ViCE/PHEC

UNIVERSITY OF SURREY

29-30 August 2024

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Welcome to ViCEPHEC 2024

A very warm welcome to all attendees of the Variety in Chemistry Education and Physics Higher Education Conference, ViCEPHEC 2024, along with the preceding CiTP, RSC HEG, and IoP HEG Satellite meetings. We are incredibly excited to host you all in lovely Guildford, at the University of Surrey. The team at Durham did an amazing job of bringing the conference back in-person last year; we hope to be a fitting follow-up act. The Physics & Chemistry community made last year's event as warm, welcoming and memorable as I remember of previous years, which we are looking forward to continuing this year. ViCEPHEC is particularly close to my heart as a welcoming space for new attendees and community members; I hope this year also continues in that spirit.

We stand by the same Code of Conduct that has kept ViCEPHEC strong throughout the past few years, that is designed to encourage open and constructive dialogue, and ensure an enjoyable and valuable sessions for all. We are pleased that the abstract selection process has led to a great range of diverse talks and speakers, different backgrounds, experiences, and career stages, particularly abstracts demonstrating collaborative work with students. We would like to thank all who are contributing through oral or poster presentations, along with workshops and labs. We would also like to thank and welcome our invited keynote speaker, Ed Foster from Nottingham Trent University, who will be speaking on Thursday about the important issue of student engagement. We also wish to thank Friday's keynote speakers: on behalf of the RSC, Prof Gita Sedghi (University of Liverpool); and for the IoP, Dr Matt Mears (University of Sheffield).

Thank you to all the people who have helped to make ViCEPHEC 2024 a reality, specifically the Local Organising Committee and conference team at Surrey, who have put in so much work behind the scenes; the ViCEPHEC National Steering Committee, who have been a constant source of support throughout the process; the Abstract Selection Committee who have put together a fantastic programme; and lastly all the helpers and technical staff who help ViCEPHEC run smoothly.

We hope that attending ViCEPHEC is a thought provoking, welcoming and worthwhile experience for you. Should you need any support or have any comments and queries during the conference, you can email ViCEPHEC24@surrey.ac.uk, tag us on X (Twitter) @vicephecconf, or find one of the local committee members and helpers. Pictures and names of all the local committee are below and on the next page so you can spot us. We look forward to seeing you all in attendance!

Dr James Wright
Chair of the Local Organising Committee

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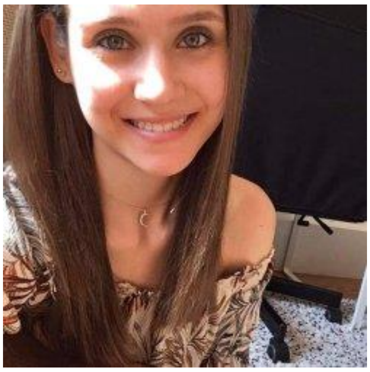
Dr Nathaniel Bingham


Prof Esat Alpay


Dr Lewis Baker


Dr Marion Heron


Dr Lisa Morrison


Dr Noelia Noël


Dr Alison Taylor


Dr Scott Turner

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Ethos & Code of Conduct

Ethos

ViCEPHEC is a national conference that brings together educators in chemistry and physics to discuss and share developments, ideas, and good practice in learning and teaching at tertiary level.

ViCEPHEC is friendly, discursive, and stimulating, and that culture relies on our excellent speakers and the contributions from our participants. We set out below a **Code of Conduct** for the meeting to encourage open and constructive dialogue that will ensure enjoyable and valuable sessions.

We value the participation of each member of our community and want all attendees to have an enjoyable and fulfilling experience. Accordingly, all attendees are expected to show respect and courtesy to other attendees throughout the conference and at all conference events.

To make clear what is expected, all attendees, speakers, organisers, and volunteers at ViCEPHEC24 are required to conform to the following **Code of Conduct**.

*This **Code of Conduct** is based on that produced by Michael Seery for MiCER 2020, by Vicky Mason for ViCEPHEC 2020, for the EAMS Conference 2021, and as used in ViCEPHEC 2023.*

Elements of this Code of Conduct have been adapted from https://evidencebase.org.uk.

Further useful information on accessibility and inclusion can be found at https://northernpowerinclusion.org/equality-and-inclusion-practices/

Code of Conduct

All conference attendees are required to abide by the Code of Conduct.

Please find below a Code of Conduct to support an inclusive event, and which we hope encourages open and constructive dialogue. We would like everyone to enjoy the event and feel able to contribute to the discussion, while treating everyone with dignity and respect. Specifically, we would ask that everyone:

- respects everyone’s pronouns.
- communicates in an appropriate manner for a professional audience.
- is considerate of people from different cultural backgrounds.
- is considerate and kind in our communications, taking care not to insult or put down other attendees.
- agrees that exclusionary jokes or any other form of harassment are not appropriate. [1]
- contributes to the discussion in a constructive and positive manner.
- is mindful of the diversity of all participants.
- values everyone’s contribution equally.
- avoids commentary and is careful not to share communications disclosing anyone’s personal circumstances or experience.

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Participant Diversity

The audience will comprise of those new to the field and those who are world leaders in the field. We want everyone to enjoy the meeting and contribute their ideas to discussions, and we will treat each other with dignity and respect. All communications in the meeting will be mindful of the diversity in our group.

Speaker Diversity

As well as audience members, speakers are purposefully selected from a range of career stages, educational settings, and roles. We have invited speakers because of their known expertise in particular areas usually disseminated in some form by publication, or other known significant activity. Speakers have offered their time voluntarily. We welcome discussion, and all communication will be appropriate for a professional audience, mindful of the diversity of backgrounds and educational settings of our speakers.

Discussions

Audience correspondence in this meeting will be through face-to-face interactions and online through twitter. We encourage participants to engage in ongoing discussions fully and freely. These can include ongoing commentary and informal discussion, light-hearted conversation, and questions for the speakers. Discussions will be dynamic, and we hope that the space is a welcoming one where audience members can fully engage. We will be mindful of the tone of our speech and avoid commentary on anyone's personal circumstances or experiences. We will avoid commentary relating to political matters. We will be kind to each other and will not insult or put down other meeting attendees.

We are very excited about ViCEPHEC24 and we look forward to bringing together educators in chemistry and physics for friendly, discursive, and stimulating conversations regarding developments, ideas, and good practice in learning and teaching at tertiary level.

Anyone observing or experiencing abusive behaviour or harassment while engaging in this conference is encouraged to contact the organising committee: vicephec24@surrey.ac.uk.

Credit for the original version of this statement goes to Michael Seery.

This Code of Conduct have been adapted from the ViCEPHEC23 organising committee's work.

Further useful information on accessibility and inclusion can be found at https://northernpowerinclusion.org/equality-and-inclusion-practices/

[1] Harassment includes offensive verbal comments, deliberate intimidation, stalking, following, harassing photography or recording, sustained disruption of discussions, inappropriate physical contact, and unwanted sexual attention.

Diversity

Support of Diversity

We are actively seeking to increase the diversity of our attendees and speakers through our calls for proposals and through dialogue with the communities we serve.

This is an ongoing process.

Here are some ways you can help us build a more diverse conference experience:

- Recommend appropriate speakers to the conference organisers, by contacting the organising committee: vicephec24@surrey.ac.uk.
- Forward our call for abstracts to relevant affinity groups with the message that we are looking for a diverse set of speakers. Suggest to potential speakers that they submit an abstract.
- Strongly encourage submissions from early career colleagues and students.
- Where the work is from a collaborative team, please encourage students and early career colleagues to be part of the presenting team (there can be more than one presenter for talks, posters and workshops). The abstract selection process will positively consider submissions that provide the opportunity for students and early career colleagues to present. Suggest ways that the onsite conference experience can be more welcoming, supportive, and free from intimidation and marginalisation. Share your ideas and best practices for how we can realise our vision.

We value diversity in the communities we bring together, and we welcome your contributions to bringing balanced representation of the richness of our collective human experience.

Sponsors and Supporters

The National and Local Organising Committees are grateful to the following sponsors for their generosity and support.

RSC INTEREST GROUP
HIGHER EDUCATION

The Royal Society of Chemistry's Higher Education Group is the proud sponsor of ViCEPHEC and of the poster prize(s) for chemistry and/or chemistry-related posters presented at the conference.

IOP Institute of Physics
Higher Education Group

The Institute of Physics Higher Education Group is the proud sponsor of the conference and of the Lillian McDermot Poster Award for best physics education research poster presentation.

SCHOOL OF CHEMISTRY AND CHEMICAL ENGINEERING
UNIVERSITY OF SURREY

The School of Chemical and Chemical Engineering as well as the School of Maths, Physics, and Space at the University of Surrey have both provided additional monetary support for ViCEPHEC 2024.

DigitalEd möbius

DigitalEd's sponsorship of ViCEPHEC will include a stand in the lobby.

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dixon's sponsorship of ViCEPHEC will include a stand in the lobby.

LearnSci's sponsorship of ViCEPHEC will include a stand in the lobby.

ROMIL's and Shimadzu's sponsorship of ViCEPHEC will include a stand in the lobby.

UVISON's sponsorship of ViCEPHEC will include a stand in the lobby.

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Accessibility

The location of the conference will be mainly held in the Surrey business school, which contains ramps to access, lifts to upper floors, and accessible toilets on all floors. The University has supported an accessibility guide with AccessAble to support staff, students, and visitors to get to and around our sites and buildings more easily. All access guides are available on the AccessAble website and app.

Along with the organising committee and AccessAble, guests can discuss specific needs or requirements in confidence with the Purple Network before or during the event. The Purple Network are a safe space for those with experiences of disability and chronic illness. The chair of the Purple Network is Sarah Clements and the Purple Network can be contacted through the following email address: purplenetwork@surrey.ac.uk

Religious Support

The Religious Life and Belief Centre at the University of Surrey is home to all our spiritual, faith and belief communities on campus. It is run by a team of 26 people including 16 Chaplains (Faith and Belief Workers) from eight faiths and the humanist tradition; all are welcome no matter one's faith:

We are a vibrant multi-faith, multi-cultural community and a wonderful place to learn, teach and grow. You are welcome, whatever faith or belief you have.

The University also has a dedicated Islamic Prayer Room, that is open throughout the day, and Friday at 1 pm, the University Hall is opened for Friday Prayers, led by a Muslim Imam. Access to the Religious Life and Belief Centre and Islamic Prayer Room, can be provided to delegates before or during the event, with the chaplaincy always welcoming to guests. The Cathedral is also open to all visitors. Pastoral care is always available through the chaplaincy, which all visitors will have access to.

What to do in Surrey?

The University is a short walk from Guildford town centre, which contains many restaurants, bars, department stores, the G-Live theatre, and Guildford castle. Within walking and bus distance are also The Gym Group, Guildford Spectrum (bowling, ice-skating, and swimming), and the University owned Surrey Sports Park (gym, sauna, swimming, squash, and climbing). The University is also within walking distance to the Surrey Country Cricket grounds. The area surrounding Guildford town is particularly beautiful, where the town is situated at the edge of the Surrey Hills area of outstanding natural beauty. Level walks can also be enjoyed along the towpath which runs alongside the River Wey overlooking Dapdune Wharf (National Trust). We highly recommend visitors to see some of these sights and walks if you get the chance!

Safety

If you are on campus and require emergency support, please contact Campus Safety on **Internal Phones: 3333** or **External Phones: 01483 68 3333**.

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Venues and Programme

Buildings at Surrey all have two-letter codes (i.e., MS) and room numbers precede the letter codes, with floor numbers following (e.g., 03 MS 01 is room 03, on floor 01, of the MS building).

Find a campus map and directions to our venues by clicking here (page 2) or asking any of our friendly local committee and helpers.

Session venues

03MS01	Main lecture theatre for plenary sessions	Ground floor MS building
MS Foyer	Registration, sponsor stands & refreshments	Ground floor MS building
AP Foyer	Poster boards	Ground floor AP building
32MS01	Parallel sessions & workshops	Ground floor MS building
39MS02	Parallel sessions & workshops	First floor MS building
80MS02	Parallel sessions & workshops	First floor MS building
75MS02	Quiet working space	First floor MS building
30AY01	Lab-based workshops	AY building*

*The AY building is a roughly five-minute walk from the main conference venue. Conference helpers will gather at the registration desk in MS building, to guide delegates to these sessions **ten minutes** before sessions in AY begin.

Room 75MS02 can be used as a quiet working space throughout the conference except for during session 6 when the room will be used as a drop-in for advice on ViCEPHEC bids.

Notable locations

Stag Hill Campus (Page 2)

Academic Buildings:

- 3 (D2) – Austin Pearce Building (AP) – Poster location
- 9 (E3) – Dorothy Hodgen Building (AY) – Chemistry Teaching Labs
- 26 (E4) – University Hall
- 30 (E2) – Rik Medlik Building (MS) – Main conference location
- 31 (E3) – Robert Boyle Building (AZ) – Chemistry
- 32 (C4) – Roundhouse – Faith and Reflection centre
- 33 (E3) – Senate House – Campus safety (Ground floor)
- 37 (E3) – Thomas Telford Building (AA) – Islamic Prayer Rooms (Ground Floor)

Café's / Restaurants:

- 2 (E4) – Hillside Food Court
- 7 (E2) – The Lake

Car Park:

- 3 (D1) – Permit Parking – Main Conference Parking

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ViCEPHEC24 programme - Thursday 29th August

Click on a session number, name or abstract number to jump to the abstract page. Venue information displayed in **blue bold font**.

