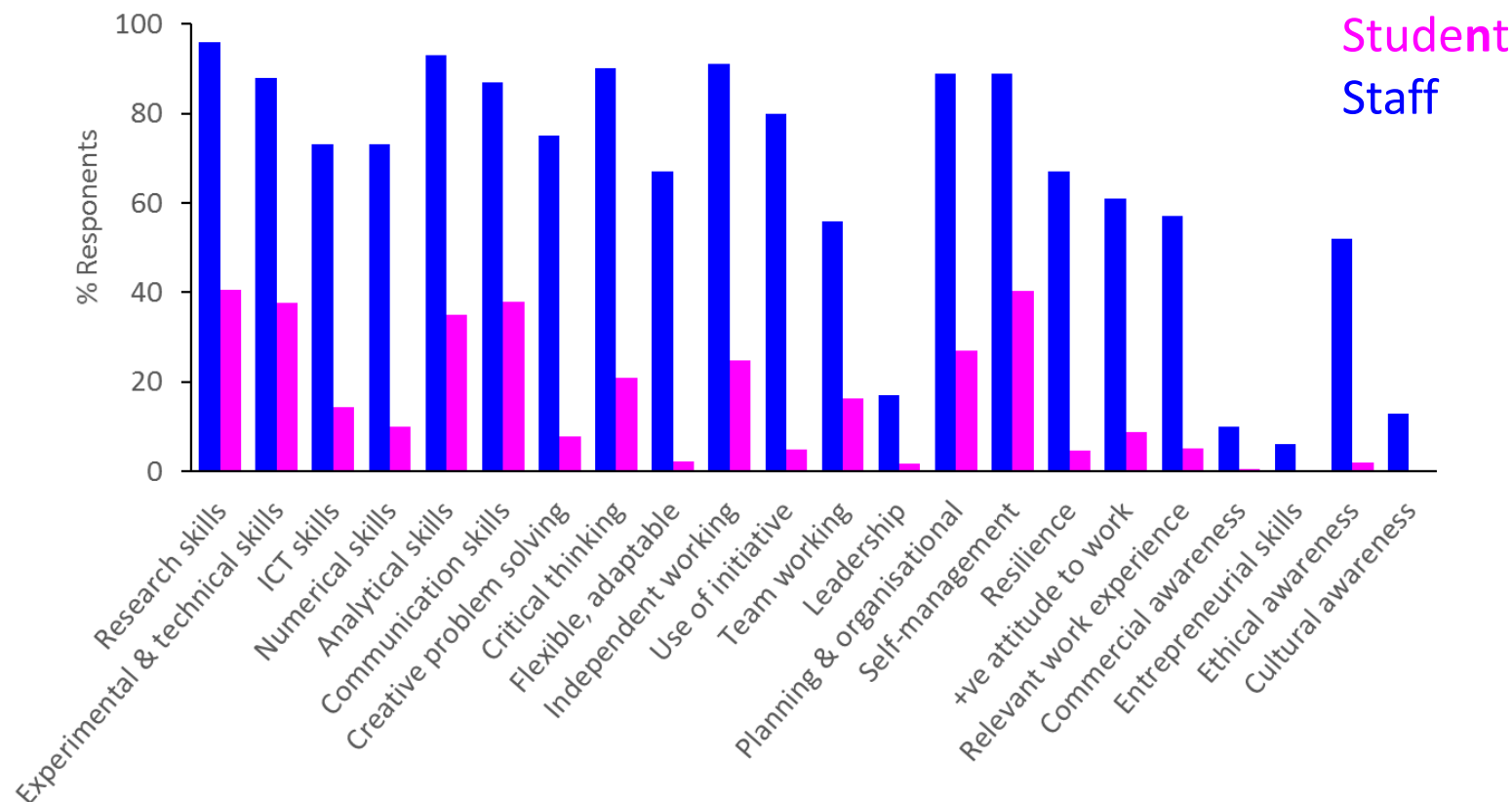


- Student centred
- High impact educational practice
- Transformational and transitional
- Build-on, showcase & apply knowledge, skills & understanding
- (Co-)Create new knowledge & understanding
- Develop new skills
- Inform career choices
- Work experience & employability

