DECONSTRUCTING STUDENT NEEDS IN EAP FOR STEM: INSIGHTS FROM BALEAP 2023 SYMPOSIUM

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Abstract

The BALEAP STEM SIG 2023 Symposium on 'Deconstructing student needs in EAP for STEM' provided insights into the unique challenges and strategies for teaching English for Academic Purposes (EAP) in science, technology, engineering, and mathematics (STEM) disciplines. Key presentations included Natasha Rust's emphasis on integrating register, genre, and discourse analysis into EAP for science courses, Sanchia Rodrigues's exploration of mathematical proficiency and discourse in EAP for maths, and Aaron Woodcock and Lori-Ann Milln's strategies for creating sustainable English for Specific Academic Purposes (ESAP) curricula focusing on vocabulary, speaking, mediation skills, and reflection. Audience discussions highlighted the need for flexible teaching approaches to cater to diverse STEM student groups and the importance of embedding EAP within the broader academic framework. The symposium underscored the collaborative nature of developing effective EAP programs that address both language and subject-specific needs, ensuring the preparation of students for academic success in their respective STEM fields. This interactive infographic and symposium write-up aims to summarise the presentations and discussion at the symposium, to foster ongoing discussions and developments in EAP for STEM education.

Keywords: EAP, STEM Education, Curriculum Design, Pedagogy, Technology, Partnerships, Attendance, Assessment, Mathematics Vocabulary, Language Learning, Educator Support.

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Note to Readers:

This document was originally designed as an interactive Microsoft Sway presentation, referred to as an 'infographic'. The Sway version offers a dynamic and engaging experience, allowing you to explore multiple responses and thought-provoking follow-up questions related to English for Academic Purposes (EAP) in STEM disciplines. We highly encourage you to visit the online multi-linear infographic for a richer, more interactive exploration of the content. You can access the Sway presentation here: https://sway.cloud.microsoft/VfLnqfMoUDWgKQwp

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1 INTRODUCTION

Our team, comprising Natasha Rust (University of Leeds), Aaron Woodcock (University of Reading), Sanchia Rodrigues (University of Warwick), and Lori-Ann Milln (University of Southampton), introduces an interactive infographic in this BALEAP 2023 Biennial Conference write-up. The immersive experience allows users to explore multiple responses and thought-provoking follow-up questions related to English for Academic Purposes (EAP) for science, technology, engineering, and mathematics (STEM).

The symposium began with speakers dissecting EAP for STEM through the lenses of EAP for science, EAP for maths, and EAP for STEM. Natasha Rust (NR) highlighted the importance of register, genre, and discourse in science courses, emphasising the need for a curriculum centred around these elements. Sanchia Rodrigues (SR) then explored the components of a successful EAP for maths curriculum, emphasising mathematical proficiency, practices, and discourse. Finally, Aaron Woodcock (AW) and Lori-Ann Milln (LAM) addressed the challenge of creating a sustainable English for Specific Academic Purposes (ESAP) curriculum in STEM, focusing on vocabulary production, speaking skills, mediation skills, and reflection.

Audience questions then followed. These were centred on teaching ESAP for STEM, addressing issues of diverse student groups, approaches for in-sessional, pre-sessional, and foundation year courses, and text selection

for analysis in class. The discussion extended to the position and purpose of EAP within the academy, overcoming the focus on academic practice over specific language needs, funding roles within institutions, and dealing with issues of attendance and assessment links. The audience also sought insights into entering EAP for STEM, support received, and overcoming challenges faced in teaching, prompting discussions on the implications of 'math is a method' and the existence of a mathematics vocabulary list.

This infographic serves as a dynamic resource, fostering developmental discussions within the Special Interest Group (SIG) and beyond. Join us in unravelling EAP for STEM, collaboratively understanding evolving needs.

2 PRESENTATIONS: STEM DECONSTRUCTED

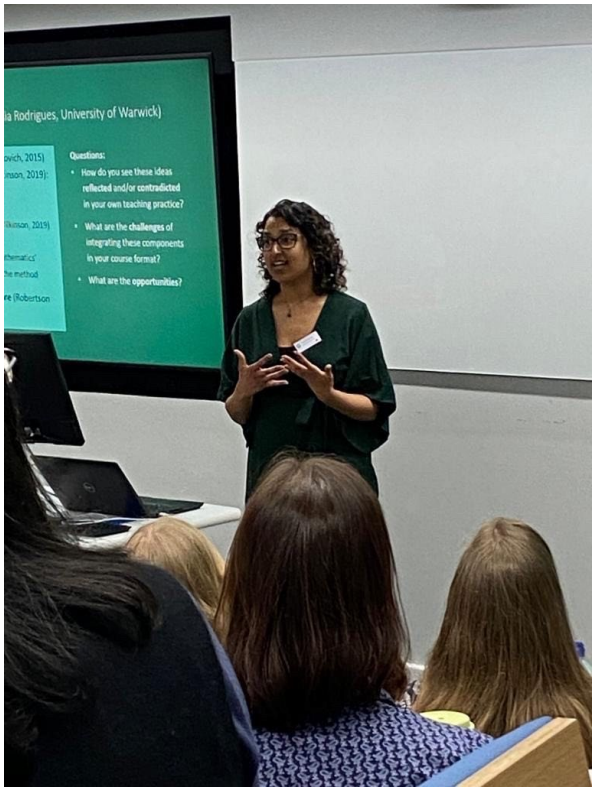
The symposium kicked off with a comprehensive exploration of the STEM acronym by the speakers. Their analysis explored each component, dissecting the individual elements of Science (S), Maths (M), and subsequently, examining the amalgamation of STEM as a unified entity.