9:30 - 10:00	**Registration & refreshments, MS Foyer**			
10:00 - 10:10	**Prof Bob Nichol**, University of Surrey, **03MS01**			
10:10 - 11:00	Keynote Speaker: **Ed Foster**, Nottingham Trent University, **03MS01**			
11:00 - 11:20	**Break & refreshments, MS Foyer**			
	1.1 – Generative AI in HE **03MS01**	***1.2 – Transitioning to HE*** **39MS02**	***1.3 – Inclusive lab learning*** **80MS02**	***1.4 – Belonging & community*** **32MS01**
	1.1.1 – Exploring the Role of Generative AI in Python Programming Skills within Physics Higher Education Dr Arin Mizouri & Dr Christina Zambon *Durham University*	1.2.1 – End-to-end tailored active blended learning Prof Simon J. Lancaster *University of East Anglia*	1.3.1 – Mental health, anxiety, and the chemistry laboratory across the UK: WELLChem National Study report Dr Patrick Thomson *University of Strathclyde*	1.4.1 – Sense of Belonging and Perceptions of learning of STEM Undergraduate students Toluwalase Akanbi-Akinlolu *King's College London*
11:20 - 12:20 Session 1	1.1.2 – Comparative evaluation of identity and quality of AI and Humam-generated physics essays Dr Oto-obong Inyang & Dr Elise Agra *Durham University*	1.2.2 – Informing Student Support Mechanisms through Measurement of Student Confidence in Core Chemistry Topics Dr Dylan P. Williams *University of Birmingham*	1.3.2 – How Do We Make Teaching Laboratories More Inclusive? Charlotte Oliver *University of Oxford*	1.4.2 – The Role of Participating in Physics Communities in the Development of Physics Identity: A Study of Physicists in an Academic Environment Lauren Muir *University of Glasgow*
	1.1.3 – Student Portfolios: Adding GAI Resilience to Final Year Projects Dr Laura Hancock *University of Birmingham*	1.2.3 – Bridging the Gap: Enhancing Transition to Year 1 Practical Chemistry through a new Introductory Activity Dr Chris Marsh *University of Leicester*	1.3.3 – Characterising a new undergraduate teaching laboratory through the lens of sensory overload Dr Benjamin E. Arenas *University of Edinburgh*	1.4.3 – Joining the 'Chemunity': Improving the transition into university chemistry Dr Euan Doidge & Dr Charlotte L. Sutherell *Imperial College London*
12:20 - 13:40	**Lunch & poster session, MS Foyer & AP Foyer**			
	2.1 – Authentic assessment **03MS01**	***2.2 – Diversity and inclusivity in STEM HE*** **39MS02**	***2.3 – New tools for assessment & feedback*** **80MS02**	***2.4 – Learning from the pandemic*** **32MS01**
	2.1.1 – Introducing an authentic assessment to a second year applied analytical chemistry module Dr Terri Grassby & Dr Bolanle Oloyede *University of Surrey*	2.2.1 – Exploring the Barriers and Facilitators of Neurodivergent Learners in Tertiary Chemistry Education Dr Niamh O'Mahoney *University College Cork*	2.3.1 – Students' Perspectives on First Year Chemistry Tutorials Dr Claire McDonnell *Technological University Dublin*	2.4.1 – Overcoming poor performance in remote exams Prof Sally Jordan *The Open University*
13:40 - 14:40 Session 2	2.1.2 – Undergraduate students as chemistry lecturers – Peer-to-peer teaching and authentic assessment Dr Juliet Collins & Dr Francesca Dennis *University of Bristol*	2.2.2 – How can we increase the diversity of physics UG students? Dr Maire Gorman *University of Bristol/ University of Sussex*	2.3.2 – Building a better quiz for Newtonian mechanics Ashutosh Kumar Pathak *The Open University*	2.4.2 – A reflective analysis of freeform revision sheets in closed-book exams – did they have a positive outcome on exam performance? Dr Neil S. Keddie *University of St Andrews*
	2.1.3 – Reducing Assessment Without Losing Engagement in a First Year Chemistry Practical Course Dr Tom Anderson *The University of Sheffield*	2.2.3 – Predictors and Socio-Demographic Disparities in STEM Degree Outcomes: A ten-year UK study using Mixed-Effects Logistic Regression Dr Andrew Low *University of Liverpool*	2.3.3 – Evaluative judgement in chemistry education – researching how chemistry students understand what quality looks like in their work Alexander Palmer *King's College London*	2.4.3 – Increasing engagement through flipped learning in Forensic Chemistry (learnings from the pandemic) Dr Patrick Sears *University of Surrey*
14:40 - 15:00	**Break & refreshments, MS Foyer**			
	30AY01	**39MS02**	**80MS02**	**32MS01**
15:00 - 16:00 Session 3: Workshops	3.1 – Inclusive Laboratory Teaching: Building a new approach through a UDL lens Dr Matt Mears *University of Sheffield* Dr Paul Duckmanton & Dr Sam Perry *University of Southampton*	3.2 – Concept Maps as Assessment Tools in STEM Education Milena Vujanovic *University of Leeds/ CERN*	3.3 – Exploring Chemistry Transferable Practical Skills: Insights from the National Practical Skills Inventory Dr Anna Bertram *University of Nottingham* *Dr Craig Campbell, Dr Megan Midson & Dr Malcolm Stewart* *University of Oxford*	3.4 – Qualitative data analysis: A hands-on introduction to Thematic Analysis - how and when to use it Dr Helen Coulshed *King's College London* *Dr Anna Roffey, UCL* *Dr Charlotte Sutherell, Dr Laura Patel, & Dr Simon Gerrard, Imperial College London*
16:00 - 16:10	**Break**			
16:10 - 17:00	Thursday summary panel, **03MS01**			
19:00	**Conference dinner**			

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ViCEPHEC24 programme - Friday 30th August

Click on a session number, name or abstract number to jump to the abstract page. Venue information displayed in **blue bold font**.

9:00 - 9:30	**Registration & refreshments, MS Foyer**			
9:30 - 9:40	Welcome, **03MS01**			
9:40 - 10:30	RSC invited talk: **Prof Gita Sedghi**, University of Liverpool, **03MS01** & IOP invited talk: **Dr Matt Mears**, University of Sheffield			
10:30 - 10:40	**Break**			
10:40 - 11:40 Session 4	***4.1 – Learner-AI interface*** **03MS01**	***4.2 – HE Outreach*** **39MS02**	***4.3 – AR and visualisation*** **80MS02**	***4.4 – Lab learning*** **32MS01**
	4.1.1 – Use of Artificial Intelligence in Higher Education Chemistry: Student and Staff Perceptions Dr Stephen E. Potts *University College London*	4.2.1 – Establishing a STEM Postgraduate Outreach Group Dr Charlie Devlin *University of Liverpool*	4.3.1 – Unleashing Augmented Reality to Support a Skills based Lab Curriculum Dr Lesley Ann Howell *Queen Mary University of London*	4.4.1 – Integrating reflective exercises in undergraduate chemistry laboratories: insights and challenges Dr Mairi Haddow *University of Edinburgh*
	4.1.2 – AI and EDI in Chemistry assessments: friends or competitors? Dr Konstantin Luzyanin *University of Liverpool*	4.2.2 – ChemBoost: a widening participation tutoring programme Dr Alexandra Males *Sheffield Hallam University*	4.3.2 – Augmented Reality meets Peer Instruction Prof Simon J. Lancaster *University of East Anglia*	4.4.2 – Peer assessment of practical skills in a first-year chemistry lab – implementation and evaluation Dr Cosma E. A. Gottardi, Tess M S Lynn, & Claire E Johnston *University of Glasgow*
	4.1.3 – Enhancing Accessibility in Physics Education through Bespoke Large Language Models Dr Elise Agra *Durham University*	4.2.3 – Toolkit: Making the Most of Public Engagement Dr Rachel Schwartz-Narbonne *Sheffield Hallam University*	4.3.3 – Precise Animations for the STEM Classroom Dr Miguel Rivera *University College London*	4.4.3 – Using pre-activity videos in forensic science: reducing cognitive load and increasing practical confidence Dr Anna Kirkham *University of Central Lancashire*
11:40 - 13:00	**Lunch & poster session, MS Foyer & AP Foyer**			
13:00 - 14:00 Session 5: Workshops	**30AY01**	**39MS02**	**80MS02**	**32MS01**
	5.1.1 – Using light to drive reactions: A photoredox catalysis experiment for 3rd year undergraduate students Dr Karen Parrish *University of Bristol* 5.1.2 – An (un)expected journey towards an ELN: interactive demonstration and survey Dr Konstantin Luzyanin *University of Liverpool*	5.2 – Inclusive assessment in Physics and Chemistry Dr Nicolas Labrosse & Dr Linnea Soler *University of Glasgow*	5.3 – Learning about Academic Integrity and Codes of Conduct Workshop Dr Jenny Burnham *University of Sheffield*	5.4 – Journeys in live polling: Using mentimeter in reverse gear to explain physical science concepts Dr Maire Gorman *University of Bristol/University of Sussex*
14:00 - 14:20	**Break & refreshments, MS Foyer**			
14:20 - 15:00 Session 6	***6.1 – VR*** **03MS01**	***6.2 – Assessment & feedback*** ~~39MS02~~ **32MS01**	***6.3 – Playful learning*** **80MS02**	***6.4 – Criticality and inclusivity in STEM education*** ~~32MS01~~ **39MS02**
	6.1.1 – Glassware Heroes: A Virtual Reality Game to Teach Glassware Assembly That Reduces Mistakes Made by Laboratory Novices Dr Ella M. Gale *University of Bristol*	6.2.1 – Improving assessment and feedback experiences for neurodivergent students Dr Helen Coulshed & Alexander Palmer *King's College London*	6.3.1 – Meme making for reflection and retention of knowledge Dr Felicity Carlysle-Davies *University of Strathclyde*	6.4.1 – A proposed imposter phenomenon intervention for undergraduate physics students Dr Ewan Bottomley *University of Aberdeen*
	6.1.2 – Exploring the Impact of using Social Virtual Reality and Videos as Pre-Laboratory Preparation on Student Confidence and Interest Lee Armstrong *University Of Kent*	6.2.2 – Are we literate? Exploring how views on feedback amongst Chemistry staff influence their undergraduate course design Dr Charlotte L. Sutherell *Imperial College London*	6.3.2 – Using Comic strips as an educational tool for learning about the stages of 'respiration' and promote team-work Dr Shelini Surendran *University of Surrey*	6.4.2 – Re-measuring Schrödinger: inclusive leadership in quantum mechanics Dr Claire Davies *University of Exeter*
	6.5 ViCEPHEC hosting information drop-in with National Steering Committee members, *concurrent with other session 6 talks*, **75MS02**			
15:00 - 15:45	Friday summary panel, **03MS01**			
15:45 - 16:00	**Closing remarks, refreshments and networking, MS Foyer**			

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ViCEPHEC24 programme - posters list

Click on an abstract number to jump to the abstract page. Posters will be displayed in the **AP Foyer**, with refreshments, lunch and sponsor stands in the **MS Foyer**.

P1	**PERIODIcally Season 2: Investigating the Experience of People who Menstruate Within STEM Careers and Education** Charlie Simms, *University of Oxford*
P2	**Enhancing Student Performance: Insights from 1st Year Undergraduate Physics Laboratory Module** Mark Chester Jude Emmanuel, *King's College London*
P3	**Sustainable! - Impact of Laboratory Practice and Student Reflections** Dr Lorraine Gibson van Mil, *University of Strathclyde*
P4	**ChemQuest – The Education for Sustainable Development Game** Dr Lorraine Gibson van Mil, *University of Strathclyde*
P5	**Assessing teachers' conceptual knowledge gains using concept maps** Milena Vujanovic, *University of Leeds and CERN*
P6	**Representation: Motivations for studying and staying in Chemistry** Dr Laura Hancock, *University of Birmingham*
P7	**A Snapshot of UK Pre-Lab Practices, and Instructor Perceptions of their Purpose and Effective Design** Dr Patrick Thomson, *University of Strathclyde*
P8	**Chemistry on the bench: bridging maths, chemistry and critical thinking skills in undergraduate labs** Dr Melissa D'Ascenzio, *University of Dundee*
P9	**Drug Discovery Bingo** Dr Katherine J. Haxton, *Keele University*
P10	**Crabby about Politics: A Simulated Political Committee Inquiry** Dr Katherine J. Haxton, *Keele University*
P11	**Role Play in the Teaching Labs: Boosting Engagement and Learning from Unexpected Results** Sam Trouton, *University of Warwick*
P12	**Piloting Peer Assisted Learning (PAL) in the Chemistry Department** Dr Michael M. Piperakis, *University of Reading*
P13	**Empowering Students to Critically Self-Reflect on Graduate Competencies** Dr Donna L. Ramsay, *University of Strathclyde*
P14	**Improving Undergraduate Labs with Digital Sensors and Introducing the Lt Online Learning Platform** Tyler Cooke, Elana Patrick, and Dr Jenny Burnham, *University of Sheffield*
P15	**Training students to be highly employable, professional chemists** Dr Michael Rogers, *University of Strathclyde*
P16	**Analysis of Student Preparation for Practical Sessions in Undergraduate Chemistry Labs** Tyler Hughes, *King's College London*
P17	**How to bridge the gap that university teaching staff face when it comes to sustainable chemistry education?** Dalia Taleb, *Imperial College London*
P18	**CHEMmunicate: a new game to increase engagement and build scientific communication skills** Dr Cristina Navarro Reguero, *Newcastle University*
P19	**Investigating PeerWise as a means for fostering inclusivity in STEM Education** Gina Craig, Pippa Petts, and Peter Swift, *Durham University*
P20	**Aphantasia in Chemistry** Morgan Norris, *University of East Anglia (UEA)*
P21	**Assessment of Three-Dimensional Learning in an Undergraduate Chemistry Practical Course** Dr David Cheung, *University of Galway*
P22	**Physics Education Research at The Open University** Prof Sally Jordan, *The Open University*
P23	**Attitudes towards generative AI in physics and astronomy education** Dr David Millar, *University of Glasgow*
P24	**How Explosive Chemistry Helps and Hinders Public Engagement** Dr Chris Armstrong, *University of Hull*
P25	**Making diversity count: fixing the leaky pipeline** Dr Giorgio Chianello, *Queen Mary University of London*
P26	**Student-led development of an interactive online course in AI ethics and inclusion, to be trialled in Chemistry, as part of the University of Glasgow's Student Learning Development service** Dr Ciorsdaidh Watts, *University of Glasgow*
P27	**How do we attract the chemists of the future? An international study on enablers and barriers to choosing chemistry degree programmes.** Dr Frances Docherty, *University of Glasgow*
P28	**An Investigation of the Cognitive Skill Development of Physics Students Through Different Assessment Types** Poppy Bennetts, *University of Glasgow*
P29	**Experimental training course in balancing the technical profile of STEM students: development and implementation experience of an innovative educational initiative** Dr Aleksey Kozikov, *Newcastle University*

Abstracts: Thursday 29th August

Keynote Speaker: 10:00 – 11:00, 03MS01

The Answer is Student Engagement

Ed Foster, Nottingham Trent University
ed.foster@ntu.ac.uk

If we take the definition of student engagement as the time and effort that a student puts into educationally purposeful activities and how an institution enables that time on task, we ought to have enough to discuss for at least a few minutes. When we analysed student engagement at my institution, we found that time on task is a better predictor of success than background characteristics or entry qualifications. And perhaps it ought to be. If time on task isn't a good predictor of outcomes, we're doing something very wrong.

And yet, many students struggle to engage, struggle to adapt to life at University and carry with them learning strategies better suited to school or college. In this keynote, we will explore the concept of engagement, barriers to engaging and a little about our work in learning analytics. We will end thinking about classroom strategies for engaging students.

