Learning futures: introducing authentic assessment to enable practice-oriented learning in science

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68412 Energy Science & Technology

New task:
The 'PAM Review' a research paper journal
(peer-reviewed and group based)

Students felt empowered by the fact that they could 'self-manage' their learning

Learning outcomes - Authentic assignment (Focus Group Response)

Workplace scenario

it *made 'the subject more applicable to future careers'* and *'hands-on'*

'I have also learned a lot about being a leader and making sure everyone is on the right track, but in a positive and encouraging manner'

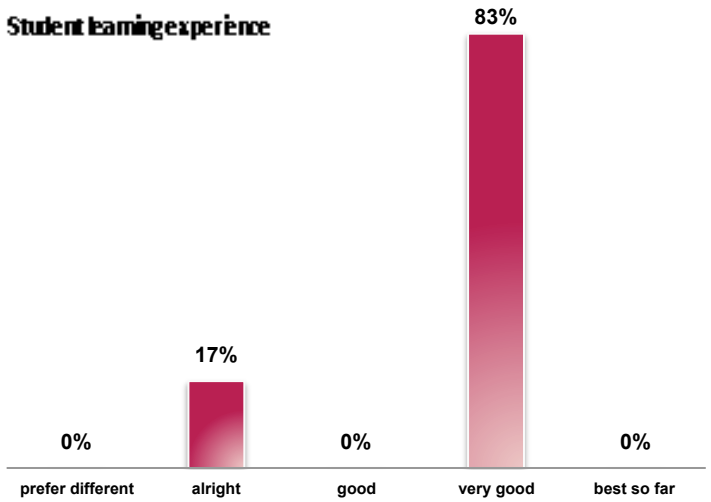
'working in a team was rewarding, it helped to improve my skills of collaboration and collaborative time management'

Learning outcomes- Authentic assignment (Focus Group Response)

'enjoyed the self-managed learning the most, as I feel information I've collected during this project will have greater "staying power" than it may otherwise'

'there are ways to pass tests without understanding but this way we have to understand'

