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Improving scientific writing in undergraduate geoscience degrees through peer review

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Geosciences at Imperial

- We offer 4 undergraduate degrees in geosciences at Imperial College London
- Students on all degrees carry out at least one major piece of scientific writing coursework in all years of the degree.
- Many of our students have not written an essay since they took GCSEs, and are not necessarily confident writers.

Degree	Prerequisites
Geology	2 A-levels from: - Maths - Physics - Chemistry - Geology - Geography
Petroleum Geosciences	
Geology and Geophysics	
Geophysics	Maths and Physics A level required.

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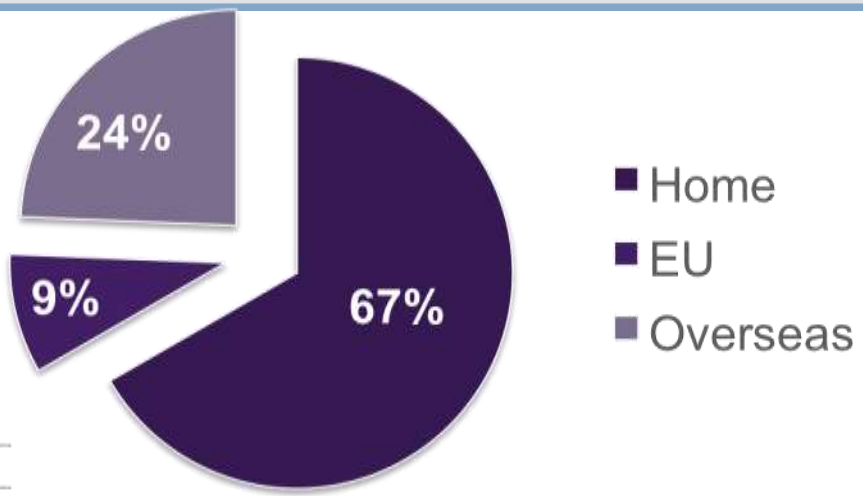
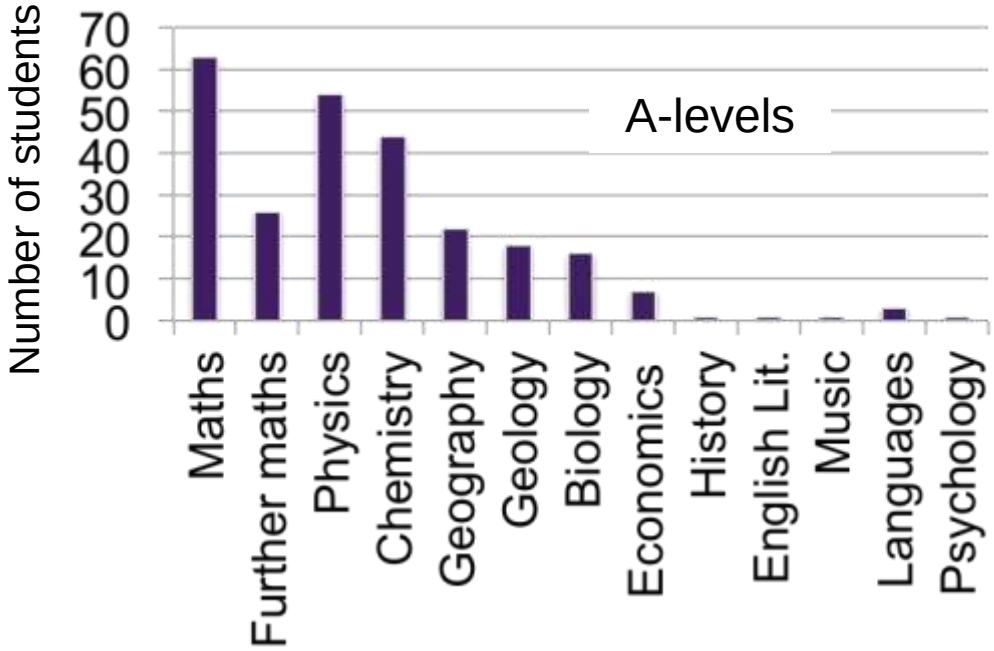
Undergraduate background

- Around 30% of our students are international students
- For students who struggle with studying in English the “Centre for Academic English” runs courses.