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Session 1: 11:20 – 12:20

1.1 – Generative AI in HE, 03MS01

1.1.1 – Exploring the Role of Generative AI in Python Programming Skills within Physics Higher Education

Dr Arin Mizouri, Durham University
arin.mizouri@durham.ac.uk
Dr Cristina Zambon, Durham University
Charlotte Stevenson, Durham University

Incorporating Generative Artificial Intelligence (gAI) in higher education will significantly transform the landscape of physics education, especially in programming skills development (Zeb et al.,2024, Sun et al., 2024). This study explores the effects of gAI tools on enhancing Python programming competencies among physics students at the introductory and intermediate levels. Through a structured experimental approach, 27 participants were allocated into three groups: Group A, with access only to internet resources; Group B, facilitated with a ChatGPT 3.5 chatbot; and Group C, provided with a customised chatbot designed to prompt learners towards solutions through guidance. The participants engaged in 16 diverse Python programming tasks to assess various skills, from function creation to code optimisation. A short survey followed by a 15-20 minute interview followed this to capture their experiences and perceptions.

The findings from this study, to be shared during the conference presentation, illuminate the positive impact of gAI tools on programming within physics higher education. Initial analysis reveals that participants experienced enhanced learning efficiency and performance in Python programming tasks, alongside a strong preference for integrating gAI tools into educational practices. These insights underscore the potential of gAI to supplement learning outcomes and foster a more inclusive and effective programming education landscape.

Zeb, A., Ullah, R. & Karim, R. (2024). Exploring the role of ChatGPT in higher education: opportunities, challenges and ethical considerations. International Journal of Information and Learning Technology, 41(1), 99-111. https://doi.org/10.1108/IJILT-04-2023-0046

Sun, D., Boudouaia, A., Zhu, C., & Li, Y. (2024). Would ChatGPT-facilitated programming mode impact college students' programming behaviors, performances, and perceptions? An empirical study. International Journal of Educational Technology in Higher Education, 21, Article 14. https://doi.org/10.1186/s41239-024-00288-1

1.1.2 – Comparative evaluation of identity and quality of AI and Humam-generated physics essays

Dr Oto-obong Inyang, Durham University
o.o.a.inyang@durham.ac.uk
Dr Elise Agra, Durham University
elise.agra@durham.ac.uk
Dr Will Yeadon, Durham University; Dr Paul Mackay, Durham University; Dr Arin Mizouri, Durham University; Dr Alex Peach, Durham University; Dr Craig Testrow, Durham University

Recent rapid development in large language models (LLM) has led to a paradigm shift in assessment in Higher Education (HE) giving rise to apprehension around academic integrity and the possibility of undesirable disruption to students' learning process(Cotton et al., 2024). Evidence has shown that AI-generated Physics essays can achieve a first-class grade, which implies that Physics Education as a discipline is not an exception (Yeadon et al., 2023). Hence, this study on a comparative evaluation of the identity and quality of physics essays.

A double-blind assessment of a mixture of 300 short Physics essay questions authored by both humans and AI (generated by GPT-4) was evaluated by 5 markers following 5 key criteria from a module proforma. Markers were to measure the quality of work and identify the authorship of each set of essay questions. Further evaluation of authorship was performed with five (5) well-known AI detection tools such as ZeroGPT, Sapling etc.

Results showed no statistically significant differences in scores between essays authored by humans and AI. Identity of authorship from markers indicated randomness, which was marginally better than random, while amongst the five (5) detection tools used, ZeroGPT showed a 98% accuracy in detection. Looking forward, ≤ 50% AI-generated content is proposed as an acceptable standard of human authorship for the interest of the evolving future and respect to human authorship. Details of research findings are detailed in Yeadon et al(Yeadon et al., 2024).

Cotton, D.R.E., Cotton, P.A., Shipway, J.R., 2024. Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. Innovations in Education and Teaching International 61, 228–239. https://doi.org/10.1080/14703297.2023.2190148

Yeadon, W., Agra, E., Inyang, O., Mackay, P., Mizouri, A., 2024. Evaluating AI and Human Authorship Quality in Academic Writing through Physics Essays. http://arxiv.org/abs/2403.05458

Yeadon, W., Inyang, O.-O., Mizouri, A., Peach, A., Testrow, C.P., 2023. The death of the short-form physics essay in the coming AI revolution. Phys. Educ. 58, 035027. https://doi.org/10.1088/1361-6552/acc5cf

1.1.3 – Student Portfolios: Adding GAI Resilience to Final Year Projects

Dr Laura Hancock, University of Birmingham
l.hancock@bham.ac.uk

The capabilities of Generative Artificial Intelligence (GAI) have grown exponentially in the last 18 months, and its capabilities continue to evolve.[1] This presents both challenges and opportunities in chemistry education.[2]

Long term, a major review of coursework items in degree programmes should be undertaken with inclusion of appropriate activities to support ethical use of GAI to support student learning. At the University of Birmingham, and elsewhere, a significant number of students undertake a substantial literature project including a report comprising a large proportion of the marks. In the short term, it became clear that this report was vulnerable to the use of GAI, and we needed to change the assessment regime to address this.

Herein the introduction of a student portfolio designed to record the progress of a literature project, is described. Students are provided with a clear framework mapped onto the assessment criteria. The key aspects are that the portfolio must be contemporary and include reflections on papers and discussions with the supervisor. Staff evaluation is presented which shows, alongside GAI resilience, the portfolio has also provided a more effective way to both support and assess literature projects.

1. M. Emenike and U. Emenike, J. Chem. Educ. 2023, 100, 4, 1413–1418

2. E. A. Alasadi and C. R. Baiz, J. Chem. Educ. 2023, 100, 8, 2965–2971

1.2 – Transitioning to HE, 39MS02

1.2.1 – End-to-end tailored active blended learning

Prof Simon J. Lancaster, University of East Anglia
S.Lancaster@uea.ac.uk
Sarah Lynch, University of East Anglia; Holly Reader, University of East Anglia

We teach a FHEQ Level 3 chemistry module to a diverse cohort of mixed experience students embarking on a variety of Science degrees. Those students who have previously studied A level chemistry but whose grades were not sufficient for direct entry, to, for example, a Pharmacy degree, can find the first semester material simple and repetitive. While students who have not studied chemistry beyond GCSE and for whom it is a requirement of their Biology degrees can find the same material new and daunting. We tailor the student experience according to results in online quizzes. Students who demonstrate little familiarity are directed to project-student-authored interactive video resources with simple attention-enhancing questions. Those who do well in the quiz are excused the initial video resources. All students participate in sense-making synchronous sessions led by the module instructor, in which several active learning pedagogies are employed. A conceptually challenging end-of-section test gauges whether the learning outcomes have been met. Students who require additional study or who simply wish to revise are presented with further project-student-authored interactive video resources, with end-point-assessment level challenging questions. The extent to which the student experience is blended and flipped is tailored to their individual needs.

S. Chamberlain, D. Elford, S.J. Lancaster, F. Silve (2021), Tailored Blended Learning for Foundation Year Chemistry Students, Chimia 75, 18–26.

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1.2.2 – Informing Student Support Mechanisms through Measurement of Student Confidence in Core Chemistry Topics

Dr Dylan P. Williams, University of Birmingham
d.williams.12@bham.ac.uk
Dr Laura M. Hancock, University of Birmingham; Joshua Holloway, University of Birmingham

Supporting students during the transition from A-level to University chemistry has been a priority for educators for a number of years.[1-3] In order to create an evidence-base for future support mechanisms, this project investigated student confidence levels in chemistry topics, from the beginning of their degree to the end of first year, and to investigate the correlation between student confidence levels and exam performance through the following research questions:

1. How confident are students in key chemistry topics when they start their undergraduate chemistry degree?
2. How do confidence levels of students in key chemistry topics change during the first year of their degree?
3. Do confidence levels in key chemistry topics correlate with exam performance?

The research questions were addressed through the implementation of a self-evaluation of confidence in key chemistry topics selected through analysis A-level of university curricula conducted in collaboration with a student partner. The self-evaluation tool was used at three critical points in the year: (i) welcome week (09/2023), semester 2 induction (01/2024) and post-semester 2 (05/2024).

This talk will present the key findings along with a discussion of the changes that will be made to support mechanisms following reflection on these outcomes.

1. C. J. Smith, Chem. Educ. Res. Pract. 2012, 13, 490–499
2. D. C. Stone, Chem. Educ. Res. Pract. 2021, 22, 579–601
3. J. L. Spencer-Briggs and J. P. Rourke, J. Chem. Educ. 2023, 100, 554–563

1.2.3 – Bridging the Gap: Enhancing Transition to Year 1 Practical Chemistry through a new Introductory Activity

Dr Chris Marsh, University of Leicester
c.marsh@leicester.ac.uk
Dr Richard Blackburn, University of Leicester

Students arriving at university come from a variety of backgrounds and prior educational experiences, with the provision of chemistry practical experiments at pre-university institutions varying significantly and often being minimal. University chemistry laboratories are seen as unfamiliar and daunting environments, which can cause anxiety amongst students. Coupled with this is the fact that many laboratory courses have a steep learning curve, with only a short one-off lecture-based briefing being provided before students begin a series of assessed experiments.

To reduce student anxiety, enhance familiarisation and improve practical induction and education in HE, a new introductory non-assessed practical session was designed and implemented. Students had the opportunity to work in the laboratory in a non-pressured environment, were given a tour of the laboratory and were introduced to fundamental concepts which would be revisited in future experiments. The effectiveness of this activity was evaluated after a semester, with students responding that they enjoyed the exercise, found it helpful and it increased their confidence. Students particularly benefited from familiarisation of the laboratory layout, and students felt the activity prepared them for subsequent experiments. Through development of this formative session, the transition into completing experiments within an advanced university chemical laboratory was eased.

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1.3 – Inclusive lab learning, 80MS02

1.3.1 – Mental health, anxiety, and the chemistry laboratory across the UK: WELLChem National Study report

Dr Patrick Thomson, University of Strathclyde
patrick.thomson@strath.ac.uk
Dr Jenny Burnham, University of Sheffield; Pia Singh, University of Strathclyde; Dr Fraser Scott, University of Strathclyde; Prof Debra Willison, University of Strathclyde

Student mental health is a major challenge, with one recent analysis suggesting many students experience anxiety, potentially due to the university environment or study pressures (1). Moreover, an increasing number of students are diagnosed with anxiety or a generalised anxiety disorder, a type of non-visible disability.

Anxiety specifically related to laboratory learning has been previously evaluated in a number of studies (2,3). This "lab anxiety" has many dimensions, such as the complexity of the lab environment, and our preliminary research suggests that it disproportionately impacts students with anxiety diagnoses. (4-6)

Last year we ran a study, seeking to explore the main causes of anxiety in students undertaking practical laboratory work in the UK, the effect that a mental health/anxiety diagnosis may have, and implications for inclusive practice. We combined and expanded existing lab anxiety instruments, and conducted a multi-site survey of students from nine UK institutions.

Here we report on our research findings, and recommend specific interventions to alleviate lab anxiety and potentially close the experiential gap for students with recognised mental health disabilities.

1) Elena Sheldon, Melanie Simmonds-Buckley, Claire Bone, Thomas Mascarenhas, Natalie Chan, Megan Wincott, Hannah Gleeson, Karmen Sow, Daniel Hind, Michael Barkham, (2021) Prevalence and risk factors for mental health problems in university undergraduate students: A systematic review with meta-analysis, Journal of Affective Disorders, Volume 287, Pages 282-292, https://doi.org/10.1016/j.jad.2021.03.054.

2) Craig W. Bowen, 'Development and Score Validation of a Chemistry Laboratory Anxiety Instrument (Clai) for College Chemistry Students', (1999) Educational and Psychological Measurement, 59(1):171185, doi:10.1177/0013164499591012

3) Cara Rummey, Tristan D. Clemons and Dino Spagnoli, 'The impact of several demographic factors on chemistry laboratory anxiety and self-efficacy in students' first year of university', (2019) Student Success, 1, 87-98, doi:10.5204/ssj.v10i1.1104

4) Patrick Thomson, Egizia De Pascale, Fraser Scott, Debra Willison, " Exploring the Hidden Disabilities of Mental Health in the Chemistry Laboratory", Poster Presentation, ViCEPHEC 2022

5) Jenny Burnham, Jolie Hamilton-Warford, "Lab Anxiety in a time of Covid", Poster Presentation, ESLTIS 2021

6) Jenny Burnham, Patrick Thomson, Fraser Scott, Debra Willison "The WELLChem project: mental health, anxiety, and the chemistry laboratory." Presentation, ViCEPHEC 2023

1.3.2 – How Do We Make Teaching Laboratories More Inclusive?

Charlotte Oliver, University of Oxford
lottie.oliver27@outlook.com
Dr Lucy J. Rowlands, University of Oxford; Dr Malcolm I. Stewart, University of Oxford
lucyjaynerowlands@hotmail.co.uk; Malcolm.stewart@chem.ox.ac.uk

There is growing discussion regarding how to make teaching laboratory environments comfortable to a diverse range of students (Flaherty, 2022; Boval and Kennedy, 2018 ; Feo et al., 2023). It is a unique environment full of sensory inputs, social interactions and manual challenges alongside hazard warnings, sharp needles and student assessment. How can we make it a space where students feel comfortable enough to learn?

In order to make these spaces more comfortable we need to first understand the difficulties they currently pose for students; however, there is an absence of instrumentation to assess this in the literature. This research has aimed to create a multi-dimensional understanding of how students are impacted by their laboratory environment, by developing a new survey and shadowing procedure. This methodology is a unique synthesis of existing literature with the student author's perspective. It aimed to examine how the laboratory environment impacted students' ability to learn, including effect on their self-efficacy; and if this particularly disadvantaged students identifying as disabled/ neurodivergent or students who experience periods.

The research is still ongoing, but initial findings have already illuminated students' difficulties with communication, internal regulation, and sensory inputs within the laboratory. By understanding the environment and students' experience of it, we can ensure the laboratory is a place where every student is comfortable enough to enjoy, learn, and flourish.

