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Syllabus Design Grounded in the Scientific Method in Foundation Year STEM for Authenticity and Engagement

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Students engage best with materials directly relevant to their disciplines and clearly supporting undergraduate study preparation. Authenticity in EAP enhances student engagement and disciplinary literacy for STEM foundation students. Learning is enhanced when EAP teaching aligns with actual disciplinary texts, genres and practices. This study proposes a syllabus framework centred on the scientific method, involving systematic observation, hypothesis formation, testing, and analysis. Using this framework, students explore how their disciplines apply the scientific method as a common thread. The framework treats each discipline as a distinct culture of practice and integrates accessible popular science content. It examines pseudoscientific myths, enhancing critical analysis while connecting science literacy to everyday life.

Introduction

In the context of STEM (science, technology, engineering and mathematics) education, English for Academic Purposes (EAP) can at times be seen by students as peripheral to their development, reduced to 'learning English.' This reductionist view may suggest a disconnection between the language pedagogy provided in EAP modules and the actual communicative practices required in STEM disciplines, with students viewing the former as irrelevant to the latter. While EAP practitioners would be quick to point out how inaccurate this is, efforts to convince students to fully engage or see the value of academic communication may not be successful. This misperception of EAP in STEM can undermine student motivation and limit the potential of EAP to function as a meaningful part of disciplinary socialisation. It is important to clarify that for high proficiency foundation year students, the 'English learning' aspect of EAP is not a matter of remedial syntax or grammar, but of rhetorical control and precision for communicative purposes. The challenge for these students is not constructing sentences or paragraphs, but understanding how specific linguistic choices, such as the use of passive voice or hedging for hypotheses, are integral parts of science communications.

To engage students, EAP for STEM modules often adopt theme-based approaches with topics like 'sustainability', 'global issues' or 'innovation' as organising concepts. At first glance, this approach offers a broad base to cater to students from a wide range of STEM disciplines. However, disciplines such as computer science or cognitive/psychological sciences may still pose challenges in the context of assessment, since it may not be obvious to students how these specific disciplines connect to the aforementioned generic themes. Since EAP practitioners typically have a stronger background in language or humanities at large, an approach that relies on the application of science and engineering in real-world issues can often be challenging for module teachers too.

This paper argues that a syllabus design grounded in the Scientific Method can enhance authenticity in EAP provision for STEM students and thereby effectively facilitate student engagement. The Scientific Method refers to a cycle of observation, hypothesis, experimentation, analysis, and evaluation (Hepburn & Andersen 2021). It is a shared intellectual framework across STEM disciplines. With an EAP syllabus and materials that reflect scientific genres (e.g. lab reports, technical documentation, multimodal scientific communication), students engage with EAP not as an isolated language course, but as an integrated part of becoming a STEM practitioner.

This example of practice proposes a syllabus around the Scientific Method that supports disciplinary acculturation, particularly across the diverse and evolving landscape of STEM and interdisciplinary studies. It aims to demonstrate that EAP, when it engages meaningfully with the STEM curriculum at large, can function not as remediation but as support for students' engagement in their STEM disciplines.

Background

Syllabus design in EAP has long faced a tension between general academic skills and discipline-specific literacies. Traditional approaches often prioritise surface-level language outcomes (e.g. citation accuracy, grammatical range), but this runs the risk of reducing academic writing to technical form and mechanics rather than disciplinary meaning-making and communications. Principled syllabus and curriculum design must align with learner needs, institutional contexts, and disciplinary demands (Graves 2016; Macalister & Nation 2019). Specifically for STEM students, this would mean moving beyond decontextualised language practice, which often leads to a sense of disconnection from their core subject identity, and toward syllabi that can reflect how scientific knowledge is actually constructed and communicated at foundation year and undergraduate levels.