- Most students have specialised in science subjects at school

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Improving writing – motivations

- Staff note that they write similar feedback comments on written work of students in all years in the degree.
- These comments frequently refer to issues with **structuring work**, **referencing**, and a lack of understanding of the importance of **peer reviewed scientific sources**.
- Students also appear to struggle with **project management** in large pieces of work, especially early in their degrees.

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Improving writing – aims

- How can we encourage a culture of **redrafting** work frequently, and considering previous comments to strengthen our undergraduates' writing skills?
- How can we help our students to learn how to deliver constructive **criticism** of the work of others?
- How do we improve their understanding of the role of **peer review** in scientific publishing and prepare them for potentially submitting the undergraduate projects to journals?

In 2015-16 we introduced a cross-year "peer review" component in 2 modules, to address these concerns. This was partly motivated by the success of peer-marking in numerous studies.

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Peer marking

•Peer marking has been used with success in a range of undergraduate teaching.

See: - Bloxham & West, *Assessment & Evaluation in Higher Education*,

- Stanier, *Journal of Geog. in Higher Ed.,*1997

•However, there can be gender biases in peer marking (see Falchikov & Magin, *Assessment & Evaluation in Higher Education*, 1997)

https://isit.arts.ubc.ca/peer-evaluation-and-review/

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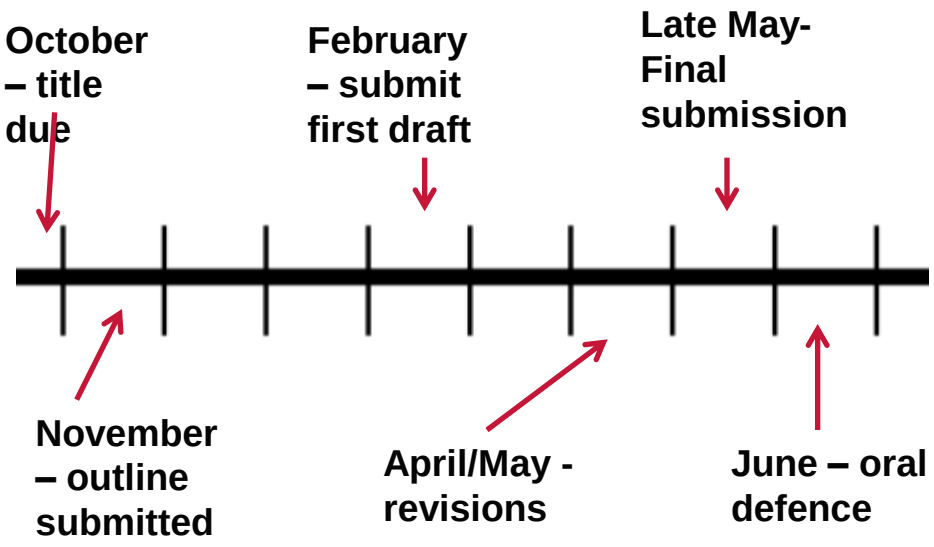
Year 1 – "Projects and Tutorials"

All first years (~80 students) write a 2500 word essay on a geoscience topic of their choice.



Students learn how to access library resources, report writing, project management in workshops throughout term 1.