Learning Experience



Challenges – what we started with

Energy science and technology = 3rd semester subject

Starting Point

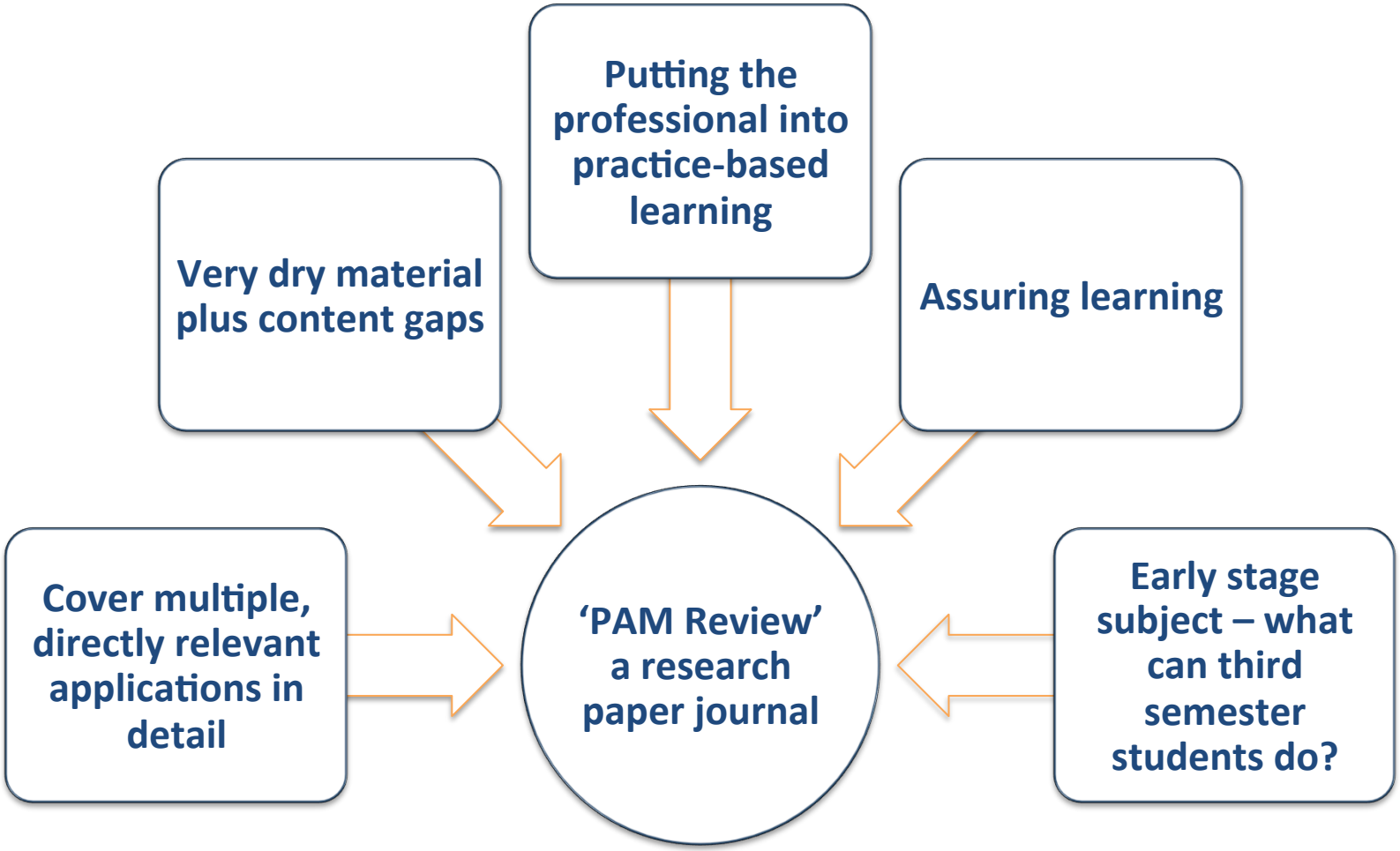
95% theoretical material
(concepts, problem solving)

no time to cover practical applications in detail

The class test and final exam = 75%
+ 1 practical

www.gogreennation.org/2012/11/nuclear-power-plant-cancer-risks-studied-by-nrc/

Challenges – how to make it engaging



Challenges – the plan

Putting the professional into practice-based learning

What: The academic workplace

Writing scientific papers

How:

- **working in research teams**
- **publishing in a peer-reviewed journal**
- **learning to peer-review**
- **meeting review and publishing submission deadlines**
- **producing a printed journal**

Challenges – the workload

Workload implications

Add: **Assessment rubric, scaffolding**

Drop: **Final exam preparation/marking**

Flip: **One third of content**

Implementation

Flipping

One third of subject content delivered as project work

Scaffolding of skills and implementing a peer-review cycle

Creating room for scaffolding of (A) scientific writing skills and (B) professional peer-review (using Spark^{PLUS} software)

Assuring that new skills are acquired

Feedback loop for
(A) scientific writing skills and (B) professional peer-review
Post-project feedback

Implementation

Authentic assignment

Environment similar to creation of real scientific publication:

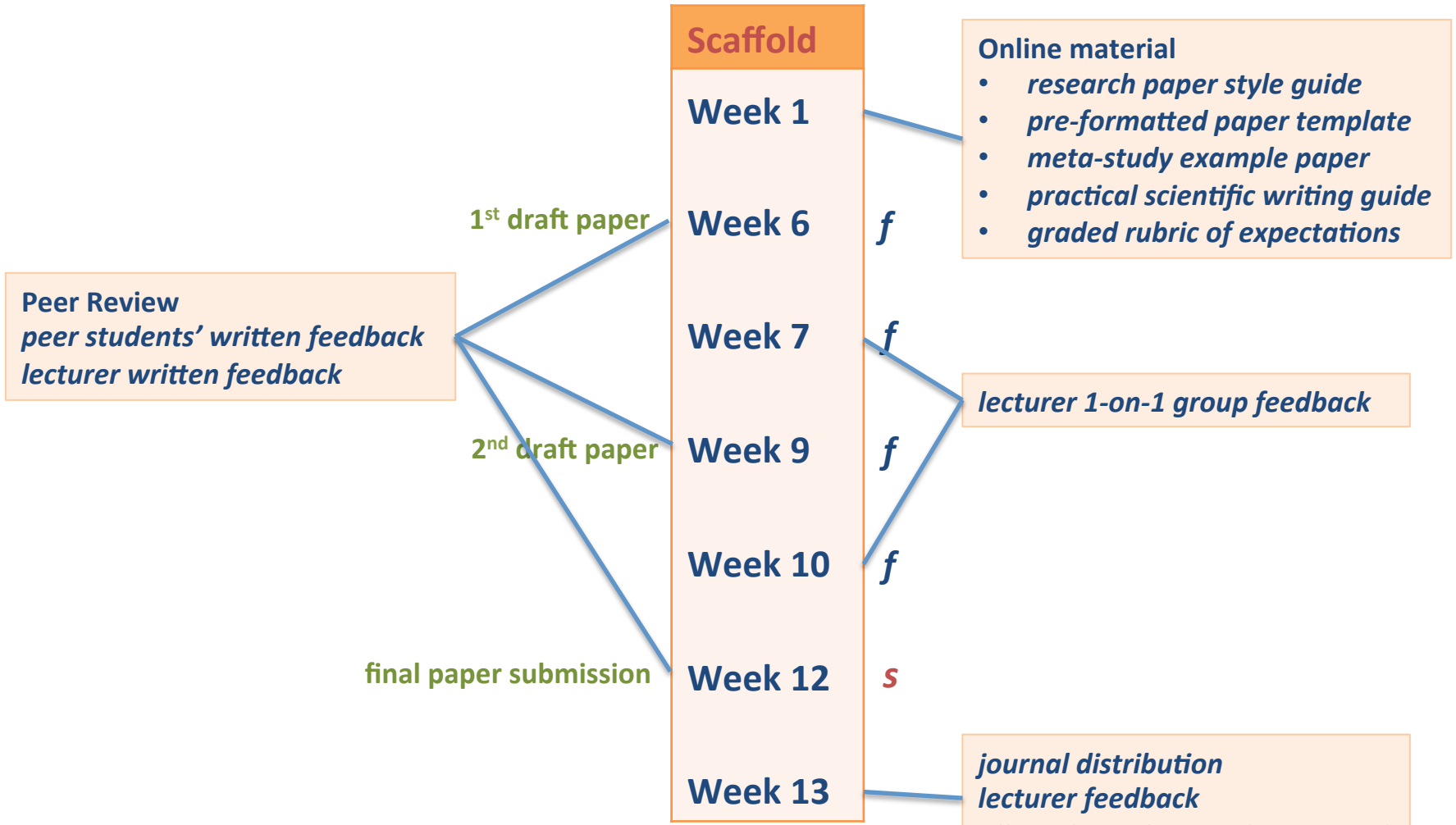
- consulting scientific databases;
- reading peer-reviewed scientific papers and extracting relevant information;
- formulating a research objective for the meta-study;
- writing a paper in a prescribed scientific publication format;
- working in a research team with a range of expertise;
- managing research and paper writing workloads within a team;
- acting as a peer-reviewer for other group papers;
- assessing papers according to prescribed peer-review guidelines;
- completing & submitting meta-study paper within journal's publication timeline.

This assignment also requires the students to

- gain expertise in an unknown topic within a short period of time.