STEM students entering International Foundation Year (IFY) programmes in the UK face complex linguistic demands beyond general academic English. Building on influential studies of EAP at large (Hyland 2006; Biber & Conrad 2009), Milln et al. (2025) stress that students need explicit support with disciplinary discourse, genre conventions and the mediation of subject knowledge. Students' needs often require more than generic EAP syllabi to be adequately addressed. In the context of this article, when the students are at the foundation year level, it is even more crucial to ensure that their needs for scaffolded and explicit support are met. This line of research often focuses on the academic knowledge and skills to be incorporated in EAP provision. While it often focuses on identifying the necessary academic knowledge and skills, the present study complements these theoretical discussions by providing a syllabus design as a practical implementation. The following sections describe how scientific communications can be better represented in EAP syllabi, addressing the challenge of some instructors feeling that they lack training in the discursive practices of the target subject areas (Hyland 2006; Wingate 2012).

Authenticity is a key element in this implementation. The notion of authenticity refers not only to the use of 'real-world' materials, but more critically to the alignment of the language learning goals with actual communicative practices (Hyland 2006; Gilmore 2007). This approach shifts the focus from generic academic skills to contextual authenticity, where language is learned through its role in disciplinary meaning-making (Flowerdew & Peacock 2001). Meanwhile, engagement is conceptualised as more than task participation. It should also involve cognitive and even identity investment in the learning process. Learners are more engaged when EAP modules enable them to participate meaningfully in the communities they aspire to join (Lave & Wenger 1991; Dörnyei & Ushioda 2011). A syllabus designed with STEM knowledge in mind encourages students to reflect on their disciplinary practices and develop a sense of disciplinary belonging (Lea & Street 1998).

This disconnect between language-focused instruction and subject knowledge has often been a source of tension in EAP instruction. The issue is exacerbated in STEM by structural and epistemological divides. STEM disciplines rely heavily on empirical data and quantifiable results. The orientation therefore shapes the genre conventions (e.g. lab reports, data visualisations) to be formal and discipline-specific. Given that these genres may be unfamiliar to both students and EAP practitioners, the resulting challenge is not simply to teach English, but to acculturate students into scientific ways of thinking and writing. To achieve this, practitioners should go beyond teaching isolated skills or technical jargon, to apply a broader, principled approach that connects language to disciplinary practice.

The proposed syllabus design

This syllabus adopts a method-centric design, using the notion of Scientific Method as the foundation to structure the teaching of academic communication in STEM. Rather than organising the syllabus around specific assignment themes (e.g. sustainability or innovation), a practice that often results in a curricular disconnection for students in non-environmental disciplines, this approach focuses on how scientific knowledge is produced, evaluated and communicated across disciplines. Drawing on discussions of the Scientific Method (Hepburn & Anderson 2021; Tang et al. 2010) and the nature of science (Hansson 2021; Dagher & Erduran 2016), Scientific Method is presented not simply as procedures to be followed, but as a mental framework to understand and justify practice and conventions employed in all

STEM disciplines. The proposed syllabus takes an academic literacy approach that aims to motivate students to address their learning needs as they prepare for their undergraduate studies, rather than teaching to the assigned tasks. The following outlines the progression within the module illustrating how the Scientific Method can serve as an organisational and conceptual framework. A proposed weekly schedule is also provided in Appendix 1. Each phase aligns with essential components of academic practice, enabling students to develop disciplinary awareness and understanding of disciplinary practice, while acquiring the language and literacy skills required for their success in the undergraduate programmes.

Weeks 1-2 introduce the module rationale and expected outcomes, in addition to the generic orientation which is useful for students who are new to higher education in the UK and are joining via the IFY. Within these weeks, students will be invited to reflect on the nature of science. This includes the following steps that are generally accepted to be the essential parts of the Scientific Method:

1. Observation
2. Forming hypotheses and making predictions
3. Testing hypotheses with empirical data
4. Reporting results
5. Using results to guide further investigation and observation (this last step links iteratively to the next cycle of the scientific pursuit)

From a linguistic perspective, the formulation of a hypothesis serves as a vehicle for teaching modality and language about relations (including both correlational and causal), moving students away from absolute assertions towards the more nuanced possibilities required in academic discourse. The Scientific Method also establishes the principles behind the practice in both EAP (e.g. academic integrity, paraphrasing, signposting and coherence) and scientific practice (e.g. critically reviewing and synthesising previous studies, following established procedures and protocols, using appropriate statistics and visualisation). For many students, provision focused on language and communication can be seen as merely a requirement for speakers of languages other than English. With the academic literacy approach, the module syllabus can address the needs of all students, including students whose only language is English,[1] and those in 'dry lab' disciplines, such as computer science and electronic engineering.