Titles and outlines are discussed with personal tutors

Example essay topics

T-Rex: The Most Furious Carnivore to have Walked the Earth
The Precambrian explosion and the Green River shales
The Geology of Mars
Flow Mechanics of Pyroclastic Deposits
Processes involved in the formation of diamonds
Ophiolites - Their Origin and Distribution
Did Volcanism Cause the K-T Extinction?
Sedimentary Processes on the Belizean Barrier Reef
Hot Spots, an example of Intraplate Volcanism

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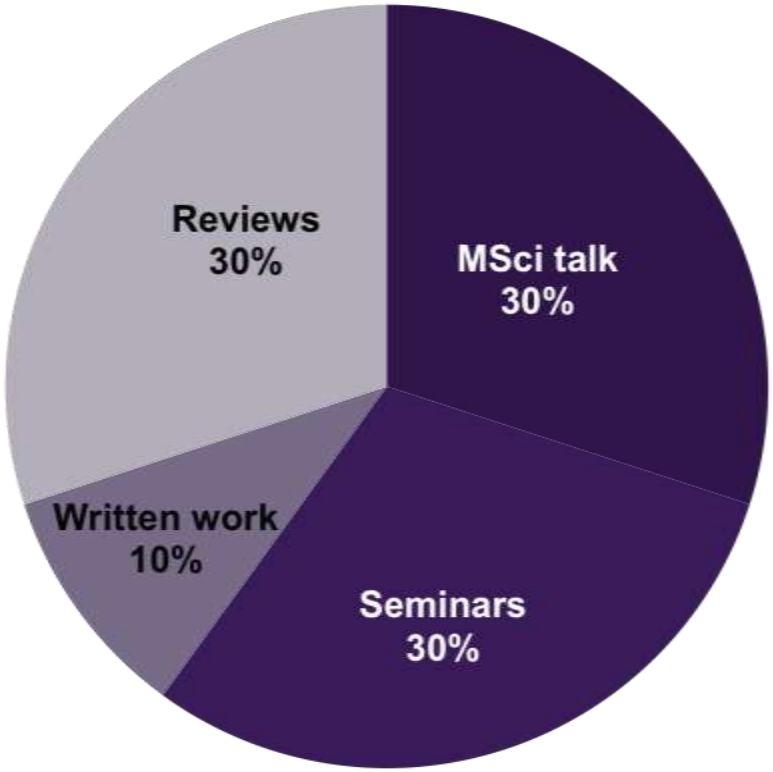
Year 4 – “Science Communication”

- All fourth years attend Science Communication
- This module is designed to strengthen their communication skills while they complete MSci undergraduate projects.
- In 2015-16 introduced a “Peer Review” component, where fourth years “review” the draft first year essays.



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Essay and "review" timeline

October – Peer review introduced to year 4. Applications accepted from volunteer undergraduate associate editors (~15 students)

February – year 1 submit first drafts of essays, which will receive 2 reviews. Editorial team convene and assign reviewers.

March – reviews are sent to associate editors for inspection. Decision letters are written and these are distributed to year 1.

Year 1 revise and resubmit their essays for assessment in May.
Year 4's reviews are marked by staff.

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Allocation of reviewers

- A volunteer team of fourth years acted as “associate editors”
- Based on a list of anonymised essay titles they allocated essays to 2 reviewers each in an editorial meeting.
- Every fourth year reviewed 4 or 5 essays, which should have matched their geoscience interests.
- Associate editors were also asked about any potential conflicts of interest

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Guidance for reviewers

- Fourth years had a lecture on peer review and academic publishing, drawing heavily on Nicholas, K. A. and W. S.Gordon (2011), A Quick Guide to Writing a Solid Peer Review, Eos Trans. AGU, 92(28), 233.

- All students received written guidelines on how to complete the reviewer forms.

JESE reviewer guidelines

Thank you for reviewing manuscripts submitted to JESE

The aims of this review exercise are to:

- ✓ Get **insight into scientific writing** by reviewing other assignments
- ✓ **Learn from comparison** by seeing other students' work
- ✓ **Improve understanding** of subject matter
- ✓ Develop **generic skills**
  - Critical thinking
  - Problem solving
  - Delivering constructive feedback

Your tasks:

- ✓ Read the drafts thoroughly (ideally once quickly and again in detail)
- ✓ Annotate/make notes
- ✓ Decide on the strengths/areas for improvement
- ✓ Complete review form for each report
- ✓ Spend approximately the same time (~2 hours) on each review
- ✓ **Aim for balance** – highlight strengths as well as areas for improvement
- ✓ **Be specific** – include explanations & examples (page or line numbers)
- ✓ **Prioritise** – attend major issues first (message, structure, organisation) then move onto finer detail
- ✓ **Focus** – on material & content (NOT the writer)
- ✓ **Be diligent & respectful** – take care & think about how you would feel if you received the review
- ✓ Proof-read reviews!