2.1 EAP for Science

Natasha Rust answering audience questions at the symposium. (Credit: Philippa Bunch)

What content knowledge does the EAP practitioner need to develop a curriculum for both pre-sessional and in-sessional ESAP science courses? The emphasis and use of subject-specific content within ESAP courses is in my view quite contentious and inconsistent leading to an EAP practitioner feeling ill-equipped or a dilution of subject-specific content. Within ESAP courses for the physical sciences (and transferable to broader STEM subjects), the EAP practitioner should be maximising on their current (or developing) skillset of exploiting **register**, **genre** and **discourse** analyses together with learners to be developing specialised knowledge of science (or STEM) language and discourse (Hyland, 2005; Biber & Conrad 2009). By having register, genre and discourse as the central tenets of the curriculum, you pave a way for **knowledge transfer** (Monbec, 2018) among students through developing **metalinguistic toolkits**, reframing content as specialised (EAP) knowledge and maintaining the role of the EAP practitioner from pre-sessional, in-sessional and scholar in the field of EAP and the subjects they teach within. These approaches allow an organic development of needs analysis with a focus on register, genre and discourse understanding and competence.

2.2 EAP for Maths



Sanchia Rodrigues speaking at the symposium. (Credit: Philippa Bunch)

What are the components of a successful EAP for Maths curriculum? Taking an academic literacies approach (see also Tuck, 2022), Judit Moschkovich (2015) highlights the following:

1. **Mathematical proficiency**, or the ability to apply and adapt mathematical knowledge.
2. **Mathematical practices**, or the mathematical behaviours and types of semiosis that are valorised in a particular sociocultural context.
3. **Mathematical discourse**, including but not limited to the register of mathematics (Halliday, 1975) as well as its discursive organisation. For example, in place of the more common I-M-R-D structure, research articles in mathematics follow an I-R structure, as the **mathematics** *is* **the method** (Graves, Moghaddasi & Hashim, 2013).

Moschkovich (2015) states that learning is optimised when all three of the above are integrated, though I feel her framework could be further strengthened by the active encouragement of students' 'full [multilingual] repertoires to enhance their mathematical sense-making opportunities' (Robertson & Graven, 2020, p.95).

2.3 EAP for STEM

Aaron Woodcock and Lori-Ann Milln answering audience questions at the symposium. (Credit: Philippa Bunch)

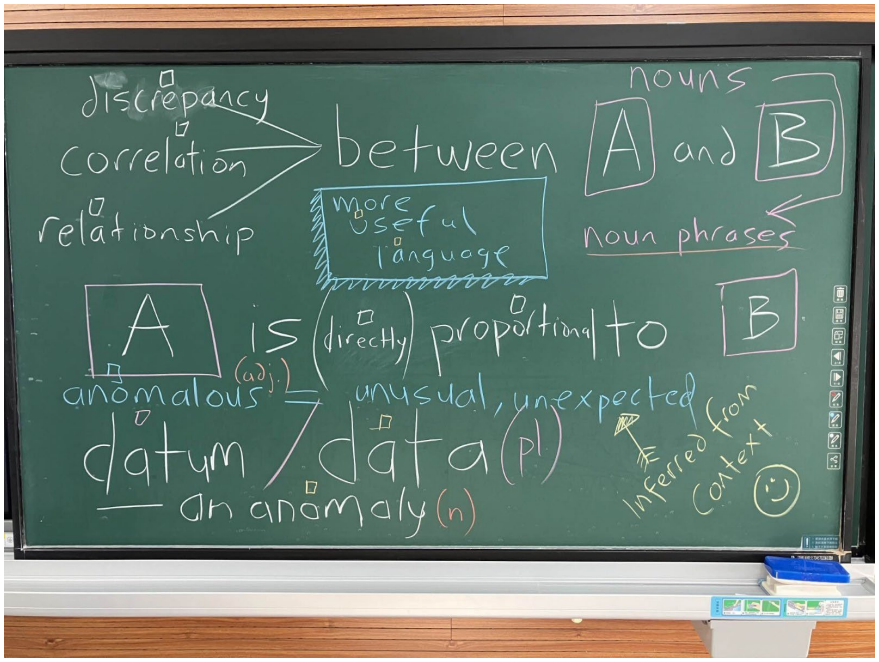
Creating a flexible and sustainable English for Specific Academic Purposes (ESAP) curriculum in a context of high staff turnover and diverse subjects poses a crucial question: How can we ensure its sustainability? Despite differences, commonalities among STEM students in an English Medium