Weeks 3-5 introduce the notion of scientific development as a gradual progress, and self-correction within the scientific community. To be a constructive member of the

[1] In the case of the author's institution, students who are administratively labelled 'international' may include those from countries where English is frequently used (e.g. USA) or those who have grown up in international schools, where English is used predominantly (as in the case of many students from International Baccalaureate programmes). As such, the 'home' vs. 'international' distinction often does not reflect students' English proficiency.

community means academic honesty, giving credit to previous studies, and effectively communicating the context of the study. This is where many of the traditional EAP practices (e.g. using sources, paraphrasing, synthesising, academic integrity) can be connected and grounded without resorting to a plagiarism avoidance narrative. Aligning with what science specialists would expect, this module does not foreground a focus on text, phrasing, or citation formatting. Rather, academic practice is justified and explained in the context of productive and good science. To encourage students to reflect on the negative consequences of poor academic integrity, major incidents of malpractice will be discussed to illustrate how bad science and engineering harm the scientific community and the general public. This is also a place to introduce popular science magazines that can bridge the gap between general news outlets and highly specialised peer-reviewed journal articles.

Weeks 6-8 introduce 'replicability' and relevant notions surrounding methods and data collection. This is particularly important for preparing foundation year students for undergraduate studies, because many of their tasks are about reporting the procedures and methods in various genres like lab reports, technical reports (e.g. in electrical and electronic engineering), reflective journal entries and case studies. This can be expanded to enhance students' ability to employ the meta-language in explaining methods (e.g. summarising what approach is taken, instead of listing the experimental procedures involved). These weeks on replicability also provide opportunities to engage students with the idea that science, while methodologically rigorous, is not immune to errors or misuse. Focused discussions on pseudoscience, myths, and scientific misconduct can be useful in supporting students' understanding of social and ethical dimensions of the scientific community. Hansson's (2021) work on demarcating science from pseudoscience can be used as extended reading to scaffold discussion on what counts as science. Students may find discussions on 'flat-earthers' or other myths/conspiracy theories related to science interesting, and these can also offer opportunities for reflective and essay-style writing tasks. Other cases of misuse, such as the *Theranos* scandal, and the Milgram and Stanford Prison experiments, would be good starting points to provide a contextualised understanding of ethics and their impact in the real world. It should also be noted that these topics do generally require more careful facilitation and debriefing, especially with the psychology experiments, where the details can be sensitive.

Weeks 9-10 focus on the reporting of empirical results. This includes signposting skills to connect the results to the methods section and language command to articulate the results (e.g. comparing numbers across experimental groups, describing trends and patterns). The current module leaves room for further engagement in this area.

Week 11 will be reserved for hands-on editing workshops and assessment. Students will be guided through peer review and final editing of their lab reports, alongside preparation for their poster presentation in a mini science fair. The learning objectives and language focus are on skills in editing and revising. Teachers can also conduct sessions that guide students to workshop and polish their drafts. Such a skill is crucial and highly transferable for any member of the academic community. These activities also allow students to apply and practice the full cycle of the Scientific Method to their own work, using both written and oral communications.

Proposed strategy in assessment and module evaluation

Assessment strategies

Assessment in this framework is designed not merely to test linguistic proficiency, but to simulate the authentic communication channels of the scientific community. To prepare students for the realities of undergraduate STEM study, the assessment strategy prioritises genres that reflect how scientists actually exchange information, which often differs significantly from humanities-based conventions.

Written Assessment

The laboratory report is a staple of assessment in STEM disciplines, as it is effective in evaluating students' ability to conduct science experiments and report their findings. However, the STEM curriculum does not necessarily focus on training students around the communication and rhetorical needs in lab reports, which can leave students feeling unprepared. While this would be true for students who are not confident in their academic English, it should also be pointed out that even stronger students (for example, those who have attended international schools and education programmes across the globe) can still benefit from level-appropriate guidance. In the classroom, it can be emphasised that the given examples are at the university-level, which may differ from what students are used to from their secondary education.