# Increased focus on personal & professional development



UNIVERSITY OF LEEDS



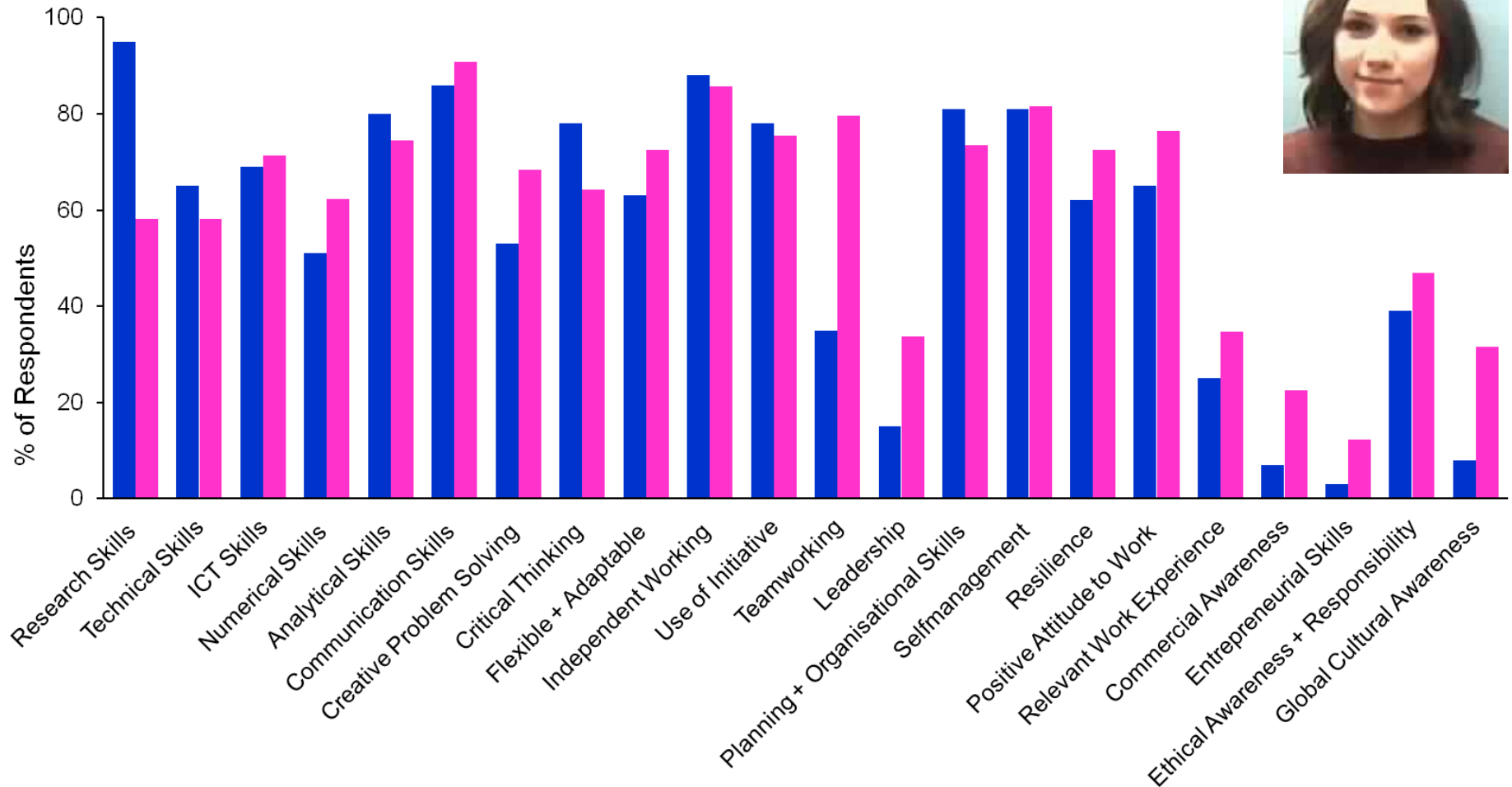
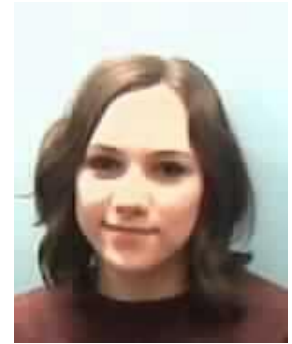
**Females:** Independent working; Team working; Self management; Use of Initiative; Professionalism