Your reviews will be assessed based on:

- ✓ Balance – did the review both highlight strengths & suggest areas for improvement?
- ✓ Insight – did the review improve scientific content?
- ✓ Helpfulness – did the review contain specific suggestions to implement?
- ✓ Clarity – was the review well-written and easy to understand?

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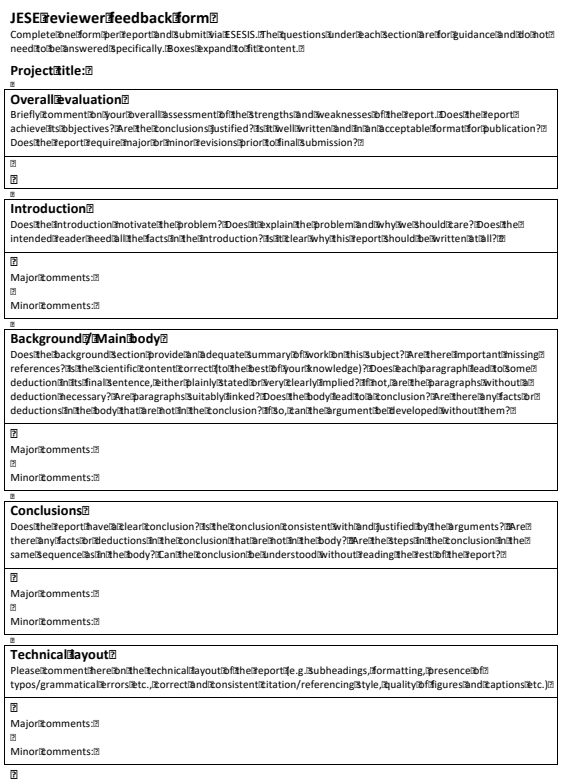
Reviewer forms

- Reviewer forms were screened by associate editors for appropriateness
- Associate editors wrote decision letters which summarized the reviews and recommended minor or major revisions.
- Decision letters, reviews and, in some cases, annotated essays were returned to first years in late April.



JESE reviewer feedback form

Complete one form per report and submit via ESESIS. The questions under each section are for guidance and do not need to be answered specifically. Boxes expand to fit content.

Project title:

Overall evaluation

Briefly comment on your overall assessment of the strengths and weaknesses of the report. Does the report achieve its objectives? Are the conclusions justified? Is it well written and in an acceptable format for publication? Does the report require major or minor revisions prior to final submission?

Introduction

Does the introduction motivate the problem? Does it explain the problem and why we should care? Does the intended reader need all the facts in the introduction? Is it clear why this report should be written at all?

Major comments:

Minor comments:

Background / Main body

Does the background section provide an adequate summary of work on this subject? Are there important missing references? Is the scientific content correct (to the best of your knowledge)? Does each paragraph lead to some deduction in its final sentence, either plainly stated or very clearly implied? If not, are the paragraphs without a deduction necessary? Are paragraphs suitably linked? Does the body lead to a conclusion? Are there any facts or deductions in the body that are not in the conclusion? If so, can the argument be developed without them?

Major comments:

Minor comments:

Conclusions

Does the report have a clear conclusion? Is the conclusion consistent with and justified by the arguments? Are there any facts or deductions in the conclusion that are not in the body? Are the steps in the conclusion in the same sequence as in the body? Can the conclusion be understood without reading the rest of the report?

Major comments:

Minor comments:

Technical layout

Please comment here on the technical layout of the report (e.g. subheadings, formatting, presence of typos/grammatical errors etc., correct and consistent citation/referencing style, quality of figures and captions etc.)