Instruction (EMI) setting provide a foundation for a more resilient curriculum:

- **Vocabulary Production**: All STEM students, regardless of subject diversity, share the need to enhance fluency in high-frequency vocabulary (Coxhead, Dang, & Mukai, 2017). Our approach involves studying context-specific high-frequency vocabulary (e.g. the Academic Word List or the Oxford 3000) and assessing fluency through cloze tests.
- **Speaking Skills**: STEM disciplines emphasise learning through spoken interaction (Mercer et al., 2004). Sociolinguistic competence is vital, encouraging effective communication in diverse settings and media (University of Reading, 2018). In our ESAP for STEM courses, students develop these skills through interactive poster presentations, considering audience, purpose, and mode.
- **Mediation Skills**: Linked to spoken interaction, all STEM students learn through explaining concepts and summarising texts and data. Our curriculum teaches strategies for effective mediation of ideas (knowledge transfer), enhancing students' ability to explain familiar concepts and summarise complex subject-specific texts (Council of Europe, 2018, pp. 126–129).
- **Reflection**: A focus on self-awareness, especially in effective vocabulary learning strategies, promotes students as lifelong learners of language (QAA, 2019, p. 12; University of Reading, 2018). Opportunities for reflection, from formative discussions to summative reflective journals, are integrated into our curriculum.

This transnational education-adapted approach not only meets immediate needs but also propels students toward sustained success in academia and beyond. In ESAP, the 'S' for specific involves a collaborative synergy between students' subject knowledge and teachers' linguistic expertise, creating educational magic.

3 AUDIENCE QUESTIONS: THE KNOWLEDGE AND SKILLS NEEDED TO TEACH ESAP FOR STEM



Following the presentations, the audience actively engaged in a dynamic exchange, posing pertinent questions that illuminate the intricate landscape of teaching English for Specific Academic Purposes (ESAP) in the STEM context. This interactive segment became the focal point, capturing the symposium's essence and exploring the practical aspects of instructing diverse STEM cohorts.

This first section of three on audience questions centres around crucial inquiries regarding the knowledge and skills requisite for effectively teaching English for Specific Academic Purposes (ESAP) within the STEM domain. Exploring the challenges and insights shared by the presenters, we explore the multifaceted landscape of instructing diverse groups in varied STEM subjects, addressing issues of curriculum sustainability, and fostering effective communication skills within this specialised academic context.

3.1 HAVE YOU HAD TO TEACH GROUPS IN WHICH STUDENTS ARE STUDYING VASTLY DIFFERENT STEM SUBJECTS? HOW DID YOU DEAL WITH THIS?

NR: I have been a module leader on the Language for STEM pre-sessional at the University of Leeds since 2016 with mixed STEM cohorts. The syllabus threads and curriculum within the modules I lead are to embed

good genre and discourse analysis for students to replicate with their more specific texts. The driving force of the syllabus is language knowledge and how to explore this within your specific discipline. In addition, looking at being a good communicator and what that means. More information is available through these slides, which I co-presented with my module co-leader at the Language Centre Summer conference.

AW: At the University of Reading, we take a similar approach to Tasha's. We offer Part 1 undergraduate credit-bearing ESAP modules for STEM subjects, covering a range of disciplines, such as maths, atmospheric science and environmental engineering. Due to limited resources, these modules require a common syllabus.

Like at Leeds, the syllabus is designed to focus on common language knowledge, communication, and mediation skills, and how they are used in a student's specific discipline. The syllabus is divided into three themes: Discipline-specific Vocabulary, Communication Skills, and Explaining and Summarising Skills, and an overarching fourth theme of reflection to encourage lifelong learning. The learning outcomes of these modules, such as the English for Atmospheric Science example, are based on these themes.

All Part 1 ESAP modules share this description, with the 'S' of ESAP explored in the application of these themes to each specific discipline. For instance, students learn three strategies for explaining concepts (Council of Europe, 2018, pp. 126–129), and learn the pronunciation and subject-specific collocations of AWL words, which they practice in various forms, from controlled to open activities, to explain core concepts and processes in their field. These activities could range from 2-minute explanations of core concepts like 'pressure' or 'precipitation' (using AWL words such as 'area', 'formula' and 'occur') to group assignments like producing video tutorials on the 'water cycle' (using AWL words such as 'cycle', 'source' and 'release').