**Males:** Experimental & Technical skills

# Employability skills: Capstone vs Employment



UNIVERSITY OF LEEDS



## Learning Outcomes

**Develop and utilise employability skills**  
**Gain discipline specific research experience**  
**Develop research skills**  
**Gain experience of research design**  
**Develop discipline specific technical skills**

Communicate research product or outcome to non specialist or lay audiences  
Gain new knowledge and understanding  
Create new knowledge and understanding

## Employability skills

**Planning and organisational skills**  
**Communication skills**  
**Information and communications technology skills**  
**Critical thinking**  
**Analytical skills**

Independent working  
Self management  
Creative problem solving  
Numerical skills  
Ethical awareness and responsibility  
Team working

## Criteria for accreditation

To achieve accreditation for a programme, HEIs will need to provide robust evidence in support of their application, which will be judged by peer review against the standard metrics listed below. The evidence should show how the intended learning outcomes are being achieved by all graduates through **appropriate assessment strategies**.

1. **A graduating level capstone experience which includes analysis, synthesis and critical evaluation, resulting in a defined output**
  - i. The capstone experience will **integrate** and **develop** the **skills** and **knowledge** gained in **earlier years**; bring **reflection** and focus to the whole of the degree experience; and provide students with the opportunity to **demonstrate** and **apply** the **understanding** and **skills** that they have developed.
  - ii. The capstone experience will be:
    - a. An extended piece of **enquiry-based** work, relevant to the degree, with a justified approach that effectively **communicates** its **outcomes**
    - b. Underpinned by a range of relevant sources, and will show recognition of health, safety, environmental and ethical considerations
    - c. **Contextualised**, and show recognition of the provisional nature of knowledge, **building to an appropriate conclusion**
    - d. Based on the processes of critical thinking, synthesis, reflection and evaluation.



- Apply knowledge, understanding and skills gained in earlier years to a problem
- Gather or generate information: critically analyse this information to address the problem
- Gain new knowledge, understanding and skills in creating a solution to, or output for, this problem