Implementation

Scaffolding (absolutely essential): A. paper writing, B. peer-review process



Learning outcomes

Learning Experience for students

Students pick their own research topic (complement lecture) **research objective**	***Students work on a task they are really interested in***
Professional outcome	***Meta-study allows student to create new knowledge without being research expert in the field***
Tangible outcome	***Professionally printed, student peer-reviewed journal, ("1st publication")***
Role of feedback	***Feedback given on all semester assessment tasks***

Learning outcomes - Authentic assignment (Focus Group Response)

Peer-review feedback cycles feedback

'I wasn't actually aware that scientific papers were reviewed in this way before publishing'

'This type of task is not one I am familiar with. I really enjoyed it and would enjoy doing it again'

'it was good to see feedback from class-mates too, as they often had different perspectives on the paper writing process'

Ownership: 'not doing what we have been told to do', 'freedom of choosing'

Engagement

Value of the peer-review

Lecturer experience

Practice-based assignment

Workload

Balanced

Challenges

Students' prior skills (knowledge)

Timing, Scaffolding

Guidance (peer feedback)

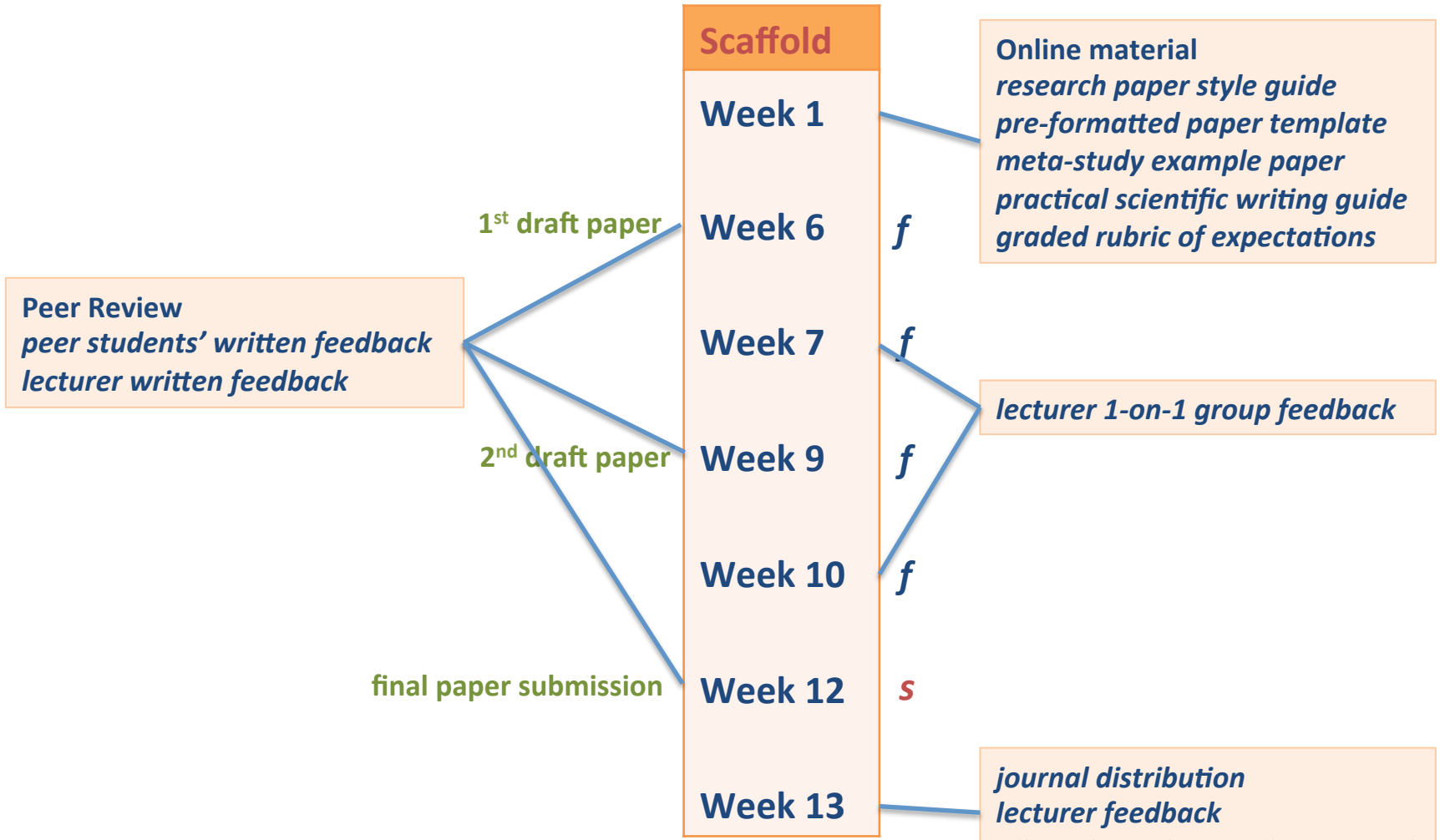
Removing the learning towards an exam allowed experience of deep learning