3.2 WHAT ARE YOUR APPROACHES FOR TEACHING EAP FOR STEM ON EMBEDDED IN-SESSIONAL, PRE-SESSIONAL AND FOUNDATION YEAR COURSES?

LAM: In the English for Engineers component of our joint engineering degree programme, we aim to incorporate elements of Content and Language Integrated Learning (CLIL), whenever feasible by selecting appropriate reading texts, materials, and assessment design from the engineering modules which will be studied (Coyle et al, 2010). We try to place a strong emphasis on acquiring technical vocabulary and specialist

linguistic structures which ensures that students have a comprehensive understanding of the terminology and methods of communication used in their engineering degree programmes.

The syllabus and materials are designed with a focus on communication, engagement, and collaboration. These skills are tested through group seminar discussions based on reading or a presentation followed by a Q&A session. Students also produce technical essays and poster presentations on related engineering topics and laboratory reports based on hypothetical experiments. The teaching of critical reading is facilitated via Academic Reading Circles (ARC) (Seburn, 2016). The ARC texts progressively increase in academic rigor and complexity over the course of the semester and this element is assessed with a reading exam and seminar discussion. These skills are intended to provide students with the necessary tools to excel in their degree programmes and subsequent professional careers.

NR: While I led on an international foundation year for STEM disciplines, the syllabus was very similar to the ones Lori-Ann describes. We similarly embed academic reading circles informed by Tyson Seburn. Additionally, I saw foundation year as a way of developing awareness of HE, an understanding of the linguistic/communicative demands of HE and the depth, and criticality required within assessment tasks. I think these elements are maintained on pre-sessional and in-sessional tasks but I prioritise more genre and language analysis of the texts the students are reading and producing and the communicative contexts they will be within for MSc students.

SR: My approach for foundation students has two main strands: (1) constructing the disciplines, which for the students on my module are mathematics, statistics, operational research and/or computer science; and (2) simultaneously deconstructing English for Academic Purposes. This is only possible because the course runs from October to March, and so we have time to do this in an almost exploratory way. The 'discipline construction' element is supported by concurrent modules in students' respective subjects, and the 'EAP deconstruction' addresses the imperative to decolonise the curricula I write and teach, which aligns with my own teaching and research interests.

My approach on pre-sessionals is necessarily different; there, I don't have the luxury of time and so I feel more pressure to teach towards the assessments. I feel better about this now than I have in the past, as the assessments at my current institution allow for elements of disciplinarity and have UK HE genres designed into them at every level, and so the washback effect aligns to some extent with at least the first strand described above.

When negotiating the design of courses and assessments for both foundation and pre-sessional, I have had to fight hard against the view that tasks which prioritise ways of knowing from the social sciences, arts and humanities are somehow generic (*i.e.* not discipline-specific and therefore suitable for EGAP courses and assessments that include STEM students). This in turn appears to rely on the assumption that STEM disciplines, and especially the mathematical sciences, are language-poor or even languageless in comparison to other disciplines. I disagree with both of these positions, which informs much of my approach to teaching EAP for STEM.

3.3 HOW DID YOU GO ABOUT SELECTING TEXTS FOR ANALYSIS IN CLASS, GIVEN THE RANGE OF SUB-GENRES AND DISCOURSES?

NR: I was provided with student texts for the different assessment tasks within the research methods modules within both the School of Chemistry and School of Physics and Astronomy. I then try to find peer reviewed research and review articles on the same or similar topic alongside news or blog articles to contrast genres and language and structure choices. I also worked with content lecturers on selecting texts for formative tasks. Within my mixed cohort on the pre-sessional, we aim to have models exploring our language themes and learning outcomes but like Sanchia mentions, we would rather the students choose the texts and apply our language or literacy themes to their own texts and start to explore the different influences on the text production (discourse community).

SR: Following a Critical EAP approach, I am a big fan of having students choose the texts they read. Aside from increasing motivation and engagement with the content, I think source selection is a skill in itself that will serve them well on their degree programmes and should therefore be developed inside and outside the usual context of selecting sources for assessed work. Here are some ways I've included student-led source selection in my teaching:

- Each student chooses the text(s) they'd like to read as they work towards an individual assessment (e.g., essay or presentation).
- A student chooses a text for the whole class (or for their assigned group in the class) to read and discuss. Next week, a different student gets to choose, and so on.
- Each week, two students get to choose a text. They get 5 minutes each to explain to the rest of the class why they chose

it. Then, the class votes. The winning text is read and discussed by the whole class.

- At the end of the year/module, the students put together a collaborative annotated bibliography or reading list. The following year/ iteration of the module, students choose their reading from this list.