J. Boval and S.Kennedy, Laboratory Safety for All: Accommodating Students with Disabilities in Chemistry Teaching Laboratories, J. Am. Chem. Soc., 2018, 1272 (8) 99-115. DOI: 10.1021/bk-2018-1272.ch008

E. Feo et al., Periods and practicals: how to help your students, Trends Chem., 2023, 5 (11) 789-791, https://doi.org/10.1016/j.trechm.2023.09.003

A.Flaherty, The Chemistry Teaching Laboratory: A Sensory Overload Vortex for Students and Instructors?, J. Chem. Educ., 2022, 99, 4, 1775–1777, https://doi.org/10.1021/acs.jchemed.2c00032

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1.3.3 – Characterising a new undergraduate teaching laboratory through the lens of sensory overload

Dr Benjamin E. Arenas, EaStCHEM School of Chemistry, University of Edinburgh
benjamin.arenas@ed.ac.uk
Sally Stone, EaStCHEM School of Chemistry, University of Edinburgh

In 2023, the University of Edinburgh opened the Nucleus Building, a "new shared learning, teaching and social hub at the heart of the King's Buildings" [1]. It houses the School of Chemistry's new Nucleus Teaching Laboratory (NTL), a 100-capacity teaching space predominantly used for first-year practical classes.

In October 2023, the Royal Society of Chemistry published its 'Disability in the Chemical Sciences' report [2]. The report explores the experiences of disabled members of the community and provides suggestions on improving disability inclusions. These include adjustments for making laboratories accessible to all. Previous work and recent calls to action have brought this area to the fore [3-5, among others], including work done at the University of Glasgow [6].

This contribution reports on the student sensory perception of the NTL, explores the effect of sensory overload on learning, and investigates the experiences of neurotypical and neurodiverse students. About 25% of survey respondents reported experiencing sensory overload in a laboratory session. A number of mitigating strategies were evaluated by focus group participants, which could be adopted beyond the scope of our institute. Our results will be presented, which will allow for a fuller UK-wide picture to be obtained by adding to similar studies and initiating new ones.

[1] https://www.ed.ac.uk/science-engineering/about/nucleus, accessed 21 March 2024.

[2] https://www.rsc.org/policy-evidence-campaigns/inclusion-diversity/surveys-reports-campaigns/disability-in-the-chemical-sciences/, accessed 21 March 2024.

[3] J. P. Sarju, Chem. Eur. J. 2021, 27, 10489.

[4] O. Egambaram, K. Hilton, J. Leigh, R. Richardson, J. Sarju, A. Slater, and B. Turner, J. Chem. Educ. 2022, 99, 12, 3814–3821.

[5] R. Pells, Nature, 2022. Career Feature Article available at https://doi.org/10.1038/d41586-022-04248-5, accessed 21 March 2024.

[6] https://www.learnsci.com/tia-applicants/2023-university-of-glasgow-smita-odedra, accessed 21 March 2024.

1.4 – Belonging & community, 32MS01

1.4.1 – Sense of Belonging and Perceptions of learning of STEM Undergraduate students

Toluwalase Akanbi-Akinlolu, King's College London
toluwalase.akanbi@kcl.ac.uk

Sense of belonging, which describes "the extent to which students feel personally accepted, respected, included, and supported by others in the school social environment", has been implicated as impacting the retention and attainment of STEM students.

This study aims to understand what factors affect the sense of belonging amongst underrepresented students studying STEM subjects, using intersectionality as the theoretical framework. The main study consisted of 11 semi-structured interviews with 9 undergraduates or recent graduates in the Physics and Mathematics departments at King's College London. The interview topic guide explored themes of belonging, self-efficacy, science identity, and the perception of learning. Using a thematic analysis, it was found that friendships community spaces, and study groups are among the most influential factors in creating a positive belonging. Participants reported limited contact with academic staff and often relied on other students for academic support through student-led initiatives. Participants expressed the need to find a community that reflected their intersecting identities, more commonly expressed among students of Afro-Caribbean descent. COVID and lockdown were mentioned to harm academic engagement. Lastly, the sense of belonging in participants generally improved as students progressed through their studies, often attributed to finding friends and building confidence in the ability to do the subject. Students made several recommendations that they believed would increase academic engagement with most suggestions relating to staff training, inter-year contact, and study sessions. The presentation will highlight the study's key methodologies and results, including the pilot and main studies. It will also introduce the comic book to disseminate the research through collaboration with an artist.

Goodenow, C., 1993. Classroom belonging among early adolescent students: Relationships to motivation and achievement. The Journal of early adolescence, 13(1), pp.21-43.

Rainey, K., Dancy, M., Mickelson, R., Stearns, E. and Moller, S., 2018. Race and gender differences in how sense of belonging influences decisions to major in STEM. International journal of STEM education, 5(1), pp.1-14.

Bowleg, L. When Black + Lesbian + Woman ≠ Black Lesbian Woman: The Methodological Challenges of Qualitative and Quantitative Intersectionality Research. Sex Roles 59, 312–325 (2008). https://doi.org/10.1007/s11199-008-9400-z

Dortch, D. and Patel, C., 2017. Black undergraduate women and their sense of belonging in STEM at predominantly White institutions. NASPA Journal About Women in Higher Education, 10(2), pp.202-215.

Tinto, V., 2017. Through the eyes of students. Journal of College Student Retention: Research, Theory & Practice, 19(3), pp.254-269.

Ahn, M.Y. and Davis, H.H., 2020. Four domains of students' sense of belonging to university. Studies in Higher Education, 45(3), pp.622-634.

1.4.2 – The Role of Participating in Physics Communities in the Development of Physics Identity: A Study of Physicists in an Academic Environment

Lauren Muir, University of Glasgow
l.muir.1@research.gla.ac.uk
Dr Nicolas Labrosse, University of Glasgow; Dr Peter Sneddon, University of Glasgow

The concept of physics identity, meaning the degree to which one views themselves as a physicist, has garnered interest in recent years as a framework to understand and address the ongoing inequalities in physics participation. Initially conceptualised by Hazari et. al. [1] as a development from work on science identity conducted by Carlone and Johnson [2], the framework has been refined by many over the years, and physics identity is broadly considered to have four dimensions: (i) interest, (ii) competence, (iii) performance, and (iv) recognition. Additionally, many constructions of physics identity rely on self-identification (e.g. 'I see myself as a physics person') as a measure of a strong physics identity. However, by focusing on this measure, we do not fully encapsulate how the desire to belong, and the relationships forged through participating in physics communities - or more generally communities of practice - contribute to one's sense of self. The importance of communities within physics is well studied, with measurable positive impacts on both academic performance [3] and persistence [4], and work by Wenger highlights the relationship between identity and communities of practice in an educational context [5]. Building on this research, this work sets out to investigate how participation in physics communities contributes to the development of physics identity by constructing an extended framework that allows for a richer understanding of physics identity as a product of both self-identification and interactions with physics communities.

I will be presenting results from the first stage of this study, which involves a series of semi-structured interviews with PhD students and academic staff in the University of Glasgow, who have persisted in the field and can be considered to have developed stronger physics identities. We use thematic coding to analyse the data and investigate how the communities these physicists have engaged in have influenced the development of physics identity, with a specific focus on how one's choice to identify themselves as a physicist may change throughout their career path.

1. Hazari, Z., Sonnert, G., Sadler, P. M. & Shanahan, M.-C. Connecting high school physics experiences, outcome expectations, physics identity, and physics career choice: A gender study. J. Res. Sci. Teach. 47, 978–1003 (2010).
2. Carlone, H. B. & Johnson, A. Understanding the science experiences of successful women of color: Science identity as an analytic lens. J. Res. Sci. Teach. 44, 1187–1218 (2007).
3. Pulgar, J., Ramírez, D., Umanzor, A., Candia, C. & Sánchez, I. Long-term collaboration with strong friendship ties improves academic performance in remote and hybrid teaching modalities in high school physics. Phys. Rev. Phys. Educ. Res. 18, 010146 (2022).
4. Zwolak, J. P., Dou, R., Williams, E. A. & Brewe, E. Students' network integration as a predictor of persistence in introductory physics courses. Phys. Rev. Phys. Educ. Res. 13, 010113 (2017).
5. Wenger, E. Communities of Practice: Learning, Meaning, and Identity. Higher Education from Cambridge University Press https://www.cambridge.org/highereducation/books/communities-of-practice/724C22A03B12D11DFC345EEF0AD3F22A (1998) doi:10.1017/CBO9780511803932.

1.4.3 – Joining the 'Chemunity': Improving the transition into university chemistry

Dr Euan D Doidge, Imperial College London
Dr Charlotte L Sutherell, Imperial College London
c.sutherell@imperial.ac.uk
Amelia Barron, Imperial College London

The transition from school to university poses many challenges: adapting to new ways of learning, managing time independently, adjusting to a new culture, or joining a new community. The diversity of the student body means individuals can experience this transition very differently. [1,2] Recognising and supporting the process can be valuable in helping students ease transition and increase success.

Whilst there are many resources about university transitions in general,[3] resources specific to a local context can be useful. This project, which was co-created with undergraduate student partners, teaching staff and pastoral leads, drew on students' first-hand experiences and reflections to identify topics and create bespoke resources aimed at 'demystifying' the initial university experience in our Chemistry Department.

Here we describe the aims, process, and outputs of this project. These 'Chemunity' resources include student-created web-based pre-sessional videos to generate awareness of common concerns and about social or academic life, vital academic skills, and support routes. Interactive maps and content help students familiarise themselves with buildings and teaching spaces, particularly aimed to support those unable to attend open days or benefiting from advanced knowledge of space layout. Finally, we share the initial evaluation of this work and future plans for development.

[1] Bowles et al. (2014) Staying the distance: students' perceptions of enablers of transition to higher education. Higher Education Research & Development, 33:2, 212-225

[2] Leong et al. (2021) The transition to first year chemistry: student, secondary and tertiary educator's perceptions of student preparedness. Chem. Educ. Res. Pract., 22, 923

[3] https://www.studentminds.org.uk/transitionintouniversity.html

Session 2: 13:40 – 14:40

2.1 – Authentic assessment, 03MS01

2.1.1 – Introducing an authentic assessment to a second year applied analytical chemistry module

Dr Terri Grassby, University of Surrey
t.grassby@surrey.ac.uk
Dr Bolanle Oloyede, University of Surrey
o.oloyede@surrey.ac.uk

Authentic assessment involves evaluating learning using "real-world" activities so students can demonstrate their knowledge and understanding in a relevant way[1]. Due to the COVID-19 pandemic, a new, authentic, assessment was introduced to a second year applied analytical chemistry module involving the production of an 8-page business case to set up a lab for the quantification of food nutritional and contaminant content. This replaced a traditional exam, which was susceptible to strategic approaches to revision and required a lot of memorisation. The new assessment was retained as it covers the module content comprehensively, while being more authentic, and resistant to significant use of AI. It also requires students to describe complex chemical principles to a lay audience. This assessment aims to not only boost the critical thinking skills of students, but also expose students to what professionals in their field do, making them better prepared for the future.

This talk will give more detail on the assessment in terms of the information provided to students; AI outputs to associated prompts; marking burden; effects on module marks; relevance to future employment; and student feedback.

We will demonstrate the potential for this assessment to be modified for other modules within chemistry degree programmes.

1. Swaffield, S. (2011). Getting to the heart of authentic assessment for learning. Assessment in Education: Principles, Policy & Practice, 18(4), 433–449. https://doi.org/10.1080/0969594x.2011.582838

2.1.2 – Undergraduate students as chemistry lecturers – Peer-to-peer teaching and authentic assessment

Dr Juliet Collins, University of Bristol
Dr Francesca Dennis, University of Bristol
francesca.dennis@bristol.ac.uk

Peer-to-peer teaching has been shown to enhance communication skills, aid revision, improve exam results and allow students to gain a deeper understanding of teaching delivery.[1,2] Student teams undertaking a Masters level unit in the School of Chemistry at the University of Bristol were tasked with creating taught content and delivering a lecture and problem session to their peers to assist with revision for a final year general chemistry exam paper.

Students were provided with pedagogical training and were tasked with enhancing their communication and collaboration skills through a group working contract alongside developing and delivering level appropriate content. Students were empowered in their own learning by having agency on topic delivery choice and were best placed to understand the background knowledge of their peers. The unit was designed to encourage student ownership and co-creation by asking students to assist with development of the summative peer assessed marking rubric in a workshop session.[3–5] The unit also incorporated authentic assessment by delivering the student created lectures to other undergraduate students revising in lower years for their own end of year exams and providing a repository of revision material.[6,7] Initial survey results, findings and learnings will be presented.

1. A. M. Danowitz, J. Chem. Educ., 2021, 98, 1556–1561.
2. Y. D. Mitchell, J. Ippolito and S. E. Lewis, Chemistry Education Research and Practice, 2012, 13, 378–383.
3. C. Moore and S. Teather, Engaging students in peer review: Feedback as learning, Special Issue, 2013, vol. 23.
4. N. Falchikov and J. Goldfinch, Student Peer Assessment in Higher Education: A Meta-Analysis Comparing Peer and Teacher Marks, 2000, vol. 70.
5. F. Dochy, M. Segers and D. Sluijsmans, Studies in Higher Education, 1999, 24, 331–350.
6. Z. Sokhanvar, K. Salehi and F. Sokhanvar, Studies in Educational Evaluation, 2021, 70.
7. M. Schultz, K. Young, T. K. Gunning and M. L. Harvey, Assess. Eval. High. Educ., 2022, 47, 77–94.

2.1.3 – Reducing Assessment Without Losing Engagement in a First Year Chemistry Practical Course

Dr Tom Anderson, The University of Sheffield
t.anderson@sheffield.ac.uk

In Higher Education we face a dilemma. Students complain, sometimes with justice, that they are over-worked and over-assessed. True learning requires time for reflection as well as testing. At the same time, students have a natural urge to place more emphasis on immediate credit-bearing material and to triage non-assessed activities to the bottom of the priority list, 'it's not important because it doesn't count'. In this session I will discuss how I have squared this circle, reducing the amount of assessment in our first-year Chemistry lab course by 60% without a concomitant loss of student engagement or attendance. This session is principally aimed at colleagues who are facing a need to reduce the amount of assessment in their curriculum, but are concerned about the potential consequences. Its principles are general and are not specific either to practical lab teaching or to the physical sciences. It is especially applicable to long, sustained series of sessions where it is vital to retain student engagement throughout. The key principles are more about framing and delivery of information about assessment to students rather than how the assessments themselves are necessarily designed, so this is applicable to colleagues across many disciplines.

2.2 – Diversity and inclusivity in STEM HE, 39MS02

2.2.1 – Exploring the Barriers and Facilitators of Neurodivergent Learners in Tertiary Chemistry Education

Dr Niamh O'Mahoney, University College Cork
nomahoney@ucc.ie

Neurodiversity influences 15-20 % of the world's population. Neurodiversity is a cognitive difference in how the brain processes information and includes a variety of diagnoses, such as dyslexia, dyscalculia, Autism Spectrum Disorder (ASD), and ADHD, to name a few. Neurodiverse people have differing abilities, with strengths in creativity, outside-the-box thinking and problem-solving. Society's view of neurodiversity is directed towards the challenges. While this effort is well-intended, it does not capture the value of neurodivergent strengths. Supporting and developing neurodiverse skills is the key to enabling students and allowing them to fulfil their potential in higher education.