This also aligns well with the purpose of foundation year programmes to prepare students for their undergraduate studies. An advantage of EAP practitioners is the knowledge they possess about genres and disciplinary conventions relevant to higher education. While EAP practitioners typically do not possess expert disciplinary knowledge, they tend to have deep understanding about rhetorical structure and textual analysis. This enables them to be the ideal facilitators to address communication needs and provide guidance on the writing process.

It is equally important for students to engage with secondary research genres, such as review articles or systematic meta-analysis. While it is unreasonable to expect foundation year students to write their own systematic review, the assessment tasks can be designed to mirror the logic of this genre. The notions of replicability (by which scholars try to replicate others' studies to verify the results) and criticality (through which scholars critically engage with studies conducted by fellow scholars) are important parts of the practice of science. Consequently, assignments that require students to select, filter, and synthesise distinct sources can teach the fundamental value of 'Science as a Community' (Week 3), demonstrating how individual researchers rely on previous studies. This, in turn, promotes socialisation by shifting the focus from simply 'writing an essay' to understanding the function in persuasion and the establishment of scientific consensus.

Socialisation and academic literacy development may also be manifested in reflexive understanding in the practising of science. Increasingly, undergraduate students in STEM disciplines are introduced to reflective writing. This is used not merely as a form of assessment, but also for the purpose of encouraging continuous self-improvement. As students receive training in documenting, reporting and evaluating their own work, they typically become more proficient and accustomed to critically reflect on their own practice. This not only benefits their development as communicators, but also as practitioners of science.

Oral Assessment

For oral assessments in STEM disciplines, poster presentations are a ubiquitous practice. Unlike the 'stand-and-deliver' speeches common in humanities disciplines, poster presentations require presenters to summarise complex data visually and engage in interactive, distinct dialogues with a smaller audience. By assessing students in this format (Week 11), the module reinforces the specific 'communication channels' of the scientific community. Success in this assessment is measured not just by fluency, but by the student's ability to adopt the professional behaviours and rhetorical expectations typical of scientific conferences and symposia. Similar to the written assessment, incorporating this element emphasises alignment with practice in STEM and provides suitable preparation for undergraduate studies.

Module evaluation

For evaluating the success of the module, it is typical for institutions to implement mid- or post-module evaluation surveys. However, surveys used by institutions are often not specific to the modules and disciplines. They may not adequately target the success of the socialisation and engagement goals described in this study. Therefore, this framework proposes additional methods to evaluate the impact of the syllabus, ensuring that evaluation is both meaningful to practitioners and integrated into standard quality assurance cycles.

One possibility is to adopt modifications to standard module surveys specific to engagement and socialisation in students' respective disciplines. By including reflective items that ask students to rate the perceived relevance of syllabus tasks to their future degrees, EAP module leaders can obtain feedback on whether the proposed Scientific Method framework successfully engages with students and counters the view of EAP as peripheral or remedial.

For example, high ratings in relevance in response to questions about the utility of genre analysis or scientific ethics would indicate successful engagement with the purpose of the module.

Evaluating the socialisation aspect of the syllabus involves documenting how well students begin to identify with their target fields. This can be facilitated through the observation of collaborative assignments and cross-disciplinary conversation groups. In the context of a foundation year programme, success is not measured by a student's mastery of complex professional conventions, but by their emerging awareness of the disciplinary landscape. Evaluators and teachers can gauge success by documenting whether students can articulate fundamental distinctions relevant to their future studies when interacting with peers. Indicators of successful socialisation include the ability to distinguish between 'wet lab' experimentation and 'dry lab' (e.g. simulation and informatics), or the differing roles of fieldwork versus theoretical modelling. Furthermore, student awareness of distinct communication channels, such as recognising why a systematic review differs from a standard essay, serves as a tangible metric of their acculturation into the scientific community.

Finally, the success of the module can also be evaluated by its constructive alignment with institutional benchmarks, specifically Module Intended Learning Outcomes and Programme Intended Learning Outcomes. A successful implementation of this syllabus will demonstrate that the specific scientific tasks (e.g. the pseudoscience seminar or lab report) map directly to broader programme requirements for critical thinking, communication, and ethical practice. This can ensure that the syllabus is not only engaging for students but is also validated within the wider university quality assurance framework, serving as evidence of success of the module for all stakeholders.