~~Research~~ Enquiry-based Learning



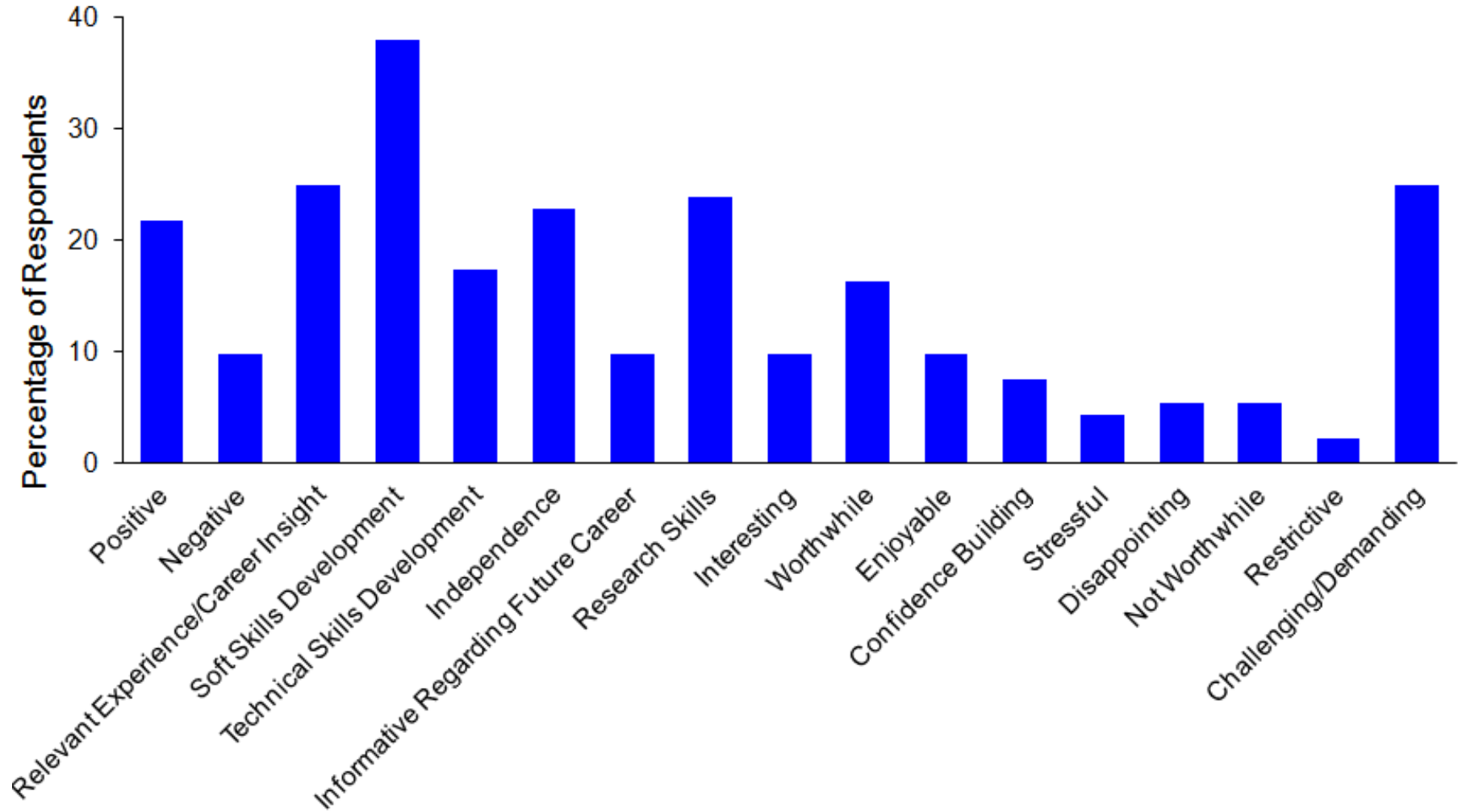
- Valid- of learning
- Relevant and applicable
- Scientific paper
- E-portfolio
- Manage risk!
- Learn from others