This study employs phenomenological methodology and co-design elements to understand the neurodiverse experience in tertiary education. Learning how-to-learn workshops based on Universal Design for Learning are implemented to measure the impact of alternative learning methods on student learning and the student experience. The study utilises a multi-methods process for data collection, including surveys, focus groups and semi-structured interviews. This research allows us to gain insights into the social viewpoints of neurodiversity in higher education and how neurodiverse learners engage with chemistry. Key themes are explored, including the benefits and challenges of neurodiversity as a student in higher education, the accessibility and inclusivity of chemistry education in the tertiary sector, and the overall impact of neurodiverse learning techniques. The goal is to compile a database of knowledge from a student perspective on supporting neurodiverse learning in tertiary chemistry education and enabling informed university course creation that aligns with the student's needs.

Keywords: Chemistry Education; Higher Education; Inclusion; Neurodivergence; UDL.

2.2.2 – How can we increase the diversity of physics UG students?

Dr Maire Gorman, University of Bristol / University of Sussex
mgg37@sussex.ac.uk
Lucy Armitage, University of Bristol; Shiri Kleinberg, University of Bristol

Gender disparities persist within physics, with females often underrepresented and facing barriers to participation. This study investigates attitudes towards the field of physics as well as the gender gap within it, using questionnaires delivered to undergraduate physics students and school students in years 11-13 (n=125).

It was found that females exhibit lower confidence at both stages of physics education, as well as less enjoyment of physics within schools. The dominant discourse surrounding the gender gap reflects its cyclical nature, with many females deterred from pursuing physics due to the prospect of being a minority in a male-dominated field.

Moreover, the study examines the contrasting viewpoints of male and female students regarding the severity and impact of sexism within physics. Females often recount experiences of discrimination, while males more frequently attribute the gender gap to a lack of interest among girls and assert the existence of equality of opportunity.

These findings underscore the necessity for interventions addressing disparities in physics education, focusing on fostering more inclusive classroom environments and initiating dialogue around the remaining biases within the field.

2.2.3 – Predictors and Socio-Demographic Disparities in STEM Degree Outcomes: A ten-year UK study using Mixed-Effects Logistic Regression

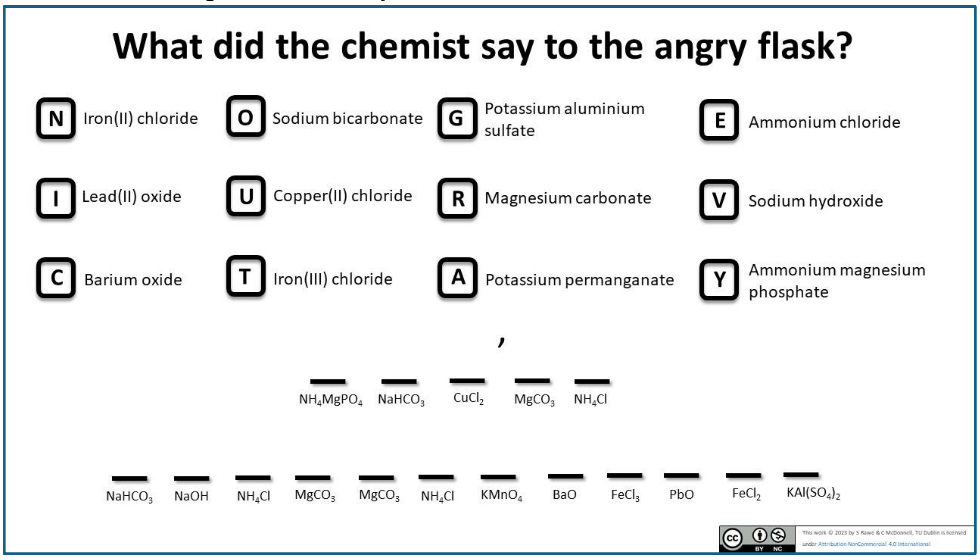
Dr Andrew Low, University of Liverpool
andrew.low@liverpool.ac.uk
Dr Yasemin Kalender, University of Liverpool

In this research study we use a combination of single-level multi-variate logistic regression and hierarchical logistic regression to identify the predictors of first-class degree outcomes in STEM subjects at a Russell Group university in the UK using a 10-year dataset from 2012-2022. We find that prior academic achievement, ethnicity, gender, socio-economic category, age and course duration are all statistically significant predictors of achieving a first-class degree. We find that the size of the Ethnicity awarding gap has remained relatively constant over a ten-year period, and we also find evidence of unexplained grade inflation which is not accounted for by the changing academic and socio-demographic profile of the student population. Finally, by comparing three different methodological approaches, we highlight the importance of accounting for multiple variables and hierarchical data structure when analysing large data-sets to identify degree awarding gaps. We provide an analysis template for use by other departments, faculties, and institutions to encourage statistically rigorous approaches to identifying awarding gaps.

2.3 – New tools for assessment & feedback, 80MS02

2.3.1 – Students' Perspectives on First Year Chemistry Tutorials

Dr Claire McDonnell, Technological University Dublin
claire.mcdonnell@tudublin.ie
Dr Sarah Rawe, Technological University Dublin



Example of escape room type puzzle used to encourage collaboration.

We implemented a redesign of first year chemistry tutorials using a students as partners approach. The aim was to ensure that tutorial time is being used as effectively as possible to support learning.Drivers were that engagement with tutorials had been declining, tools such as in-class polling apps and simulations had become available and that two escape room tutorials had been trialled and feedback was positive.

Polling app quizzes and escape room type collaborative puzzles were introduced during tutorials to provide rapid, regular and structured feedback on progress.(1,2) Another change was to demystify assessment by showing how tutorial problems align to past exam questions. Supports for before and after each tutorial were built into our virtual learning environment. Post-tutorial, a two question online quiz was made available. To get the quiz marks, students had to have attended the tutorial.

A survey of tutorial participants has just been completed and our student partners are about to run some feedback meetings to gather further insights. Findings will be presented at the conference and will be used to prepare some general guidelines on what worked. We have also made examples of the collaborative puzzles used and editable templates available for others to use.(3)

1. Manzano-León, A., Rodríguez-Ferrer, J. M., & Aguilar-Parra, J. M. (2022). Gamification in Science Education: Challenging Disengagement in Socially Deprived Communities. Journal of Chemical Education, 100(1), 170-177.
2. Veldkamp, A., van de Grint, L., Knippels, M. C. P., & van Joolingen, W. R. (2020). Escape education: A systematic review on escape rooms in education. Educational Research Review, 31, 10036.
3. https://chemedresearchteam.wordpress.com/2023/08/13/escape-room-type-group-puzzles-for-chemistry-templates-guidelines/

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2.3.2 – Building a better quiz for Newtonian mechanics

Ashutosh Kumar Pathak, The Open University
ashutosh.pathak@open.ac.uk
Dr. Jonathan Nylk, The Open University; Prof. Sally Jordan, The Open University

The Force Concept Inventory (FCI)[1] is a multiple-choice instrument to examine understanding of Newtonian mechanics and misconceptions held by students. Despite facing criticism since its introduction into physics education, it is used widely by educators and physics education researchers.

Researchers have found that free-response version of the FCI is valid and reliable[2] . In a study[3] utilizing the free-response FCI, researchers discovered that incorrect/alternative responses might not be the most effective for identifying misconceptions. A different study[4], which introduced sub-questions to the FCI items, revealed that students' responses to these sub-questions often appeared to be guesses. This suggests that the current instrument may not be adequate for probing Newtonian mechanics misconceptions or learning gain.

Inspired by the Force Concept Inventory (FCI), we have developed a quiz that consists of multiple-choice and free-response items. The development of the quiz involved a rigorous iterative refinement process including expert interviews, and a pilot study was conducted to validate it. The aim of the quiz is to examine students' conceptual understanding of Newtonian mechanics.

Even when students correctly answer the FCI items, it does not necessarily mean they understand the underlying concepts. To address this issue, for a select number of items, we have added a multiple-choice question that presents possible physical concepts, followed by the inventory item.

I will discuss the rationale behind developing this quiz and share preliminary results.

1. Hestenes, D., Wells, M. and Swackhamer, G. (1992) 'Force concept inventory', The Physics Teacher, 30(3), pp. 141–158. Available at: https://doi.org/10.1119/1.2343497.
2. Parker, M.A.J. et al. (2023) 'Establishing a physics concept inventory using computer marked free-response questions', European Journal of Science and Mathematics Education, 11(2), pp. 360–375. Available at: https://doi.org/10.30935/scimath/12680.
3. Rebello, N.S. and Zollman, D.A. (2004) 'The effect of distracters on student performance on the force concept inventory', American Journal of Physics, 72(1), pp. 116–125. Available at: https://doi.org/10.1119/1.1629091.
4. Yasuda, J. and Taniguchi, M. (2013) 'Validating two questions in the Force Concept Inventory with subquestions', Physical Review Special Topics - Physics Education Research, 9(1), p. 010113. Available at: https://doi.org/10.1103/PhysRevSTPER.9.010113.

2.3.3 – Evaluative judgement in chemistry education – researching how chemistry students understand what quality looks like in their work

Alexander Palmer, King's College London
alexander.palmer@kcl.ac.uk
Dr Helen Coulshed, King's College London

Evaluative judgement is broadly defined as an individual's ability to "make decisions about the quality of work". [1] Developing students' skill in making accurate judgements of quality in the context of undergraduate chemistry is key to supporting their educational achievements, independent working, and effective collaboration in their future careers.

This research focuses on how students construct their ideas of quality and, where these constructions diverge from staff interpretations, why this might occur. This presentation will discuss the initial findings from thematic analysis of survey responses and interviews.

This research applies constructivism and intersubjectivity as key theoretical lenses to explore student and staff constructions of quality. Constructivism views knowledge as "constructed in the mind of the learner", arguing that learners interpret and construct new information in relation to what they already know. [2] Intersubjectivity considers communication as reliant on shared knowledge of content and context, where learners' conceptions are important in mutually constructing understanding through dialogue. [3,4]

Students are to some extent already aware of the qualitative and subjective nature of assessments of quality in higher education, but building their understanding and developing their skill in making these judgements is key to better supporting students in the wider chemistry community.

1. J. Tai, R. Ajjawi, D. Boud, P. Dawson and E. Panadero, High. Educ., 2018, 76, 467–481.
2. M. M. Cooper and R. L. Stowe, Chem. Rev., 2018, 118, 6053–6087.
3. G. M. Bodner, J. Chem. Educ., 2004, 81, 618–628.
4. A. K. Rønsen, Educ. Inq., 2013, 4, 537–554.

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2.4 – Learning from the pandemic, 32MS01

2.4.1 – Overcoming poor performance in remote exams

Prof Sally Jordan, The Open University
sally.jordan@open.ac.uk
Jonathan Nylk, Becca Whitehead, Cath Brown, Fiona Moorman, Sue Pawley and Gemma Warriner, The Open University

During the Pandemic, extensive use was made use of examinations submitted online, in one form or another, in place of exams that were previously conducted in an exam hall. While most universities have now returned to previous practice, not all have, and The Open University has retained exams that are completed and submitted from students' own homes. There are fundamental differences between the completion of a handwritten exam in an exam hall and the completion of an exam electronically in a student's own home, and the latter remains poorly understood.

Aristeidou et al. (2024), found that, while four out of five students report preferring remote exams to those in an exam hall, barriers to completion exist. It can be argued that the barriers are greater in disciplines whose exams require significant input of mathematical notation and diagrams.

The talk will report on a project that is extending earlier investigations (Moorman et al., 2024; Brown & Pawley, 2024) into the factors that enable students to do themselves justice in remote online exams in physical science and related subjects. Initiatives prior to the 2022 exam had some success, and further quantitative and qualitative evaluation of recent initiatives will also be reported on.

Aristeidou, M., Cross, S., Rossade, K. D., Wood, C., Rees, T., & Paci, P. (2024). Online exams in higher education: Exploring distance learning students' acceptance and satisfaction. Journal of Computer Assisted Learning, 40(1), 342-359.

Brown, C. & Pawley, S. (2024) A timed, marked mock examination to enhance student success. Presentation to the 13th eSTEeM Annual Conference: Sharing Scholarship and Best Practice – Implementing What Works, 10th-11th April 2024, Milton Keynes.

Moorman, F., Warriner, G. & Whitehead, R. (2024) Can we reduce anxiety of students sitting online exams? Presentation to the 13th eSTEeM Annual Conference: Sharing Scholarship and Best Practice – Implementing What Works, 10th-11th April 2024, Milton Keynes.

2.4.2 – A reflective analysis of freeform revision sheets in closed-book exams – did they have a positive outcome on exam performance?

Dr Neil S. Keddie, University of St Andrews
nsk@st-andrews.ac.uk
Willow Baxter, University of St Andrews

Following loosening of restrictions towards the end of the covid-19 pandemic the School of Chemistry at the University of St Andrews chose to return to closed-book exams in the 2022–23 academic year. The transition from open-web open-book exams back to in-person closed-book invigilated exams was expected to be a challenge for students. To reduce student anxiety(1) during this transition, honours module coordinators were given the opportunity to allow a freeform revision sheet in their exams.

There were no restrictions placed on what content could be included, provided it fitted on both sides of a single sheet of A4 paper. Students constructed highly varied sheets: from handwritten mind maps and notes; to equations and keywords; to printed lectures slides; to previous exam answer schemes; and beyond. The sheets were submitted but were not formally assessed.

Analysis of historical module means showed that the sheets did assist in the transition, however, we could not establish specific trends between content type and exam performance when analysing individual sheets.

We will present our quantitative and reflective analysis of these sheets with context from structured interviews with staff and students, and a perspective of how we feel these could be used in the future.

(1) Piontkivska, H.; Gassensmith, J. J.; Gallardo-Williams, M. T., Expanding Inclusivity with Learner-Generated Study Aids in Three Different Science Courses. Journal of Chemical Education 2021, 98 (10), 3379–3383

2.4.3 – Increasing engagement through flipped learning in Forensic Chemistry (learnings from the pandemic)

Dr Patrick Sears, University of Surrey
p.sears@surrey.ac.uk

Flipped and activity-based learning approaches have been championed for many years in the chemistry education literature (Seery, 2016, Donnelly J, 2018). This talk will show how curriculum review and development, capitalising on optimised digital resources (Patel & Ponikwer, 2018, Seery, 2016) produced in response to the pandemic, were used to introduce a flipped learning approach to the teaching of forensics to chemistry students with the aim of creating time and space for workshop-based learning (Belt, Evans, McCreedy, Overton, & Summerfield, 2002). Activity based sessions were designed to build upon video content and allow chemistry students "hands-on" experience as investigators whilst minimising impact on laboratory resources and providing the opportunity for continuous formative feedback (Kappers & Cutler, 2014). The experimental content was structured to increase understanding of forensic chemistry process in the lead up to a summative "CSI-Day". The talk will explore the impact of curriculum changes on behaviour, engagement, and student feedback. This talk will be of interest to those considering flipped learning or workshop-based activities for highly practical subjects and for those struggling to increase student engagement.