Major comments:

Minor comments:

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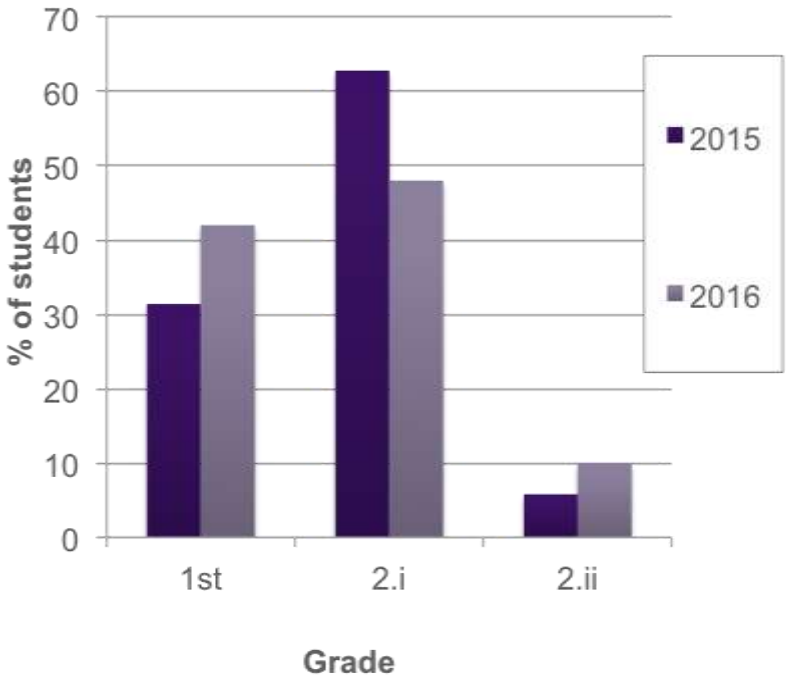
First year experiences

- Students enjoyed on the “real-life” revision experience and found most comments to be very helpful and considered.
- More essays were awarded first class marks.
- Despite inspection of reviews by associate editors, some comments were a little too blunt and knocked first years’ confidence. Having two reviews and a decision letter softened this somewhat.
- Informal mentoring occurred, where reviewers recommended elective modules given the interest shown by year 1 in topics.



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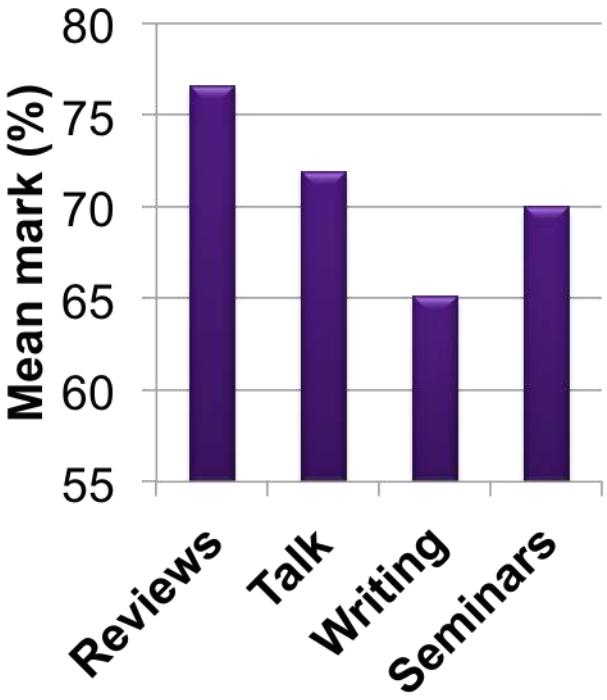
Fourth year experiences



- Most students were very positive about reviewing and received high marks.
- They enjoyed being on the “other side of the fence” and critically reading projects.
- Students also commented on having a greater appreciation of the effort that went into marking their work.