# Long term impact of Capstones



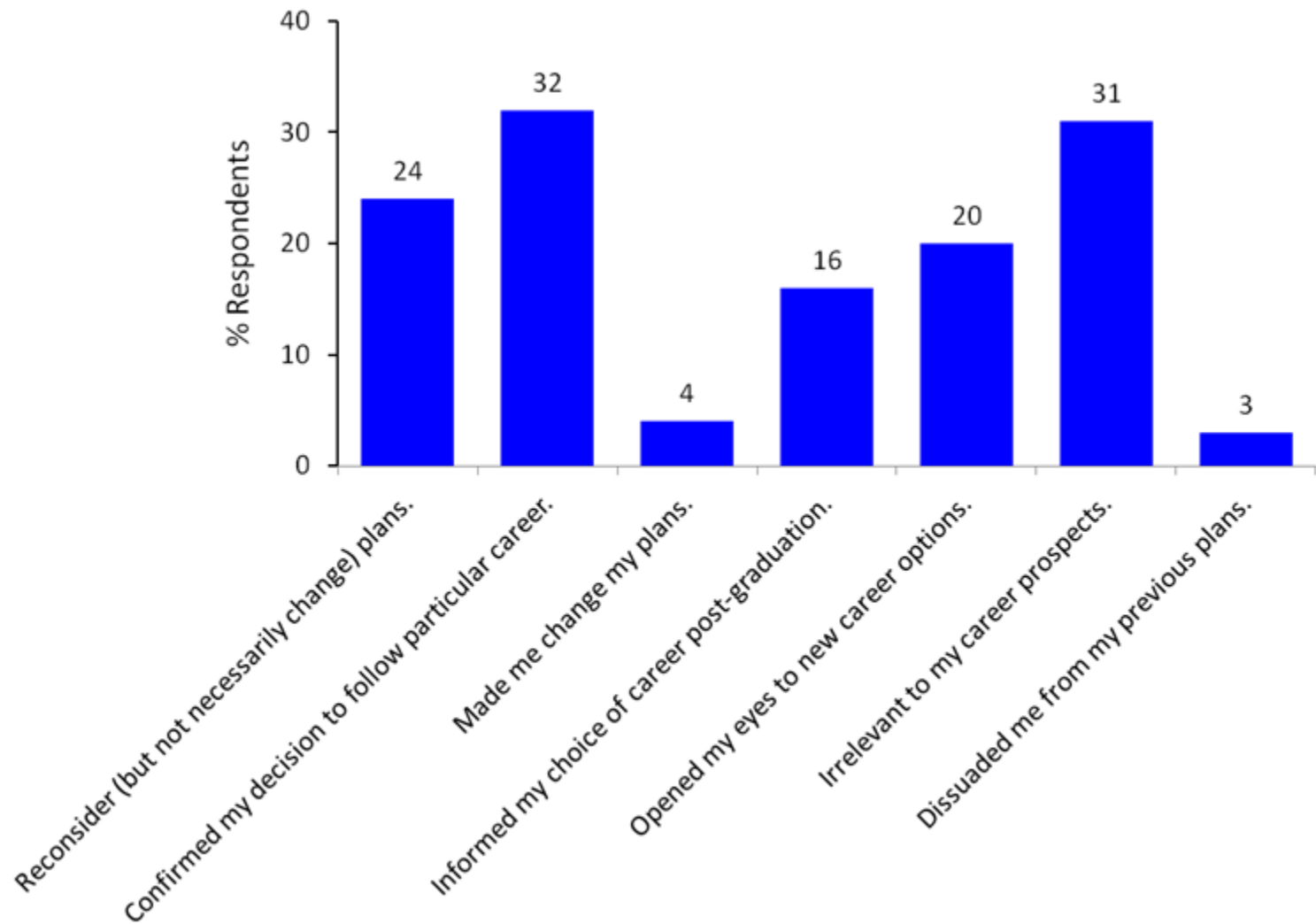
UNIVERSITY OF LEEDS



# Impact of Capstones: Career Choices



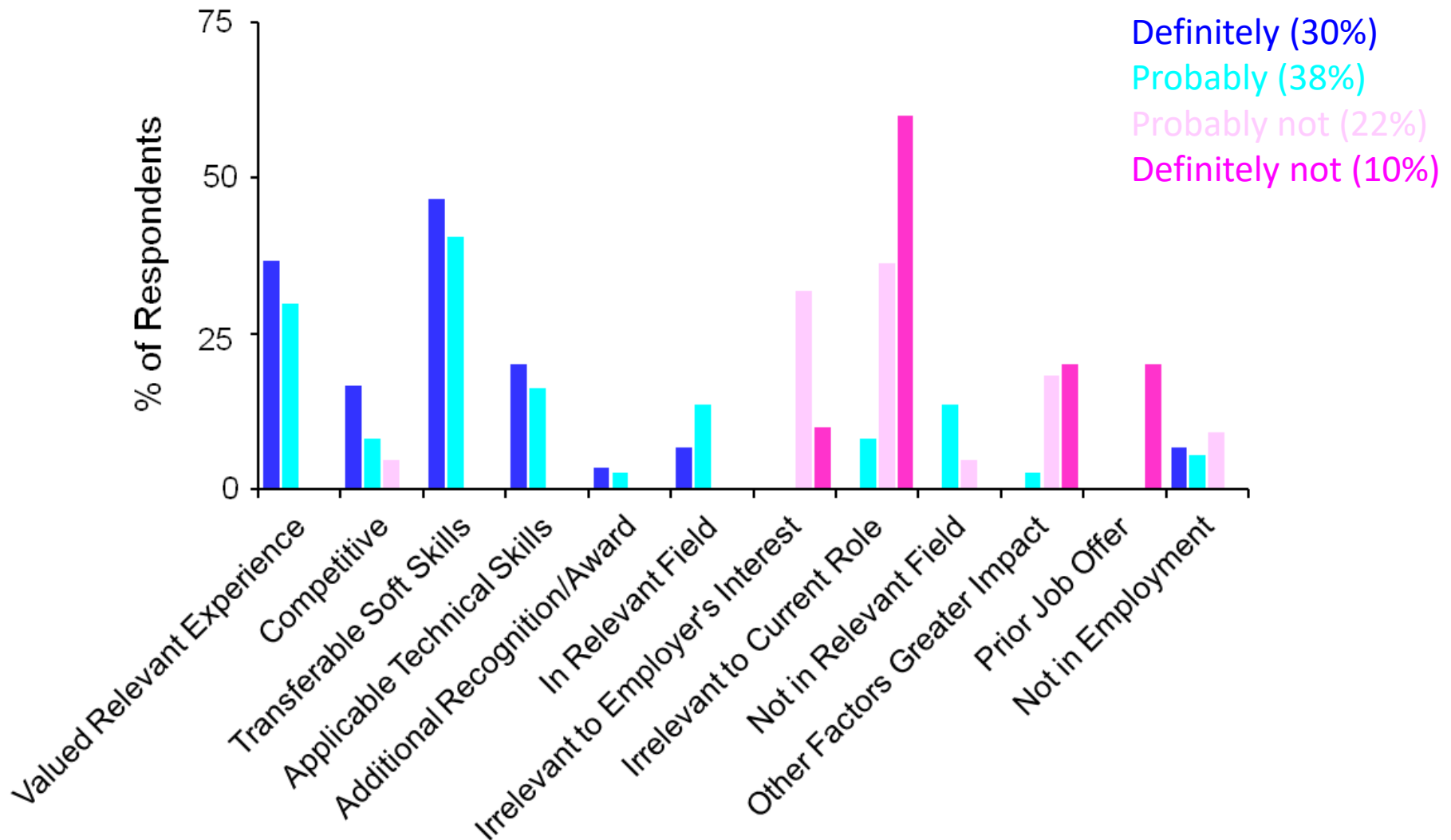
UNIVERSITY OF LEEDS



# Impact of Capstones: Employability



UNIVERSITY OF LEEDS



- Rethink concept/scope- Capstone Experience
  - Intended Learning Outcomes
  - Assessments
  - Relationships
- Increased focus on skills development & application: A showcase
- Retain & expand range of provision
- Multi-disciplinary, open-ended
- Transformational and translational
- Enhance employability & inform career choices

*In terms of what I gained personally, the thing I will remember in 10 years time, is schoolchildren running across the playground towards me screaming Miss S, Miss S, are you coming back tomorrow to teach us!*

*So rewarding, the highlight of my four years in Medicine, indeed my whole education. I gained so much from it personally and professionally.....*

**Questions, comments or more information?**

Email: [d.i.lewis@leeds.ac.uk](mailto:d.i.lewis@leeds.ac.uk)      Twitter: [@lewisd99](https://twitter.com/lewisd99)