Belt, S., Evans, H., McCreedy, T., Overton, T., & Summerfield, S. (2002). A problem based learning approach to analytical and applied chemistry. University Chemical Education, 65.

Donnelly J, H. F. (2018). Fusing a reversed and informal learning scheme and space: student perceptions of active learning in physical chemistry. Chemical Education Research and Practice, 19, 520.

Kappers, W., & Cutler, S. (2014). Poll Everywhere! Even in the Classroom: An Investigation into the Impact of Using PollEverywhere in a Large-Lecture Classroom. ASEE Annual Conference & Exposition. Retrieved from https://peer.asee.org/22921

Patel, B., & Ponikwer, F. (2018). Implementation and evaluation of flipped learning for delivery of analytical chemistry topics. Analytical and Bioanalytical Chemistry.

Seery, M. (2016). Flipped learning in higher education chemistry: emerging trends and potential directions. Chemical Education Research and Practice, 16, 758.

Session 3: 15:00 – 16:00

Workshops

3.1 – Inclusive Laboratory Teaching: Building a new approach through a UDL lens, 30AY01

Dr Matt Mears, University of Sheffield
m.mears@sheffield.ac.uk
Dr Paul Duckmanton, University of Southampton
p.duckmanton@soton.ac.uk
Dr Sam Perry, University of Southampton
s.c.perry@soton.ac.uk

Reasonable adjustments often take the form of making changes retrospectively to suit the needs of a subset of students. However the Universal Design for Learning (DL) model shifts this perspective to designing inclusivity and accessibility into our curriculum so that it is "…usable by all people, to the greatest extent possible, without the need for adaptation or specialized design" (Mace, 1985). By proactively considering how we can design our teaching to break down frequent barriers and biases, and allow us to focus our energy in supporting students whose very specific needs go beyond what UDL changes provide.

This workshop will first explore the concept of UDL and help attendees recontextualise it to their own learning environments. We will then provide tools and frameworks to help scaffold the adoption of UDL in laboratory based settings, taking attendees through some practical activities using experiments common to undergraduate chemistry and physics courses, leaving you with the skills and confidence to adopt a UDL lens in your own teaching.

Mace, Ronald L. "Universal Design, Barrier Free Environments for Everyone." Designers West 33.1 (1985): 147–52.

3.2 – Concept Maps as Assessment Tools in STEM Education, 39MS02

Milena Vujanovic, University of Leeds and CERN
milena.vujanovic@cern.ch
Prof Dr Alison Voice, University of Leeds; Dr Rob Purdy, University of Leeds; Dr Jeff Wiener, CERN

Concept maps (CM) are graphical representations of organised knowledge. Considering the practicality of CM and their connection to meaningful learning, CM have become a useful assessment tool (Fischler & et.al., 2001; Edmondson, 2005).

They are often used to assess valid and invalid ideas held by those who create CM. This is one of the ways teachers have used CM to assess their students' understanding of the topic. It was also shown that by creating CM, students were able to overcome the misconceptions they initially had (Novak 2002). When using CM as an assessment tool it is important to remember that this method has two components (Stoddart et al. 2000) - a task that learners perform to demonstrate knowledge of concepts and a set of rules the instructor uses to evaluate the learners' knowledge.

During the workshop participants will learn how to construct, evaluate, and use CM as assessment tool. An example of how this method is implemented at CERN will be shown.

Workshop structure:

1. Introduction to CM and how to construct them
2. Participants construct their CM
3. How CM are used as an assessment tool
4. How to evaluate CM
5. Results obtained at CERN
6. Q&A

Edmondson, K. M. (2005). Assessing science understanding through concept maps. In Assessing science understanding (pp. 15-40).

Fischler, H., & et.al. (2001). Concept mapping as a tool for research in science education. Research in Science Education-Past, Present, and Future, 217-224.

Novak, J. D. (2002). Meaningful learning: The essential factor for conceptual change in limited or inappropriate propositional hierarchies leading to empowerment of learners. Science education, 548-571.

Stoddart, T., & et.al. (2000). Concept maps as assessment in science inquiry learning-a report of methodology. International Journal of Science Education, 1221-1246

3.3 – Exploring Chemistry Transferable Practical Skills: Insights from the National Practical Skills Inventory, 80MS02

Dr Anna Bertram, University of Nottingham
anna.bertram@nottingham.ac.uk
Dr Craig Campbell, University of Oxford
craig.campbell@chem.ox.ac.uk
Dr Megan Midson, University of Oxford
megan.midson@chem.ox.ac.uk;
Dr Malcolm Stewart, University of Oxford
malcolm.stewart@chem.ox.ac.uk

This workshop will provide insights into the development of the National Practical Skills Inventory stemming from discussions at the 'Chemistry Teaching in Practice' (CTiP) Meetings at ViCEPHEC 2023 and at the University of Nottingham in January 2024.

Driven by comprehensive discussions at the CTiP meetings, a compelling proposition emerged: the recognition that many of the chemistry practical skills we teach are made up from a spectrum of transferable practical skills. In this workshop, we aim to foster in-depth conversations surrounding the concept of transferable practical skills, initiating the construction of a transferable skills matrix.

Participants can anticipate engaging discussions, and collaborative efforts aimed at advancing our collective understanding of chemistry practical skills education in higher education.

3.4 – Qualitative data analysis: A hands-on introduction to Thematic Analysis - how and when to use it, 32MS01

Dr Helen Coulshed, King's College London
helen.coulshed@kcl.ac.uk
Dr Anna Roffey, University College London
anna.roffey@ucl.ac.uk
Dr Charlotte Sutherell, Imperial College London
c.sutherell@imperial.ac.uk
Dr Laura Patel, Imperial College London
laura.patel@imperial.ac.uk
Dr Simon Gerrard, Imperial College London
s.gerrard@imperial.ac.uk

There is an increasing interest and activity in STEM educational research from practitioners in STEM education.[1] Discipline-based education research (DBER) projects are suitable for BSc and MSci students within accredited degrees[2] whilst scholarship is increasingly expected for career development and progression within teaching track pathways. However, differences between educational and STEM research methods and practice exist. This can present challenges in defining research questions, choosing appropriate research methods, qualitative data collection and analysis, or obtaining ethical approval, even if a researcher is already experienced in STEM research or as an education practitioner. In a recent RSC HEG meeting, anonymous comments made by participants strongly indicated training and support would be of value for the emerging DBER community.[3]

This workshop will introduce participants to qualitative educational research and selected practical methods. Giving an overview of significant differences in quantitative and qualitative approaches, participants will have opportunities to discuss what approach is most suitable in a current or future project and reflect on their positionality when interpreting data. Thematic analysis as a major qualitative research tool will be introduced: participants will be given the opportunity to practice applying this method on 'real' data sets, with the goal of building confidence in selecting and using thematic analysis.

1. Ross, P.M., Scanes, E., Poronnik, P. et al. Understanding STEM academics' responses and resilience to educational reform of academic roles in higher education. IJ STEM Ed 9, 11 (2022). https://doi.org/10.1186/s40594-022-00327-1
2. IOP Accreditation framework: https://www.iop.org/sites/default/files/2022-09/IOP-Degree-Accreditation-Framework-July-2022.pdf
3. Feedback from RSC HE Chem Teach Network Winter Meeting - Kickstarting Research, 6th March 2024 (https://www.eventbrite.co.uk/e/rsc-he-chem-teach-network-winter-meeting-kickstarting-research-tickets-779545831567), unpublished work.

Thursday summary panel 16:10 – 17:00, 03MS01

Join us for a panel session including the day's keynote speaker Ed Foster and other invitees and submit your questions. Themes for the panel discussion can include student engagement, degree accreditation and other emergent themes from your discussions with colleagues throughout the day.

See posters around the venue and the reverse of your printed programme for speaker details. Submit your questions to our panel and vote on questions using the QR code, or at pollev.com/vicephec24.

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Abstracts: Friday 30th August

Invited Talks: 9:40 – 10:30, 03MS01

RSC Invited Talk

Empowering Diversity: Inclusive Resources for Learners from Various Backgrounds

Professor Gita Sedghi, University of Liverpool
g.sedghi@liverpool.ac.uk

I am thrilled to share my journey of devising innovative teaching methods and inclusive resources that stimulate student engagement and enhance learning. I have developed inclusive resources tailored to meet the diverse needs of our student community. My teaching innovations span a range of activities, including internationalisation, peer-assisted learning, a pre-lab tutoring system, improving maths teaching, a Research Internship module and the integration of equality, diversity, and inclusion (EDI) into the curriculum. A key part of my practice is a student-staff partnership to plan, create and implement resources.

In my keynote, I will focus on the credit and non-credit bearing summer research placements abroad, embedding EDI into the curriculum and an innovative tool to assess the inclusivity of modules/programmes. These resources provide students with a wealth of inclusive opportunities for growth, both personally and professionally, and equip them with the skills and experiences needed to succeed in a globalised world.

IOP Invited Talk

EDI in the Lifecycle of the (Physics) Student Journey in HE

Dr Matt Mears, University of Sheffield
m.mears@sheffield.ac.uk

In this presentation, I will explore the theme of equality, diversity, and inclusion (EDI) in physics education through the lens of three distinct research projects, structured around the lifecycle of a student's academic journey.

Beginning with an investigation into pre-university exposure to coding, I will discuss the barriers and opportunities that different students face before entering university. Next, I will present the issue of gender bias in assessment tools within physics education, and how deeply rooted these biases may persist. Finally, I will show the impact of non-traditional modules, such as employability and soft skills courses, on students' academic outcomes and career readiness, delving into the balance between real-world skills and academic achievement.

By sharing these insights, I aim to shine a light on how the tools, experiences, and structures we use—no matter how well-intentioned—can have varied, unexpected, and sometimes conflicting impacts on different demographic groups. It’s crucial for us, as educators, to understand these nuances and rethink our approaches to foster truly inclusive and supportive learning environments.

Session 4: 10:40 – 11:40

4.1 – Learner-AI interface, 03MS01

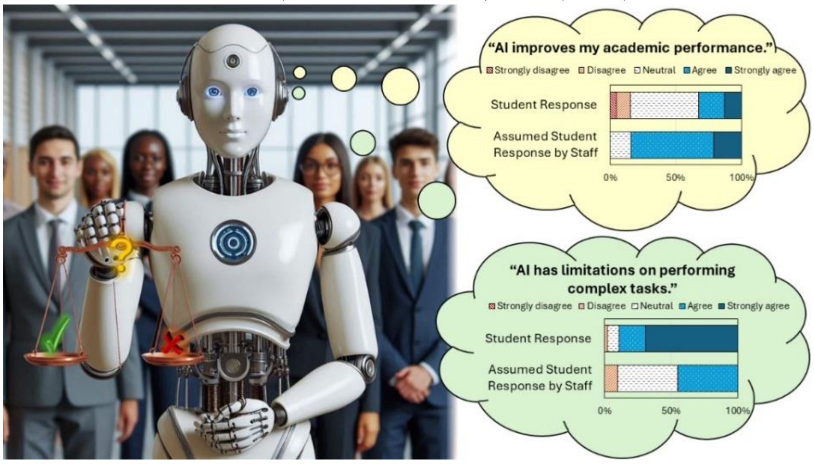
4.1.1 – Use of Artificial Intelligence in Higher Education Chemistry: Student and Staff Perceptions

Dr Stephen E. Potts, University College London (UCL)
s.potts@ucl.ac.uk
Chloe Chan, UCL; Dr Anna Roffey, UCL
anna.roffey@ucl.ac.uk

Generative artificial intelligence (AI) has exploded in popularity recently, revealing concerns and opportunities relating to its use in academic work [1–4]. Here, we report the results of an MSci project evaluating how/if chemistry students use AI and student and staff perceptions of its role in academia. The effect of year of study, gender, ethnicity and English fluency on students' perceptions and AI use were also investigated. Surveys for students (n = 85) and staff (n = 20), and follow-up interviews (n = 6) were conducted. Comparisons between demographic groups were carried out using statistical tests (quantitative data) and thematic analysis (free-text responses).

It was found that students' reasons for using AI did not match what staff believed they were using it for, and students reported using AI for academic work less than staff expected. Female students were more likely to agree that AI is biased and undermines academic integrity, whereas male students thought AI use should be allowed and they wanted training to use it effectively. Native English speakers felt more strongly that AI is factually inaccurate, but they could still become over-reliant on it. In this presentation, the possible reasons for these results will be discussed.

[1] C. M. Castro Nascimento and A. S. Pimentel, *J. Chem. Inf. Model.*, 2023, 63, 1649–1655.
[2] A. J. Leon and D. Vidhani, *J. Chem. Educ.*, 2023, 100, 3859–3865.
[3] T. M. Clark, *J. Chem. Educ.*, 2023, 100, 1905–1916.
[4] S. Fergus, M. Botha and M. Ostovar, *J. Chem. Educ.*, 2023, 100, 1672–1675.



A graphic created by Microsoft Copilot on 29/05/2024 with the prompt "Please create the following image. A humanoid robot in the centre foreground. It is holding a set of legal scales. On the robot's right are a diverse mix of university staff. On the robot's left are a diverse mix of university students."

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4.1.2 – AI and EDI in Chemistry assessments: friends or competitors?

Dr Konstantin Luzyanin, University of Liverpool
Konstantin.Luzyanin@liverpool.ac.uk

Within the realm of chemistry assessment, the role of generative Artificial Intelligence (GenAI) is frequently seen as an impostor attempting to create numerous problems of academic integrity. At the same time, early studies have shown that AI has a potential to revolutionize the educational landscape empowering the principles of Equality, Diversity, and Inclusion (EDI).

While GenAI offers powerful tools for personalized learning, it must be carefully implemented to avoid perpetuating bias or disadvantaging students from diverse backgrounds. This is where EDI steps in, providing a critical framework to ensure AI-powered assessments are fair, inclusive, and effective for all learners.

Drawing upon the results of our pilot studies, this presentation delves into the potential of GenAI tools for crafting assessment formats within analytical chemistry courses. We will explore how GenAI can be harnessed to generate interactive, small-group problem-based workshops that foster collaborative learning. We will also examine the application of GenAI in creating open-book final examinations that assess students' critical thinking and problem-solving abilities. Furthermore, we will evaluate student feedback regarding their perception of how GenAI tools influenced the teaching and learning process.