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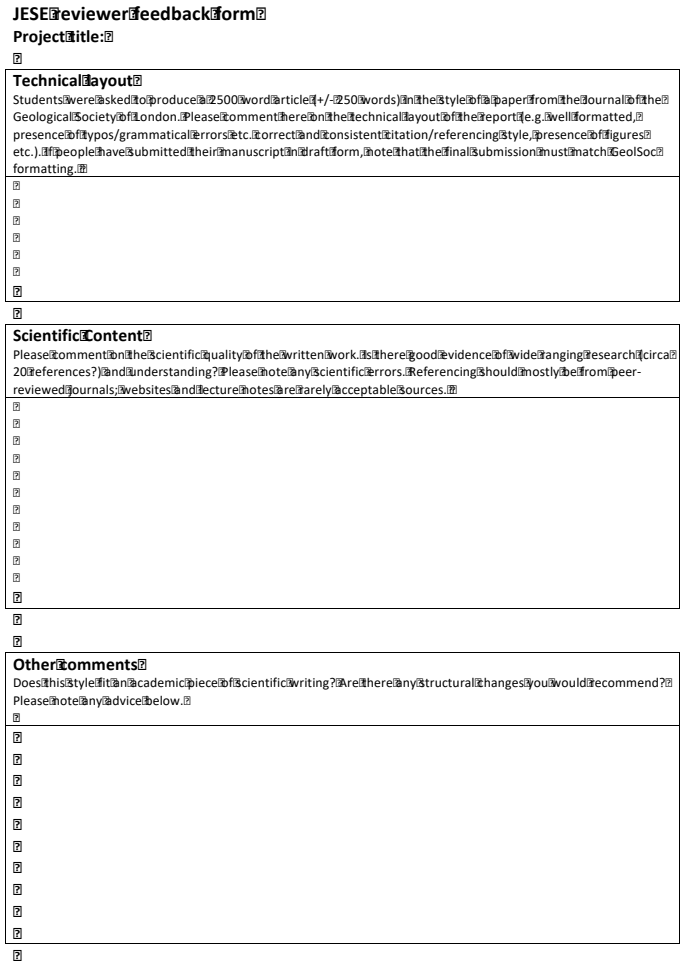
Marker experiences

Projects are graded by a team of specially trained graduate students and postdocs. Markers also carry out oral defences (unmarked) with all students and complete feedback forms

Markers discuss their experiences favourably, especially those who were undergraduates at Imperial:

- good training for reviewing scientific papers
- included as teaching experience on their CVs.



JESE reviewer feedback form

Project title:

Technical layout

Students were asked to produce a 2500 word article (+/- 250 words) in the style of a paper from the Journal of the Geological Society of London. Please comment here on the technical layout of the report (e.g. well formatted, presence of typos/grammatical errors etc. correct and consistent citation/referencing style, presence of figures etc.). If people have submitted their manuscript in draft form, note that the final submission must match GeolSoc formatting.

Scientific Content

Please comment on the scientific quality of the written work. Is there good evidence of a wide ranging research (circa 20 references?) and understanding? Please note any scientific errors. Referencing should mostly be from peer-reviewed journals; websites and lecture notes are rarely acceptable sources.

Other comments

Does this style fit an academic piece of scientific writing? Are there any structural changes you would recommend? Please note any advice below.

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Future plans

- Incorporate technology to assist with administrative load.
- Develop the teaching given to first years on report writing to incorporate more pedagogically reasoned approaches.
- Continue to monitor achievement across all student backgrounds to ensure fair assessment.
- Intervene with weaker reports at the revision stage

turnitin PeerMark™

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Conclusions

- Modified cross-year “peer” review has been broadly successful.
- Fourth years provided exceptionally detailed reviews to first years, and also acted to informally mentor the students.
- First year essays generally improved, with a higher average mark and more firsts.
- However, it is important to catch weaker writing early, as there were also more 2.2s.

We are happy to share resources and our experiences. Please contact Lizzie Day for details (e.day@imperial.ac.uk)