For me, the most interesting part is getting to hear/read the rationale behind students' choices. Sometimes it's to align with what is being studied in concurrent STEM modules; sometimes, it's exactly the opposite - they're filling in the gaps with what they wish they could study, or what is so cutting-edge that it hasn't made it to the syllabus yet, *e.g.* Large Language Models (LLMs) and Artificial Intelligence (AI).

AW: At the University of Reading, we adopt a similar approach to Tasha's when selecting research papers for students to summarise. Whenever possible, we collaborate with content lecturers to identify suitable research articles, related literature reviews, and magazine articles for teaching communication and summarising skills in our undergraduate ESAP modules.

Our collaboration with subject lecturers ensures that the chosen articles are accessible to students in terms of both content and language. We have found that the subject content should be **familiar** to students, based on concepts they have previously assimilated rather than currently studying (*e.g.*, concepts from secondary school rather than concepts from the current term). From a language perspective, the articles should be **concise** (*e.g.*, fewer than 4 pages), follow typical patterns (*e.g.*, given-new), and the magazine article should ideally be written in an **informative** rather than journalistic style.

For instance, in our English for Chemists module, we worked with the Programme Director in Chemistry to select the following articles, centred around the familiar secondary school chemistry topic of using natural polymers and enzymes to address environmental issues:

1. Dux (2017) - Plastic-eating bacteria (magazine article - contextual background)
2. Li, Smitthipong, and Zeng (2015) - Mussel-inspired hydrogels (review article - contextual background)
3. Mondal, et al. (2020) - Peptide-based gel in environmental remediation (research article)

During classes, we compare these texts in terms of their audience, purpose, and mode to understand the reasons behind their distinct

language features, including structure, register, and vocabulary. Outside of class, students engage in Academic Reading Circles (Seburn, 2016) to study and summarise each article in sequence, culminating in a group poster presentation that summarises the research article to a non-expert audience (the ESAP teacher).

This learning sequence not only helps our STEM students enhance their communication and summarising skills but also empowers the ESAP teacher to focus on their core expertise, which is teaching and assessing these skills rather than teaching the content of the students' field. In fact, if students perform well, they can effectively teach the teacher about their field—an advantageous outcome for everyone involved!

3.4 HOW DO YOU PREPARE AND WORK WITH (LISTENING) MATERIALS WHEN YOU'RE NOT AN EXPERT IN THE RELEVANT DISCIPLINE?

NR: Are EAP practitioners ever expert in any discipline we teach EAP for? And should we be moving more towards using the term expertise as opposed to an expert? For example, I have expertise in the discourse of Chemistry without the expertise of core foundational Chemistry knowledge. I have concerns about how EAP knowledge and EAP as a discipline is thought of if we start to talk about being experts in other disciplines within the EAP classroom. I also wonder how 'listening' is taught or what learning outcomes surround this skill if the EAP tutor is taking on this role of an expert in the subject rather than having EAP expertise on teaching listening strategies, the discourse of lectures and register within spoken contexts; could it lead to a lack of both knowledge transfer and a lack of focus on the learner's experience of listening.

So, my response is to reflect on what are you planning to do with the listening materials. Are you using them for comprehension or are you building up metacognitive and top-down/bottom-up listening strategies, *etc.*? I would also consider what 'content' needs to be included within your listening material to support your learning outcomes. Within my pre-sessional, my listening content is from interviews with subject lecturers on communication, culture and discourse within the sciences, which are my content and expertise as an EAP lecturer. The course then uses the content to explore the strategies above and focus on the learner's experience as a listener.

AW: To ensure listening texts align with my B2 level students, I prioritise familiar subject-specific concepts (Council of Europe, 2018, p. 57). This involves consulting subject lecturers, reviewing high school curricula, and

leveraging AI prompts. If I have the capacity, trialling concepts using the dictogloss technique refines my understanding of students' knowledge. For instance, a 2-minute listening text verbalising $E=mc^2$ is a staple for maths, meteorology, and chemistry students. The ideal listening text presents the challenge of grasping English verbalisations of familiar subject-specific concepts. I often source suitable materials from platforms like YouTube or collaborate with subject experts for custom recordings, ensuring an optimal balance between content comprehension and language focus.

What does E=mc2 mean? - YouTube

4. AUDIENCE QUESTIONS: THE POSITION AND PURPOSE OF EAP WITHIN THE ACADEMY

Exploring the broader context of English for Academic Purposes (EAP), this section addresses questions raised by the audience concerning the positioning and purpose of EAP within the academic sphere. Exploring challenges, successes, and strategies, it sheds light on the nuanced role EAP plays in academia and how it intertwines with academic practices and expectations.