Sliding Koala group (http://luzyaninlab.weebly.com) is grateful to the RSC (Inclusion and Diversity Fund Application: 174010827) and the University of Liverpool for support of these studies.

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4.1.3 – Enhancing Accessibility in Physics Education through Bespoke Large Language Models

Dr Elise Agra, Durham University
elise.agra@durham.ac.uk
Dr Will Yeadon, Durham University
will.yeadon@durham.ac.uk
Lillian Sparks, Durham University
lillian.sparks@durham.ac.uk

AI has the potential to significantly enhance accessibility in Physics courses. We present early results from a bespoke Large Language Model (LLM) designed to improve educational accessibility and inclusion, focusing on the unique challenges faced by neurodivergent students and demystifying the 'hidden curriculum' associated with technical terminology. Customized learning resources have proven effective in accommodating neurodiverse learning styles. Through the development of a vector database, we demonstrate how specific terminology and complex content can be seamlessly adapted to meet diverse educational needs. The bespoke LLM leverages an open-source foundational model enhanced with curated content specific to Physics embedded in a vector database, enabling both static and dynamic data integration. This approach allows the model to provide up-to-date, contextual information alongside fundamental concepts, such as defining Newton's laws or updating Physics exam schedules and formats. Our preliminary results offer a view into the potential capabilities of bespoke LLMs to improve educational outcomes.

4.2 – HE Outreach, 39MS02

4.2.1 – Establishing a STEM Postgraduate Outreach Group

Dr Charlie Devlin, University of Liverpool
cdevlin@liverpool.ac.uk
Dr Gina Washbourn, University of Liverpool; Michael Jones, University of Liverpool

Postgraduate outreach leaders have the potential to be powerful and inspiring role models for future generations of STEM learners [1]. Not only can they describe the university experience to potential students, but they can also contextualise their research in a way that embeds cutting-edge science into the world around us. We will highlight the importance of uniting multidisciplinary STEM postgraduate students to form a mutually supportive community, helping to tackle the ongoing national issue of feelings of postgraduate isolation [2]. We have achieved this through the medium of training in and developing outreach activities. We are already seeing success with students delivering outreach and public engagement talks and working collaboratively across departments in a novel way. As well as fostering links between departments, this helps students build transferable skills in presentation and communication, as well as disseminating the University's research [3]. We will showcase the materials we use within our monthly community meetings and some examples of student work, as well as sharing thoughts from our students about the project and our future plans.

[1] Harrison, G. et al. (2011) 'The many positive impacts of participating in outreach activities on postgraduate students', New Directions in the Teaching of Physical Sciences, (7), pp. 13–17. doi:10.29311/ndtps.v0i7.461.

[2] Barry, J. and Corcoran, N., 2022, April. Virtual Communities of Practice for Research Postgraduate Students: Determining Needs and Reducing Isolation. In European Conference on Social Media (Vol. 9, No. 1, pp. 229-236).

[3] Harrison, T.G. et al. (2023) 'Outreach: Impact on skills and future careers of postgraduate practitioners working with the Bristol ChemLabS Centre for Excellence in Teaching and learning', Journal of Chemical Education, 100(11), pp. 4270–4278. doi:10.1021/acs.jchemed.3c00261.

4.2.2 – ChemBoost: a widening participation tutoring programme

Dr Alexandra Males, Sheffield Hallam University
a.males@shu.ac.uk
Dr Alice Johnson, Sheffield Hallam University; Dr Mel Lacey, Sheffield Hallam University

ChemBoost is an online tutoring programme running from April 2024-April 2025. It has been designed to support year 12 and 13 students from widening participation groups in the South Yorkshire and wider area to consider chemistry degree courses. The programme includes an in-person welcome event where undergraduate students will meet the participants and run a practical lab session with them. Subsequently for the participants, there will be online weekly 1 hr sessions in a three-week rolling programme rotating between 1) academic staff-led tutorials, 2) guided self-study sessions and 3) student-led mentoring sessions. Undergraduates and PhD students will act as accessible role models for A-level Chemistry and BTEC Applied Science from minoritised groups.

Our talk will discuss how we developed and implemented the ChemBoost programme and the challenges we faced. The programme specifically encouraged applicants from widening participation groups and those underrepresented in Chemistry to apply. The demographics of applicants, those selected for the programme and those retained by the programme will be explored, as well as ChemBoost attendees feedback from the first term of the programme.

4.2.3 – Toolkit: Making the Most of Public Engagement

Dr Rachel Schwartz-Narbonne, Sheffield Hallam University
r.schwartz-narbonne@shu.ac.uk
Dr Melissa M. Lacey, Sheffield Hallam University; Dr Katherine E. Rawlinson, Sheffield Hallam University

Science public engagement is essential to maximise the impact of research on the public and to inspire the next generation of scientists. Inspiring diverse future scientists is essential as currently science is not representative of the communities it serves, an issue that is exacerbated by the STEM leaky pipeline. The leaky pipeline is the decrease in representation, including of women and ethnic minorities, moving through increasing levels of higher education and STEM careers (Almukhambetova et al., 2021, van den Hurk et al 2019). In turn, this increases the challenge of conducting representative science public engagement, as there is a lack of mid and high-level scientists to be representative role models for school and college students (Herrmann et al., 2016).

Here we present a "coat hanger" approach to public engagement: a toolkit that different research projects and target audiences can be "draped" on. The three sides of the coat hanger are 1) co-design, where the target audience is involved in the project design, 2) research, where the public engagement is underpinned by publishable research and 3) student researchers, where undergraduate, Masters and doctoral student researchers lead the outreach project. This triangulated approach gives participants agency within the project both in the co-design and the research, and the student researchers showcase the diversity of early career scientists, providing more relatable role models.

We will present a recent co-designed, research and student-led project using the toolkit. This project encompassed 280 key stage one, 140 key stage two, 100 key stage three and 30 post-16 school students in an interdisciplinary soil chemistry and environmental science research project. The school students' science identity and career aspirations were ascertained by questionnaires with closed and open questions before and after the project. Data presented here will show the impact of the coat hanger approach to outreach across the spectrum of school aged children as well as impact of the project on the undergraduate student researchers.

Almukhambetova, A., Torrano, D.H. and Nam, A. (2021). Fixing the Leaky Pipeline for Talented Women in STEM. International Journal of Science and Maths Education. DOI:10.1007/s10763-021-10239-1

Herrmann, S. D., Adelman, R. M., Bodford, J. E., Graudejus, O., Okun, M. A., and Kwan, V. S. (2016). The effects of a female role model on academic performance and persistence of women in STEM courses. Basic and Applied Social Psychology, 38(5):258-268. DOI:10.1080/01973533.2016.1209757

van den Hurk, A., Meelissen, M. and van Langen, A. (2019). Interventions in education to prevent STEM pipeline leakage, International Journal of Science Education. 41(2):150-164. DOI:10.1080/09500693.2018.1540897

4.3 – AR and visualisation, 80MS02

4.3.1 – Unleashing Augmented Reality to Support a Skills based Lab Curriculum

Dr Lesley Ann Howell, Queen Mary University of London (QMUL)
l.howell@qmul.ac.uk
Dr Megan Bryden, QMUL; Shane Dunne, QMUL; Jawad Ali, QMUL; Nivetha Jeyachandran, QMUL; Mark Hudson, QMUL

In recent years the focus of our practical chemistry classes at QMUL have shifted away from getting the "right" answer and instead onto the key skills and techniques needed to get to that answer. We have identified 16 key skills that we consider essential for all year 1 chemistry students to master by the end of the academic year. To support this approach, we have co-created with our students a library of augmented reality instructional guides using the Microsoft Hololens2 technology. Students are able to book time on the headsets outside timetabled lab classes and work through the guides at their own pace and multiple times if required. This provides a low stake environment, where our students can make mistakes without it impacting final grades, that helps to build competence and confidence in these key skills. We will present both the technology as well as the impact and results of this study.

4.3.2 – Augmented Reality meets Peer Instruction

Prof Simon J. Lancaster, University of East Anglia
S.Lancaster@uea.ac.uk
Dr Daniel Elford, University of East Anglia; Dr Garth Jones, University of East Anglia

Peer Instruction (PI), is a student-centred teaching method, which engages students during class through structured, conceptual questions, delivered by classroom response apps. The key feature of PI is the objective of resolving student misconceptions. Within our coordination chemistry PI session, we provide students two opportunities to answer each question – once after a round of individual reflection, and then again after a round of augmented reality (AR)-supported peer discussion. Most students who answer incorrectly in the individual round switch to the correct answer after the peer discussion. For the six questions posed, we analysed students' discussions, in addition to their interactions with our AR tool. Furthermore, we analyse students' self-efficacy, and how this, in addition to factors such as question difficulty influence response switching. For this study, we found that students are more likely to switch their responses for more difficult questions, as measured using the approach of Item Response Theory. Students with a low assessment of their problem solving and science communication abilities were significantly more likely to switch their responses from right to wrong than students with a high assessment of those abilities. Analysis of dialogues revealed evidence of the activation of knowledge elements and control structures.

4.3.3 – Precise Animations for the STEM Classroom

Dr Miguel Rivera, UCL
miguel.rivera@ucl.ac.uk

The skill of visualisation is a requirement of many STEM subjects and is often leveraged to explain essential topics ("Imagine a spherical cow in a frictionless field…"). This seldom taught skill often constitutes an obstacle to accessing concepts which are difficult to represent for the instructor, and therefore must be imagined by the student.

Representing motion precisely is especially challenging, where instructors often rely on literal hand-waving or third-party videos. This case study focuses on a recent open source project: manim (mathematical animations), which enables the creation of high-quality animations driven by Python and aimed at STEM education.

I will discuss my uses of manim to teach atomistic modelling, give an overview of its main features, presuming little to no knowledge of programming, and create an animation live.

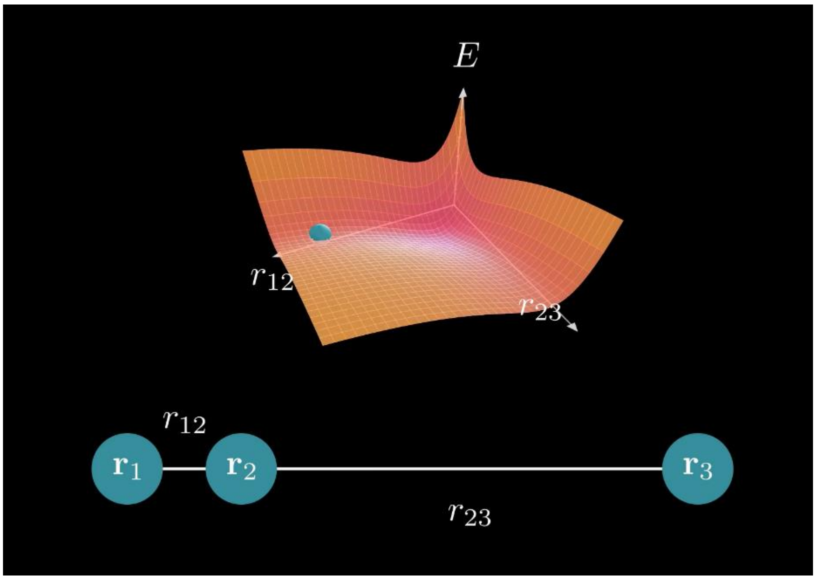

Figure 1: Still frame of an animation showing a potential energy surface.

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4.4 – Lab learning, 32MS01

4.4.1 – Integrating reflective exercises in undergraduate chemistry laboratories: insights and challenges

Dr Mairi Haddow, University of Edinburgh
mhaddow@ed.ac.uk

Reflective exercises are common practice in clinical and pedagogical learning settings, and are increasingly employed across other disciplines to promote metacognitive awareness and facilitate self-directed learning. In the context of physical sciences, the integration of reflective exercises into laboratory learning holds offers students opportunities to evaluate their performance, identify strengths and weaknesses, and set actionable goals for improvement.

This study examines the effectiveness of short reflective exercises in developing second-year chemistry students' laboratory skills. Students were asked to complete a structured pre- and post-lab reflective exercise after each experiment. Feedback was collected via an end-of-year survey. Analysis reveals mixed perceptions among students regarding the utility and effectiveness of reflective exercises. While some students acknowledged the benefits of self-reflection in enhancing learning and identifying areas for improvement, others express concerns about the time-consuming nature and perceived lack of relevance of these exercises. The findings highlight the importance of carefully designing and implementing reflective practices to maximise their impact on student learning and engagement. Central to the process is addressing student concerns, such as clarity of learning outcomes, and the engagement of those assessing the reflective exercises. This study also highlights some of the challenges involved in implementing small-scale reflective exercises.

4.4.2 – Peer assessment of practical skills in a first-year chemistry lab – implementation and evaluation

Dr Cosma E A Gottardi, University of Glasgow
Cosma.Gottardi@glasgow.ac.uk
Tess M S Lynn, University of Glasgow
Claire E Johnston, University of Glasgow
Dr Beth Paschke, University of Glasgow

In this talk, we report on the implementation of a new authentic, direct assessment of laboratory skills in the first-year Quantitative Lab course in the School of Chemistry at the University of Glasgow. The aim was to address the notion that traditional assessment (e.g. lab reports, online quizzes) does not adequately assess or provide feedback on practical skills,[1,2] as well as to offset concerns from the Royal Society of Chemistry, who highlight the disparity in practical experience and skills of students who enter post-school education, exacerbated by the restrictions of the COVID-19 pandemic.[3]

The new assessment involves students observing and marking each other while they perform three tasks with the aid of a detailed checklist. In our talk, we share feedback from students and staff, demonstrating a growth in students' skill level and confidence and highlighting areas for further improvements.

This project evolved from Tess Lynn's final-year undergraduate research project and has been developed jointly as a team of staff and students, including second-year student Claire Johnston, and our talk includes some brief reflections on the benefits of our collaboration.

1. Seery M. K., Agustian H. Y., Doidge E. D., Kucharski M. M., O'Connor H. M. and Price A. (2017). Developing laboratory skills by incorporating peer-review and digital badges. Chemistry Education Research and Practice, 18, 403–419. DOI: 10.1039/C7RP00003K
2. Wright J. S., Read D., Hughes O. and Hyde J. (2018). Tracking and assessing practical chemistry skills development: practical skills portfolios. New Directions in the Teaching of Physical Sciences, 13 (1). DOI: 10.29311/ndtps.v0i13.2905
3. Royal Society of Chemistry. (2021). The future of practical science lessons: Teacher training during the pandemic and the long-term impact on practical work in schools. Report. Available via: https://www.rsc.org/globalassets/22-new-perspectives/talent/covid-and-teacher-training/rsc-report-on-the-effects-of-covid-on-chemistry-teacher-training.pdf (accessed 10 April 2024).