It is more interesting and rewarding to assess student work when there is a chance to see it improving than assessing an examination when there is little or no chance for a cycle of feedback and learning after the final result.

The assessment re-design encouraged the application and retention of knowledge and skills rather than accumulating them in a package to be discarded after a final exam.

NEXT ITERATION

Scaffolding (absolutely essential): A. paper writing, B. peer-review process



LEARNING OUTCOMES

Practice-based assignment

Environment similar to creation of real scientific publication:

- gaining expertise in an unknown topic within a short period of time;
- consulting scientific databases;
- reading peer-reviewed scientific papers and extracting relevant information;
- formulating a research objective for the meta-study;
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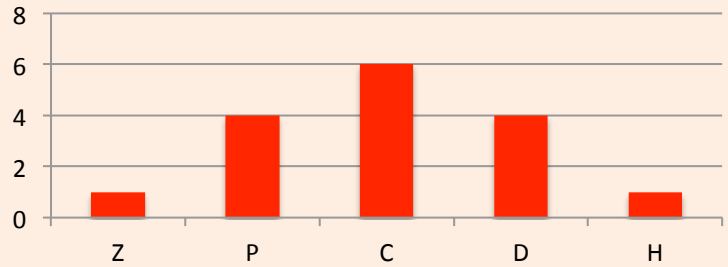
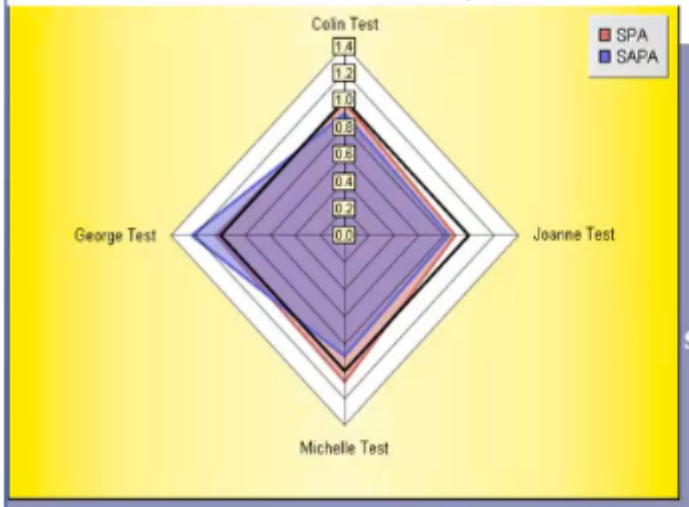
LEARNING OUTCOMES