4.1 HOW HAVE YOU OVERCOME THE PUSH FROM BOTH ACADEMICS AND STUDENTS TO FOCUS ON ACADEMIC PRACTICE IN THE UK (*E.G.* REFERENCING FORMATS) AS OPPOSED TO SPECIFIC LANGUAGE NEEDS?

LAM: I agree that at the outset, during the needs analysis phase, there is a widespread inclination among both academics and students to

prioritise academic practice, as perhaps they tend to perceive it as the sole option available. However, by initially directing our attention towards the students' ongoing assignment or project, we can effectively demonstrate the significance of academic skills within that specific context or genre. After this, individual language needs can be dealt with in a more holistic way through group discussion tasks on the assignment, peer review of drafts, *etc.* By actively engaging students in the learning process, I believe their individual language requirements can be addressed in a comprehensive and practical manner.

NR: I think I embrace elements of academic practice as a starting point to further explore elements from an EAP perspective. For example, you may start with a brief intro to referencing but then get texts to explore the different examples of in-text citations within different genres and across disciplines or branches of the discipline. For example, Astrophysics uses Harvard style whereas soft matter physics uses numerical. In terms of the rhetorical functions of citations and emphasis on knowledge or knower, certain disciplinary discourse features in regards to citation start to become clear. The same for literature reviews, and paragraphing, you can start from a more academic skills/literacies approach and then using more specific texts and a framework or EAP pedagogy start to explore the linguistic features of those texts within the specific discipline or sub-discipline.

SR: I think this is a very loaded question! Is that fair to say? I don't accept the binary of *academic practice* vs. *specific language needs* stated here. My approach to EAP is heavily informed by Academic Literacies and Critical EAP, so I'd say: what about reframing language as a socially and culturally situated practice, which deconstructs the above binary by placing 'language needs' in their relevant academic contexts? Similarly, what about students' rights to contribute to and take ownership of the syllabus, rather than filing it with 'needs' dictated by university staff and/or a standardised test? Returning to the spirit of your question, staff teaching concurrent modules have expected and continue to expect me to 'teach referencing' (all of it, somehow, I suppose). I do this by working with students to analyse citation practices and concomitant issues of race, gender, class and other social biases in academic knowledge production, following the theoretical frameworks I mentioned above. We also examine what it means to paraphrase and quote from sources in multiple languages, as well as how to cite authors with names that are culturally unfamiliar to students, *e.g.* family name first, two surnames, *etc.* I feel this is more important and useful in the long-term than teaching reporting verbs, for example, but I accept that not every student or teacher feels the same.

4.2 HOW ARE YOUR ROLES FUNDED WITHIN YOUR INSTITUTIONS?

NR: My in-sessional role works on a secondment model, where my Schools pay for my time. I think this helps schools feel that you are not the language fixer but someone who is prepared to learn and engage with the discourse community within the Schools.

AW: Funding for my role as Module Convenor of ESAP modules at the University of Reading comes from student fees, directed to the NUIST Reading Academy—a collaborative venture between the University of Reading and NUIST (Nanjing University of Information Science and Technology) in China.

LAM: Our Academic Centre for International Students (ACIS) at Southampton receives funds from the various faculties across the University for the work and support we provide. Our Joint Education Institute with Harbin Engineering University, China also fund my role as Programme Lead and that of our flying faculty tutors sent from our department. Our Faculty of Engineering and Physical Sciences are the account holders for this project.

4.3 HOW DO YOU DEAL WITH ISSUES OF ATTENDANCE, WHETHER STUDENTS SEE THE VALUE OF EAP, AND LINKS WITH ASSESSMENT?

NR: I think you have to consider how you are positioning EAP or are positioned within the in-sessional programmes you teach on. I have noticed an increase in saying we 'support' students in X or we support this assessment. I think support, while well intended, means that we are potentially devaluing what we do. We need to be clear on what we teach and take ownership of programme level learning outcomes or graduate attributes with being a skilled and informed communicator of the discipline within academia and the profession. We need to be seen as lecturers with a 'content' strand which is achieved through communicative lessons and transferable to assessments. We, therefore, need to be part of a programme not an additional supportive element.

https://insessional.leeds.ac.uk/

AW: Attendance, perceived value, and assessment alignment are crucial elements of our EAP approach. To encourage attendance, we allocate 10% of the module mark for active participation, aligning with our pedagogical emphasis on face-to-face interaction for communicative and task-based learning. Stressing the value of our modules, we connect

learning outcomes to the University of Reading's (2018) graduate attributes, highlighting the skills vital for students' future careers. In terms of assessment links, constructive alignment principles (Biggs, 2003) ensure cohesion between learning outcomes, teaching, and assessments within the module, while our syllabus focuses on transferable skills, aligning with other modules and fostering a holistic educational experience. Overall, our modules, benchmarked to CEFR B2 (Council of Europe, 2018) and FHEQ Level 4 (QAA, 2014, p. 21), strategically position learning within Vygotsky's (1978) zone of proximal development (ZPD) and Krashen's (1981) input hypothesis ('i+1'), ensuring both relevance and achievability.