Implications

This article proposes a framework of syllabus design that aims to address the diversity of backgrounds of STEM students at foundation year level and as a response to the disconnection between EAP instruction and the actual communicative practices in STEM disciplines. Grounded in the Scientific Method, the proposal offers a pedagogical strategy to integrate academic literacy and disciplinary development.

A key professional implication of this framework is that it empowers EAP practitioners to 'play to their strengths' and focus on critical discussions on the Scientific Method or nature of science. With the aim to focus on the epistemological structures of science, and avoid struggling with technical content, EAP practitioners can take advantage of resources available in the scientific community, such as textbooks and articles on science writing (especially those written by scientists that offer more practical views). This is an effective step to show students, and sometimes subject experts too, that writing and communication skills do play important roles in scientific endeavours. Additionally, this can introduce subject experts to deeper engagement with the EAP community and academic works,[2] such as the *Journal of English for Academic Purposes*. In other words, practitioners can leverage scholarly works in the EAP community to establish their expertise and authority.

A further pedagogical implication involves the critical re-evaluation of source credibility within the STEM classroom. Implementing this framework requires practitioners to guide students beyond the over-simplified dichotomy between 'academic' sources, such as peer-reviewed journal articles and public-facing media, which may be dismissed without sufficient attention to the underlying source of knowledge. Many universities or science centres (e.g. National Aeronautics and Space Administration (NASA) in the US or the European Organization for Nuclear Research (CERN)) have public-facing social media accounts that aim to engage the general public. By actively integrating these authoritative sources that are not peer-reviewed journal articles, practitioners can facilitate a more nuanced view on the dissemination and communication of scientific knowledge. This shifts the learning objective from simple source identification to a deeper reflection on how scientific knowledge is translated for different audiences. Consequently, the EAP classroom becomes a space where students examine the full cycle of the Scientific Method, from the generation of data to public communication via social media and popular outlets, thereby sharpening their critical judgement on reliability and credibility.

For educators in STEM disciplines, the syllabus framework demonstrates that linguistic precision and rhetorical awareness in communication are not peripheral add-on skills but are intrinsic to the practice of science. The flip side of this relationship is equally critical: explicit instruction in scientific communication fosters stronger metacognition, equipping students with the tools to dissect and comprehend complex disciplinary texts. Consequently, this study suggests that the responsibility for developing disciplinary literacy does not rest solely with EAP practitioners. There is a compelling case for STEM subject experts to integrate these communication elements directly into their core teaching, not just to improve students' writing, but to enhance their ability to read and understand science. Ideally, where resources are available, a closer collaboration between STEM faculties and EAP units is beneficial. By aligning the EAP syllabus with the epistemological structure of the science curriculum, institutions can move away from a siloed model of 'skills support' towards a truly integrated pedagogy where communication is recognised as a fundamental instrument of scientific inquiry.

Conclusion

This syllabus framework based on the Scientific Method reinforces the importance of teaching STEM as a plural and dynamic culture. The STEM community is not a monolithic one that adopts one single set of rules, especially in conventions of writing and other forms of communication. Students are often already aware of the differences in data collection and evidentiary standards; foregrounding the Scientific Method can help highlight the fact

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[2] In the author's personal experience with subject experts in biology, they are often genuinely curious and fascinated by the EAP community as a scholarly discipline, especially with the more data-driven and quantitative studies.

that such diversity can also be observed in genres and communications across disciplines. The syllabus framework proposed here aims to reframe EAP not as a gatekeeping mechanism or a remedial service, but as a space where students begin to take part in the intellectual and communicative life as a member of their respective science communities. By grounding the module in the Scientific Method, aligning study tasks with authentic materials, and addressing both traditional and emerging forms of science communication, the proposed syllabus supports students' transition into STEM in higher education, thereby promoting their engagement and socialisation in the scientific community.

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Appendix 1 – Proposed Weekly Schedule

This appendix provides a proposed week-by-week schedule that outlines how these ideas are implemented in practice. The practical breakdown offers specific readings, activities and genre focuses, along with commentary on how each component supports the academic and disciplinary development of STEM IFY students.

