



## Supporting transitions into HE through sustainable chemistry: Information literacy and co-creation

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### ABSTRACT

Our Sustainable Chemistry module (established 2013) has evolved significantly, adapting to the changing perceptions of what sustainability means to, and requires of, education, and the shifting educational paradigms that have characterized teaching in Higher Education in the UK including transnational degrees, distance learning, decolonize the curriculum and co-creation, the rise of active learning approaches, the surging skills agenda, and generative AI.

In this vignette we reflect on our approach to seeing change as an opportunity to enhance our students' transition into higher education while maintaining core values that focus on student success. We will also briefly share our insights into where next for a module like this and consider the new challenges before us.

**Keywords:** education for sustainable development, employability, student success, co-creation, information literacy

### Context

In 2013 we established our Sustainable Chemistry module as part of our BSc Chemistry programmes. Our module has adapted to opportunities such as increased awareness of sustainability, distance learning and transnational degrees, focus on active learning and assessment through coursework, decolonizing and co-creation of the curriculum, and emphasis on skills and the rise of generative AI. We have delivered a module that has maintained consistent, excellent student attainment (pass rate >84% since 2020-21). We have linked degree-relevant skills aimed at supporting transition into higher education such as information literacy emphasising peer-reviewed scientific literature and analysing chemical phenomena through social, political, and environmental lenses with employability skills including communication in different formats for different audiences and industry relevant approaches to sustainability thinking.

### Key features

Our module has broadly written learning outcomes and is a survey of topics linking chemical concepts to sustainability, assessed through coursework. Through careful curriculum and assessment design we have enabled students to co-create and personalize their curriculum, particularly by valuing choice of topic for assessment enabling students to pursue areas of interest to them and see themselves reflected in our curriculum.

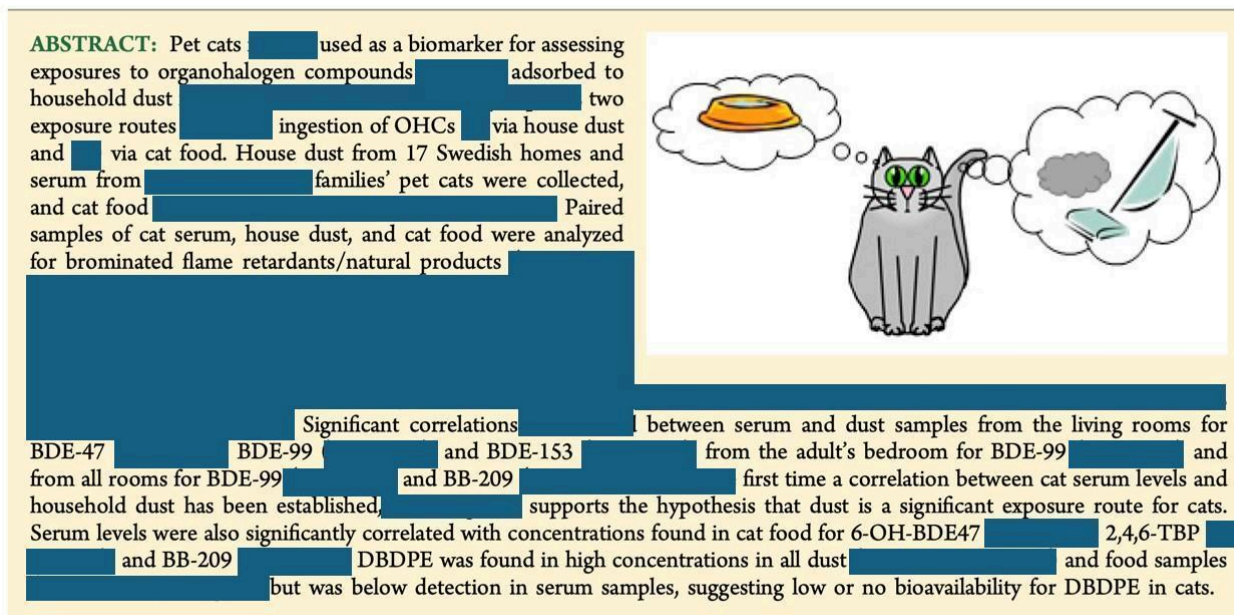
### Information Literacy

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Developing information literacy in 1st year university students is critical to an effective transition, particularly for Sustainable Chemistry where we are teaching knowledge not yet in textbooks. Primary scientific literature is essential for both our teaching and our student's work however there is unease around asking 1<sup>st</sup> years to read primary literature. Inspired by Waller et al. (2019) we recognised that our students would need support to find literature and determine what was worth reading, particularly as our coursework assessment placed the onus on our students to convey accurate scientific information. We acknowledged that reading and understanding primary literature is challenging for experts (Rhead, 2019; Rhead & Little, 2020) with different approaches being adopted (Hubbard et al., 2022). We identified transition related barriers such as unfamiliarity with the structure of articles and high levels of jargon and so designed our information literacy arc, a series of activities and formative assessments spanning several teaching sessions.