SR: The key to maintaining high levels of attendance is being able to convince departments to make the academic skills module a credit bearing one, however, understandably this is not possible in many situations. Other than this, I believe that closely aligning the ESAP syllabus to the upcoming content modules and assessment is essential in order for students to see the value of our sessions. Providing and analysing model scripts as the basis of any session is way to maintain engagement. All of these suggestions require collaboration with the content lecturers which can in itself be a challenge. Asking permission to audit some of the content lectures and having a chat at the end, is often an effective way to begin building these crucial relationships.

4.4 WHAT SUPPORT DID YOU GET COMING INTO EAP FOR STEM?

LAM: My experience of entering EAP for STEM was less seamless compared to Tasha's. The task involved developing course design, syllabus, and assessment with minimal assistance or resources provided by the faculty. Perhaps the engineers did not fully comprehend the extent to which the information was overwhelming for the non-STEM specialist. Additionally, there were very limited responses to inquiries regarding information, assessment methods, marking criteria and models. Building trust has required four years of assertiveness, persistence, and continuous 'friendly' networking. This involved attending content lectures and faculty board meetings, while consistently demonstrating our commitment to supporting students. Finally, I have successfully established robust and enduring relationships and gained trust among faculty members, enabling me to now engage in collaborative efforts and exchange of ideas and resources.

NR: The best support I got was time and trust to go into schools exploring the pedagogies and the genres students were being exposed to. I had

many very welcoming meetings with content academics, but their understanding of the students' needs was not always particularly helpful and often came from a deficit view of language. I also tried to build up a community of practice with other EAP practitioners working within STEM contexts to explore needs analysis from an EAP perspective.

AW: Entering English for Academic Purposes (EAP) for STEM, our initial support was minimal, encountering inadequacies in resource allocation within our transnational education (TNE) partnership. ESAP modules lacked sufficient resources on both ends, leaving teachers unassisted. Notably, teachers received no additional training for ESAP instruction. In response, we crafted a sustainable course designed for any language teacher, irrespective of ESAP training. The key strategy involved emphasising commonalities, such as high-frequency vocabulary, to create a curriculum that maximized teachers' linguistic expertise. Moreover, our approach empowered students to contribute significantly, placing the 'S' in ESAP. This collaborative synergy between students' subject knowledge and teachers' linguistic skills became the cornerstone of our sustainable and adaptable ESAP program, tailored to the demands of TNE.

5 AUDIENCE QUESTIONS: FOCUS ON EAP FOR MATHEMATICS

This section focuses on the audience's inquiries related specifically to the realm of mathematics in EAP. Unveiling insights into teaching strategies, vocabulary nuances, and unique challenges within the mathematical domain, this section offers a tailored exploration of the distinctive considerations and methodologies associated with EAP for mathematics.

5.1 CAN YOU SAY A BIT MORE ABOUT THE IMPLICATIONS FOR TEACHING OF THE NOTION THAT ‘MATH IS A METHOD’? COULD THIS ALSO APPLY TO COMPUTER SCIENCE WRITING?

SR: I've linked the article that I was citing when I mentioned this concept: Graves et al. (2013). See pp. 427–430 ('Absent sections') for a fuller answer to the question I think you're asking. To summarise, the authors

say that this is only possible for two reasons: firstly, because maths is a cognitive rather than an empirical science, unlike the other STEM subjects; and secondly, because mathematical methods are agreed across the discipline, unlike other non-STEM subjects such as education or the language sciences.

To address your comment about writing in computer science, I think it depends on which of the two characteristics above computer science adheres to. As a non-specialist, I would venture a guess that the second applies, but the first perhaps does not.

AW: The notion that 'maths is a method' carries significant implications for ESAP teaching. This perspective highlights the intrinsic connection between mathematics and its methodological nature. In ESAP for maths, this concept manifests in the following ways:

1. **Vocabulary Production**: Prioritising context-specific high-frequency vocabulary relevant to mathematical discourse, ensuring students are fluent in expressing mathematical concepts precisely.
2. **Speaking Skills**: Emphasising spoken interaction by engaging students in activities that enhance their ability to articulate mathematical proofs and discuss complex mathematical methodologies.
3. **Mediation Skills**: Integrating strategies that empower students to effectively mediate mathematical ideas, honing their capacity to explain intricate concepts and summarise mathematical data.
4. **Reflection**: Fostering self-awareness through reflection on effective vocabulary learning and communication strategies, instilling a lifelong learning approach to language proficiency.

In summary, the assertion that 'maths is a method' underscores the methodological essence of mathematics, guiding ESAP teaching to focus on the fluent production of mathematical vocabulary, the spoken expression of mathematical concepts, the effective mediation of mathematical ideas, and the cultivation of reflective practices tailored to the unique demands of mathematical discourse.