Table 1 shows a proposed weekly schedule with brief explanation of the weekly objectives. In addition to the weeks and topics, the last column proposes the readings and assignments. For each week, the topics can likely be covered in two to three sessions. Depending on the time allocated for the modules, one of the sessions can be dedicated to practice and seminar-style small group teaching. The more input-heavy sessions can also be achieved by lectures or even pre-class video assignments to consolidate limited resources. For demonstration purposes, the proposed assignment column includes more items than what is necessary in most contexts. Readers are therefore recommended to include only some of the items listed.

Table 1: Weekly Schedule of the proposed syllabus

Week	Topic	Reading / *Assignment
1	Module rationale and expected outcomes: What is 'the Scientific Method'? What does it mean to be a scientist and an engineer? ● Introduction to Scientific Method and the Nature of Science ● The steps in the Scientific Method ● Activity: Class discussion on the nature of scientific thinking: What differentiates astronomy and astrology?	Reading: Hepburn and Andersen (2021) *Reflective writing: 'What does science mean to me?'
2	Observation and Hypothesis: Examples of scientific observations in everyday contexts ● What does 'observe' mean across disciplines (e.g. in physics vs. computer science)? How does my discipline manifest the Scientific Method? What does a hypothesis look like in my discipline? ● Activity: Guided group work to generate testable questions; discussion on falsifiability	Reading: Dagher and Erduran (2016) *Show and explain a scientific hypothesis in your discipline: Under what condition can it be falsified?

3	Science as a community ● Why is it important for scientists to work together as a community? ● How can we help fellow scientists to understand us and build on our work? (This is a good place to introduce the various ways to share data, or the practice to report on data collection methods, so that other researchers can decide whether the data are useful for them) ● Activity: Citing sources of data and making the contribution clear to your readers	<u>Reading</u>: *Nature Methods Editorial* (2025) *Group discussion and reflective paragraph on how transparency and method shape credibility. The topic can be phrased as a question, e.g. ‘Would you trust the science, if the researchers do not release any details?’
4	Communicating with other scientists ● To enhance students’ discipline- and genre-specific writing, students need to understand the importance of readership awareness and adhering to genre conventions (e.g. the IMRD [introduction, methods, results, discussion] structure and the objectives of each section) ● This is also a good opportunity to elaborate the specific requirements of assessments	<u>Reading</u>: Excerpts from lab reports or methods sections in open-access journal articles. Discussions and examples from Divan (2009: 153-169) and Barrass (2005: 132-149) can also be used. The first half of chapter 1 in Barrass (2005) ‘Writing as part of science’ (pp. 1-5) offers a concise introduction of the central role of writing in science communication. *Analysis of components and steps in research articles.
5	Academic Honesty and Misconduct ● Essentially, this week draws on what happens when the scientific community is undermined by misconduct ● Major incidents and malpractice cases can be discussed here to highlight the importance of academic honesty (e.g. data fabrication cases; unethical data collection) ● Focus on the lessons learnt and how institutions have introduced mechanisms to ensure ethical practice in STEM	<u>Reading</u>: Popular science coverage of misconduct cases (e.g. Theranos, AI-generated papers); Deer (2011) *Podcast in groups: Report a case of academic dishonesty and misconduct. Suggest one effective measure to prevent this from happening again.

6	What is Replicability? Why is it important in the Scientific Method? ● In addition to the more theoretical discussion, focus on how students should report their methods (based on the communicative needs in 'Materials and Methods') in connection with the theme from previous weeks about communicating with fellow scientists	<u>Reading</u>: National Academies of Sciences, Engineering, and Medicine (2019, chapter 3) *Write a brief 'materials and methods' section for a common procedure. Students may choose an experiment / procedure relevant to their discipline.
7	Pseudoscience and Critical Thinking ● Engaging students with the idea that scientists, just like scholars of other disciplines, need to think critically in their practice and identify threats of misuse ● This can often contribute to developing students' use of language and critical thinking	<u>Reading</u>: Media article with dubious scientific claims (e.g. 'ionized alkaline water', 'flat-earth' belief); Hansson (2021) on pseudoscience *Critical review task – students to evaluate the credibility of a claim. The EAP lesson here is to focus on the separation of reporting the pseudoscientific claims accurately from the evaluative writing.
8	Communicating Procedures and Ethical Boundaries ● This week continues with the communication of technical writing of procedures / materials and methods. Focused feedback can be given to the written task of 'materials and methods' in week 6 to prepare students for the final assessment ● Additional care and scaffolding might be a good idea for disciplines that students know less about in terms of ethics (psychology, computer science, environmental sciences)	<u>Reading</u>: D'Angelo (2018) *Peer editing of methods drafts; optional short reflection on one misconduct case.
9	Reporting Empirical Results ● Goals in the results section ● The difference between 'showing' (in results) and 'telling' (in discussion)	<u>Reading</u>: Selected results sections from open-access journal articles; example data visualisations *Write a short results section based on a sample data set.