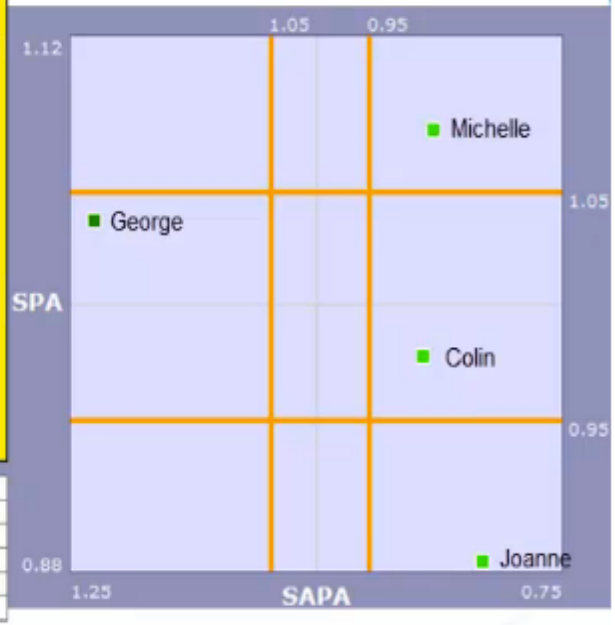
Spark^{PLUS}

Over-rater

SPARK^{PLUS} calculated team's SPA (performance - red) and SAPA (perception feedback - blue) factors



Student	Overall Contribution	
	SPA	SAPA
Colin Test	0.98	0.9
Joanne Test	0.89	0.84
Michelle Test	1.08	0.89
George Test	1.04	1.23



Radar Diagram

Monitoring Diagram

Criterion	High Distinction	Distinction	Credit	Pass	Fail
	Disciplinary Knowledge				
Paper body: Demonstrates an understanding of the scientific concepts associated with the topic studied by presenting information in a coherent and concise manner	Easy to read; only requires one read per section to be fully understood; to the point; excellent sentence structure; excellent development of argument; excellent figures/tables that are understandable without reading the text	Well written but not outstanding; argument (story) presented; good tables and figures; minor grammatical or typographic errors	Requires some work to understand the flow of argument (story); adequate figures and tables but not easily understood; requires more than one read to understand the concepts presented; minor grammatical or typographic errors	Base level writing; little development of argument (story); poor figures and tables; writing not clear; some grammatical or typographic errors	Poor sentence structure; lack of flow to the argument (story); figures or tables cannot be understood without reading the text; some grammatical or typographic errors
	Enquiry and Innovation				
Critically analyse model and competing system and associated literature to draw reasoned conclusion	Outstanding; correctly explains power/fuel generation; correctly relates thermodynamic parameters; includes 10+ analysed project system related references to scientific journals and 4 similar references to competing systems	Simply written; correctly explains power/fuel generation; little detail that relates to thermodynamic parameters; includes 8 analysed project system related references to scientific journals and 3 similar references to competing systems	Relates system to processes; restates findings but does not provide a critical comparison of systems; includes 6 analysed project system related references to scientific journals and 2 similar references to competing systems;	Base level understanding of project system; restates findings but does not provide a critical comparison of systems; includes 4 analysed project system related references to scientific journals and 1 similar references to competing systems	Failed to correctly identify thermodynamic drivers in project system; no critical comparison of systems; include 2 or less analysed project system related references to scientific journals and 1 or less similar references to competing systems
	Communication Skills				
Introduction	Excellently set the scene in the introduction; clearly stated purpose of paper; clear evidence that author has read	Simply set the scene in the introduction; ordinary stated purpose of paper; some evidence that author has read around the	Provides relevant project system information in introduction; some motivation for purpose of paper; some	Provides relevant project system information in introduction; some motivation for purpose of paper; some	Provides relevant project system information in introduction; motivation for purpose of paper not clear;
	Professional Skills				
Style, citation and references in prescribed APS guidelines	Correct paper style, citation and reference list as per APS	Slight inconsistency in reference list	Slight inconsistency in style or citation and reference	Several errors in style, citation and reference; or vice versa	Incorrect paper style; incorrectly referenced journal articles