5.2 IS THERE A MATHEMATICS VOCABULARY LIST? IF SO, HOW MIGHT IT BE USED IN TEACHING?

NR: My colleagues at Leeds took a corpus-based approach for supporting the vocabulary within their foundation maths lectures. Take a look at their approach and article in the Language Scholar:

The Lexis of Maths Lectures | The Language Scholar (leeds.ac.uk)

SR: I am aware of two such lists: the Maths Academic Vocabulary List and the Oxford Dictionary of Mathematics. (There are also separate lists for adjacent disciplines like computer science and economics, but I digress.) I have used parts of these lists to draw students' attention to some of the key features of mathematical lexis. Halliday (1975) describes these discipline-specific features as follows: a very high level of polysemy, or words with multiple and seemingly disconnected meanings (*e.g.* 'set', 'even', 'random'); compound nouns (*e.g.* 'clockwise', 'output'); longer fixed phrases (*e.g.* 'right-angled triangle', 'lowest common multiple'); and words with Greek or Latin roots (*e.g.* 'parabola', 'binomial', 'asymptote'). I've found these concepts to be useful not just in themselves but as a jumping-off point to discuss, for example, passive and active vocabulary, and what it really means to 'know' a word.

AW: At the University of Reading, we adopted an off-the-shelf 'Maths and Measurement' word list from the Oxford Advanced Learner's Dictionary, aligned with our students' CEFR level. Our list, inclusive of synonyms like 'times' and 'multiply', assures a flexible and sustainable syllabus. This adopted list serves as a versatile teaching tool, offering curated stem words categorized by importance. In class, we emphasise spelling, pronunciation, multiple meanings (polysemous lexis), word families, and collocations, utilizing tools like the Oxford Advanced Learner's Dictionary, Quizlet, and semantic maps. Engaging techniques such as dictogloss, gap fills, and games lead to active learning. The journey concludes with a vocabulary test, aligning with the assessed learning outcome. In the EMI classroom setting, our tailored 'Maths and Measurement' word list (Oxford University Press, 2023) is a dynamic tool designed to cultivate productive lexical knowledge. The key learning outcome centres on students seamlessly using the main, high-frequency subject-specific vocabulary (Council of Europe, 2018, p. 132). Emphasizing spontaneity, the goal is for students to employ this specialised vocabulary organically, without relying on a dictionary or a machine translator. This approach aligns with the oral nature of mathematical knowledge transfer in the EMI context, fostering a deep and intuitive command of essential terminology.

6 CONCLUSION

The BALEAP 2023 Biennial Conference Symposium on EAP for STEM unveiled the dynamic interplay between the specificity and universality inherent in crafting effective English for Academic Purposes (EAP) courses within Science, Technology, Engineering, and Mathematics (STEM). Guided by Natasha Rust, Aaron Woodcock, Sanchia Rodrigues, and Lori-Ann Milln, the symposium meticulously explored the nuanced tension between understanding the distinct differences within and between STEM subjects and the imperative to identify commonalities for sustainable ESAP courses.

At the heart of the discussions lay the intricate balance required by EAP practitioners. On one hand, there was a compelling call for a granular comprehension of the unique linguistic features, discourse structures, and genre demands embedded within individual STEM disciplines. The symposium spotlighted the necessity of tailoring EAP interventions to address the specific language nuances of subjects such as Physics, Chemistry, and Mathematics.

On the other hand, an equally pressing need emerged for a broader perspective that encompasses the common language threads woven across STEM domains. The tension became palpable between the demand for subject-specificity and the drive for universality. EAP teachers grapple with the challenge of creating flexible, sustainable courses that transcend disciplinary boundaries, enabling any EAP

instructor to navigate the English Medium Instruction (EMI) classroom effectively.

This inherent tension invites reflection on the delicate equilibrium required in curriculum design and pedagogical approaches. The symposium participants explored the intricacies of Content and Language Integrated Learning (CLIL) strategies, register analysis, and collaborative initiatives, seeking a harmonious resolution to the apparent dichotomy between specificity and universality in EAP for STEM.

As the dialogue continues, EAP practitioners are poised at the intersection of divergence and convergence, navigating the distinctive terrains of STEM disciplines while simultaneously illuminating the common pathways that foster accessible, sustainable EAP courses. The tension serves as a catalyst for ongoing exploration, inspiring educators to unravel the intricacies of EAP for STEM with an appreciation for both the unique and shared aspects of language across disciplines. Join us in this perpetual journey of understanding, as we navigate the dynamic landscape of English for Academic Purposes in the diverse realm of STEM education. Here is a link to our website with details on how to join: https://baleapstemsig.org/

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Notes

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