	● Workshop on language for describing trends ● Optionally, a session on data visualisation	
10	Discussion: ● Connecting numerical and empirical results to the broader research questions ● Structuring your discussion section based on the research question(s) ● Linking the discussion to the background	Reading: Samples from journal articles *Science-Fair Style Presentations (with posters or other demonstration materials): Peer and tutor feedback can help motivate student participation
11	Final editing and assessment	*No assigned reading*

Appendix 2 – Reading list

In order to support students' disciplinary socialisation and literacy of disciplinary conventions, the reading list consists of materials from four categories that complement each other. First, the 'classic texts' and philosophical discussions introduce students to the epistemological foundation of science and encourage their reflection on what constitutes valid and reliable knowledge creation. Second, textbooks on scientific communication are included to provide practical guidance on genre conventions, rhetorical strategies and writing processes, often written by scientists too. For EAP practitioners who have stronger backgrounds in language and humanities, these references complement expertise in writing and rhetoric through scientists' perspectives on STEM communications. Third, a curated list of journal articles helps students engage with real world examples in science communications. Finally, the inclusion of popular science magazines and social media offers up-to-date information on recent developments in science and engineering relevant to our everyday life, often written for non-experts.

1. Introductory and classic texts on the Scientific Method and the nature of science

    - Hepburn, B. and Andersen, H. (2021) Scientific method. In Zalta, E. N. (ed.) *The Stanford Encyclopedia of Philosophy* https://plato.stanford.edu/archives/sum2021/entries/scientific-method

    - Nature Methods Editorial (2025) The big picture in science. *Nature Methods* 22, 637 https://doi.org/10.1038/s41592-025-02679-2

    - Dagher, Z. R. and Erduran, S. (2016) Reconceptualizing the nature of science for science education: why does it matter? *Science and Education* 25, 147-164

    - Tang, X., Coffey, J. E., Elby, A. and Levin, D. M. (2010) The scientific method and scientific inquiry: tensions in teaching and learning. *Science Education* 94:1, 29-47

    - National Academies of Sciences, Engineering, and Medicine (2019) *Reproducibility and replicability in science*. The National Academies Press https://doi.org/10.17226/25303

    - Kuhn, T. S. (1962) *The structure of scientific revolutions*. University of Chicago Press (Stretch goal for students who are more curious about the evolution of science and scientific theories)

2. Textbooks for scientific communications
    - Barrass, R. (2005) *Students must write: a guide to better writing in coursework and examinations*. Routledge
    - Knisely, K. (2009) *A student handbook for writing in biology*. Macmillan
    - Barrass, R. (2005) *Scientists must write: a guide to better writing for scientists, engineers and students*. Routledge
    - Divan, A. (2009) *Communication skills for the biosciences: a graduate guide*. Oxford University Press

3. Journals article repositories for STEM, in addition to institution libraries

    - PLOS ONE
      https://journals.plos.org/plosone/
    - PubMed
      https://pubmed.ncbi.nlm.nih.gov/
    - IEEE Xplore
      https://ieeexplore.ieee.org/browse/periodicals/title/
    - arXiv
      https://arxiv.org/
    - Tools for identifying academic sources
        i. Connected Papers
           https://www.connectedpapers.com/
        ii. Litmaps
           https://www.litmaps.com/
        iii. ResearchRabbit
           https://www.researchrabbit.ai/

4. Popular science magazines

    - Quanta Magazine
      https://www.quantamagazine.org/
    - MIT Technology Review
      https://www.technologyreview.com/
    - Scientific American
      https://www.scientificamerican.com/
    - Nature Communications
      https://www.nature.com/ncomms/