For an engaging introduction to finding information, we reimagined our digital Escape Room from campus sustainability (Haxton, 2021) to a series of chemistry puzzles requiring information literacy to 'escape' (from 2021 onwards). This gamified approach allowed us to identify where students needed guidance (Chesworth 2019). We developed a hybrid approach to reading scientific journal articles, starting with blackout poetry to redact the abstract of an article to simplify language, emphasising reading for gist not comprehensive understanding (figure 1). Norrgran Engdahl's work on chemicals in household cats was selected because we felt the topic was tangible (2017). We introduced a strategy to identify key aspects of the abstract: background context, aims, methods, and results, noting that we read for different purposes (Hubbard et al., 2022), complimented by a session in another module which focused on primary literature for reporting scientific findings (McGarvey et al., 2020).

Our arc culminated with a formative news article summary of a paper which consolidated reading and summarizing scientific information for a general audience, then a summative academic essay. We set clear but achievable guidelines for the essay, a minimum of three peer-reviewed scientific journal articles and five sources in total, a degree of choice in the topic and latterly a more specific theme for the essay, which balanced freedom of choice of topic with the substantial assistance available through generative AI tools.



**Figure 1.** Blackout Poetry: Original abstract of Norrgran Engdahl et al., (2017) with words redacted. Permission to reuse the abstract has been granted by the ACS and further permissions related to this material should be directed to the ACS.

### Decolonising and co-creating the curriculum

Considering how to decolonise our curriculum challenged us to reconsider context and examples, reflecting a greater range of cultures. We started when we ran the module by distance learning for a programme with a Chinese University. Our module was strongly grounded in western European perspectives, and we had no sense of what sustainability looked like for our Chinese students. The easiest solution in these cases is simply to ask the students, and we devised two approaches. The first was producing videos in groups showing sustainability in their campus and city, requiring English or subtitles to boost the students' English skills. The second was international group work, placing UK and Chinese students into groups to discuss the similarities and differences. We neglected to foresee that the common ground between the cohorts was gossip about teaching staff! (Haxton & Darton, 2019)

Following the academic essay, students worked towards a capstone assessment, producing a magazine style article on an 'emerging topic in sustainable chemistry' aimed at a general audience. This co-creation reflects the broad nature of our topic and lets students engage with something they find interesting in a context of their own, within supportive guidelines. This is substantiated by our excellent module average and pass rate across multiple cohorts. We evaluate the module with the same questions, which indicate students felt that module coursework helped them develop skills (77%), that sustainability was relevant to their degree (77%) and that the module helped them understand sustainability better (85%). Data from module evaluations 2023 – 2025 obtained and used with ethical approval REC number 2023 – 0325 – 414. We remain perplexed by a handful of students who request short tests or exams to 'make them pay attention' and note that interest in sustainability varies each year, often mirroring global political trends.

### Employability and generative AI

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We recognised the importance of skills and using the flexibility of broad learning outcomes we have embedded activities designed to develop employability skills (Galloway, 2017) and the UNESCO competencies for sustainable development including team working, problem solving and negotiation (Rieckmann, 2017). We have created mini dynamic problem-based active learning sessions (Overton & Randles, 2015) which investigate topics that require chemical knowledge in a social or political context. We put students into scenarios that require rapid decision making based on limited evidence, with no easy solutions, only less bad ones. This challenges the students on the emotional level with frustration being a common response, coupled with the realization that this is typical of 'real world' situations.

Most recently we have adapted to the rise of generative AI tools, recognizing that critical appraisal of the outputs is a key employability skill. We created an information literacy task asking students to fact-check text with references produced by prompting ChatGPT and Microsoft Copilot. (Open AI, 2023; Microsoft, 2025) The texts included hallucinated references (Goddard, 2023), green washing (de Freitas Netto et al., 2020), and scientific inaccuracies. Students consolidate their skills in using our library search facilities to verify that cited articles existed and apply their knowledge of fact checking and greenwashing to re-write the texts in a more chemically accurate way. We do not ask students to use generative AI, because many students have legitimate ethical objections.

### Reflections

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On reflection, the design of the module to enable student choice of assessment topic and broad learning outcomes has allowed us to take an adaptive approach to the curriculum with frequent updates to reflect emerging topics. We acknowledge that this approach may not be appropriate in all contexts and that constant redeveloping teaching sessions is time-consuming.

We focus on making use of timetabled sessions to develop skills, designing activities that work with minimal technology (pen and paper, but equally well on tablets), and adopt an approach where in-class tasks are reviewed and general feedback given within the session, removing the need to give individual feedback on multiple items. This makes these activities less resource intensive and more scalable – more sustainable across broader contexts – and is integral to the future development of the module.

In 2025 the module returned to a 15-credit structure, offering both choice of topic and assessment type for the final assessment, and encouraging continuous engagement through a portfolio of tasks designed to support the students with information literacy, UNESCO sustainability competencies, and chemistry specific skills. We believe these set our students up well for later years of their degree. The learning outcomes remain broadly written; we will continue adapting to the rapid rate of change in sustainability thinking.

### Biographies

*Katherine J. Haxton*, Senior Lecturer in Chemistry, is module leader of Sustainable Chemistry and a National Teaching Fellow. She believes in a pedagogy of compassionate connectivism and is enchanted by shiny new teaching methods and assessment that values both conceptual understanding and skills.

Richard J. Darton, Senior Lecturer in Physical Chemistry, is a Materials Chemist and focuses on the relationships between structure, function and application of materials and their role in solving global sustainability related challenges. He believes in providing students with the necessary skills to see the chemical connections between the natural world and industrial processes.

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