4.4.3 – Using pre-activity videos in forensic science: reducing cognitive load and increasing practical confidence

Dr Anna Kirkham, University of Central Lancashire
akirkham1@uclan.ac.uk
Paul Langton, University of Central Lancashire

The teaching laboratory can be an overwhelming environment for a new undergraduate student. They are in a large laboratory, have a written protocol to follow and set of apparatus to use, some of which they might not be familiar. This has been exacerbated by effects of Covid. It has been proposed by Sweller, in cognitive load theory, that instead of overloading the working memory a student can use other instructional methods, i.e videos, to maximize learning.

Our Forensic Science course has been revamped with a new modules, which gave the opportunity to look at the ways we support our students' practical skills learning journey.

Last summer the videos were co-created with student focused feedback with two summer interns. These were matched to the practicals and recorded in the teaching laboratories where the students would be working. Supplemented by simulations from LearnSci and Labster.

Findings from this relate to how students are using these resources and how they match student preferences for study. Showing how a different type of teaching resource can be used to help students.

The videos are hosted on YouTube https://www.youtube.com/@UCLanForensicScience/videos.

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Session 5: 13:00 – 14:00

Workshops

5.1.1 – Using light to drive reactions: A photoredox catalysis experiment for 3rd year undergraduate students, 30AY01

Dr Karen Parrish, University of Bristol
karen.parrish@bristol.ac.uk
Elen Carter

Photoredox catalysis has been a hot topic of research in recent years, but to date there are relatively few examples of undergraduate experiments using the technology. Here at the University of Bristol we have been successfully running one such experiment for the past year with our 3rd year MSci students. The experiment employs an anti-Markovnikov addition to an alkene in the presence of a blue light and a photocatalyst[1], and was proposed by one of last year's undergraduates as part of a literature project. Students carry out the reaction, purify and characterise the product. They use instrumental techniques (UV-Vis spectroscopy, fluorimetry and cyclic voltammetry) to help them understand how light drives the reaction and molecular modelling (Gaussian) to find out why it occurs with the observed stereochemistry.

1. A. J. Perkowski and D. A. Nicewicz, 'Direct Catalytic Anti-Markovnikov addition of carboxylic acids to alkenes' J. Am. Chem. Soc., 2013, 135, 10334-10337.

5.1.2 – An (un)expected journey towards an ELN: interactive demonstration and survey, 30AY01

Dr Konstantin Luzyanin, University of Liverpool
Konstantin.Luzyanin@liverpool.ac.uk
Rose Hamilton, Harry Palmer, Xavier Sottrel, Richard Roberts, Sarah Gare, University of Liverpool

Attendees may wish to bring along their laptops to this session.

Electronic Laboratory Notebooks (ELNs) becoming increasingly popular in the scientific community, offering numerous advantages over traditional paper lab notebooks, including: i) increased data security and integrity, ii) improved collaboration, and iii) enhanced data analysis.

Despite numerous advantages which ELN brings to research, their use for teaching in STEM is severely restricted mainly due to the costs of professional ELNs, lack of specific support, and absence of strong leading examples of practice which can motivate teachers to adopt this approach.

In the past two years, our lab jointly with the Analytical Services/Chemistry have pioneered the use of ELN in teaching of large cohorts of students in both UG and PG labs. We have created a local version of ELN accessible on our Campus, configured it for specific chemistry modules, provided training to students and staff, and ran as a mode of data collection, reporting and a way of assessing lab performance.

In this interactive session, we will provide a demonstration of how ELN can be introduced to the STEM lab using our own setup, refer to the webpage with guidance and support created by our team, demonstrate how ELN can be used directly in the lab and for the assessment purpose, and survey with participants on what else can we do to help.

Sliding Koala group (http://luzyaninlab.weebly.com) is grateful to the RSC (Inclusion and Diversity Fund Application: 174010827) and the University of Liverpool for support of these studies.

5.2 – Inclusive Assessment in Physics and Chemistry, 39MS02

Nicolas Labrosse, School of Physics & Astronomy, University of Glasgow
Nicolas.Labrosse@glasgow.ac.uk
Dr Linnea Soler, School of Chemistry, University of Glasgow

Inclusive assessment and feedback acknowledges the diversity of the student body and provides all students with equitable opportunities to learn through assessment and feedback. Widespread adoption of inclusive assessment practices in quantitative disciplines like Physics and Chemistry remains challenging, however.

Based on our experience supporting the adoption of inclusive assessment in quantitative disciplines at our university, this interactive workshop will enable participants to consider:

- what inclusive assessment means,
- why inclusivity in assessments matters,
- where does inclusive assessment fit in as part of assessment for learning,
- what barriers to inclusivity in assessments may be present,
- what possible assessment strategies can be implemented in Physics or Chemistry to support inclusivity.

This will be a 60-minute workshop with a mixture of short talking points from the two presenters and interactive discussions facilitated by the two presenters where participants will be invited to share a summary of their discussions with the rest of the participants. Using padlet, examples of inclusive assessment in our disciplines will be created.

At the end of the session, participants will have gained an appreciation of the benefits of taking proactive inclusive assessment and feedback approaches in Physics and Chemistry, and leave with ideas for inclusive assessment strategies that can be implemented in their own teaching.

Butcher, J. et al. (2010) 'How might inclusive approaches to assessment enhance student learning in HE?', Enhancing the Learner Experience in Higher Education, 2(1), pp. 25–40. Available at: https://doi.org/10.14234/elehe.v2i1.14.

Guzman-Orth, D. et al. (2021) 'Equitable STEM Instruction and Assessment: Accessibility and Fairness Considerations for Special Populations', ETS Research Report Series, 2021(1), pp. 1–16. Available at: https://doi.org/10.1002/ets2.12324.

Tai, J.H.-M. et al. (2023) 'Designing assessment for inclusion: an exploration of diverse students' assessment experiences', Assessment & Evaluation in Higher Education, 48(3), pp. 403–417. Available at: https://doi.org/10.1080/02602938.2022.2082373.

5.3 – Learning about Academic Integrity and Codes of Conduct Workshop, 80MS02

Dr Jenny Burnham, The University of Sheffield
j.burnham@sheffield.ac.uk

How do students learn how to act?

Academic Integrity emerged in the chemistry education literature in articles prompted by covid [1-3]. More recently, the importance of clear expectations and students' awareness is stressed in their being able to act with integrity [4,5], and it raises the question; How do students learn how to act with integrity?

I was inspired by Helen Heath's ViCEPHEC22 talk[6] to use the fundamental values of Academic Integrity [7] as the entry point for an MSc student assignment on Codes of Conduct. In this entertaining and informative workshop, I will take delegates through my interactive workshop exploring academic integrity and producing codes of conduct. Participants will work in groups to learn about the fundamental values of academic integrity, produce criteria for a good code of conduct, write a code of conduct covering the three different aspects of an MSc student (student, research worker, scientist), review another, and improve their own for potential submission. This format is interactive and easily customisable to target potential areas of concern and unfair means. Participants will also see how working together on a common task can act as an ice-breaker and start of building community in our new MSc cohorts.

[1] Differences in Chemistry Instructor Views of Assessment and Academic Integrity as Highlighted by the COVID Pandemic. Brittland K. DeKorver, Mitchell Krahulik, and Deborah G. Herrington, Journal of Chemical Education, 2023, 100(1), 91-101. DOI: 10.1021/acs.jchemed.2c00206

[2] Strategies for Effective Assessments while Ensuring Academic Integrity in General Chemistry Courses during COVID-19. Sonali Raje and Shannon Stitzel, Journal of Chemical Education, 2020, 97(9), 3436-3440. DOI: 10.1021/acs.jchemed.0c00797

[3] Keeping a Learning Community and Academic Integrity Intact after a Mid-Term Shift to Online Learning in Chemical Engineering Design During the COVID-19 Pandemic. Marnie V. Jamieson, Journal of Chemical Education, 2020, 97(9), 2768-2772. DOI: 10.1021/acs.jchemed.0c00785

[4] The Importance of Clear Expectations Related to Academic Integrity in a Chemistry Course Syllabus: What Counts as Cheating? Slade C. McAfee, and Jon-Marc G. Rodriguez, Journal of Chemical Education, 2024, 101(1), 3-9. DOI: 10.1021/acs.jchemed.3c00942

[5] Improving Students' Awareness and Ability of Academic Integrity in a Flipped Chromatographic Analysis Course. Bin Du, and Jialing Guo, Journal of Chemical Education, 2024, 101(1), 69-76. DOI: 10.1021/acs.jchemed.3c00718

[6] Physics Students Attitudes to Academic Integrity. Helen Heath. Variety in Chemistry Education-Physics Higher Education Conference. University of Kent (online), 23rd August 2022.

[7] The Fundamental Values of Academic Integrity. (3rd ed.). International Center for Academic Integrity [ICAI], 2021. https://academicintegrity.org/images/pdfs/20019_ICAI-Fundamental-Values_R12.pdf (last accessed 22nd March 2024)

5.4 – Journeys in live polling: Using Mentimeter in reverse gear to explain physical science concepts, 32MS01

Dr Maire Gorman (she/her), University of Bristol, University of Sussex
mgg37@sussex.ac.uk

Mentimeter is one of many versatile online teaching tools which can be used by educators to ask a variety of question types to provide them with real-time feedback of students evolving comprehension of new concepts and overall engagement.

In this workshop, I will guide participants through a series of interactive activities to demonstrate how Mentimeter can be used as a vehicle for actually explaining concepts in the first place i.e. using in reverse gear.

I will give examples of how Mentimeter can be used to a) gauge student attitudes, b) facilitate inter and intra-cohort sharing of ideas and student-inspired content to invigorate and increase motivation, c) create real-time visualisation of student-generated data and d) showcase abstract computational methods used in cutting-edge atmospheric modelling using gamification principles. I will demonstrate how to use principles of neuroscience to develop incremental series of questions which delineate and reinforce fundamental concepts.

I will share some of the harsh (!) lessons I've learned with pragmatic tips for incorporating into both small, large and mixed cohort teaching.

Session 6: 14:20 – 15:00

6.1 – Virtual Reality (VR), 03MS01

6.1.1 – Glassware Heroes: A Virtual Reality Game to Teach Glassware Assembly That Reduces Mistakes Made by Laboratory Novices

Dr Ella M Gale, University of Bristol
ella.gale@bristol.ac.uk
Adam O'Sullivan, University of Bristol; Oliver J. Matthews, Hewlett-Packard Enterprise, Bristol; Josh Dunn, University of Bristol; Diana Uchaeva; Dr Amy M. McCarthy-Torrens, University of Bristol

The first few weeks in a university level chemistry laboratory can be daunting and off-putting. Student safety is paramount, but, despite the best efforts of technicians and demonstrators, they cannot be everywhere. I will describe the development and testing of an immersive, virtual reality (VR) laboratory simulation to teach correct glassware assembly procedure before entering a wet lab. Before attempting to assemble a reflux in real life, first year students were taught via one of three interventions: the VR game, an online game, or watching an instructional video. The VR group made 0.2 ± 0.4 mistakes, less than the other two interventions and statistically indistinguishable from experts, and reported higher enjoyment and confidence. We attribute these results to the higher realism and skeuomorphism of the VR intervention and the synergistic contribution embodied cognition to the procedural learning. We believe this demonstrates the usefulness of VR in chemistry education and suggest that VR-based pre-laboratory training offers an efficient route to increased safety and effectiveness to wet laboratory training.

ViCE/PHEC

6.1.2 – Exploring the Impact of using Social Virtual Reality and Videos as Pre-Laboratory Preparation on Student Confidence and Interest

Lee Armstrong, University of Kent
1312larmstrong@gmail.com

Figure 1: A group of people in the Virtual Reality Lab.

Last year I introduced ConVRse, a Virtual Reality Social platform and discussed its possible use cases for physics education and higher education. This academic year for my master's research I used ConVRse to investigate if students engaging in VR and video pre-lab material prior to laboratories affects their confidence and interest in the laboratory.

The pre-lab video material leads to more self-reported student confidence and interest compared to the VR experience, likely because the VR experience did not have any guidance. Although the social aspect shows promise for more practical labs.

Design choices for putting together virtual environments make a significant difference; It was shown that environments can be designed to help students unknowingly perform productive behaviours. For example, putting two pieces of related equipment near each other but with enough distance that it requires two people to operate both, this incentives teamwork.

In general, VR was shown to be an excellent intrinsic motivator as students are interested in VR. If harnessed it could be used to teach and excite students to want to learn more about these subjects. Further research is needed which could include investigating which types of virtual environments are most effective at teaching and engaging students.

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6.2 – Assessment & Feedback, ~~39MS02~~ 32MS01

6.2.1 – Improving assessment and feedback experiences for neurodivergent students

Dr Helen Coulshed, King's College London
helen.coulshed@kcl.ac.uk
Alexander Palmer, King's College London
alexander.palmer@kcl.ac.uk

Assessment rarely meets the needs of student diversity, particularly disabled students. [1,2] Teaching and assessment are often not designed to be inclusive, and support for disabled students is often considered solely through the lens of accommodations, often perceived as awarding an unfair advantage, and as othering disabled students. [3] Neurodivergent students must also contend with the stereotyped beliefs and lack of awareness of neurodivergence from peers and staff, which may contribute to limited support and understanding during their studies. [4,5]

This project investigated how to support neurodivergent students through improved marking criteria, communication, and feedback literacy.

Research was co-constructed with neurodivergent students, who co-designed and facilitated accessible interviews and focus groups. These neurodivergent students were also the primary data analysts, enabling in-depth engagement with rich qualitative data. Student participants were recruited from a range of disciplines and levels of study.

This talk describes how and why neurodivergent participants experienced disadvantages or difficulties, outlining the key concepts identified from thematic analysis. From this, potential changes are proposed, identified from analysis of participants' discussions and linked to literature, to specifically support neurodivergent students in assessment and feedback.

1. J. H. Nieminen, Teach. High. Educ., 2022, 1–19.
2. J. McArthur, Assess. Eval. High. Educ., 2016, 41, 967–981.
3. J. H. Nieminen and S. E. Eaton, Assess. Eval. High. Educ., 2023, 0, 1–16.
4. D. Weiting Tan, M. Rabuka, T. Haar and E. Pellicano, Autism. DOI:10.1177/13623613231219744.
5. C. M. Syharat, A. Hain, A. E. Zaghi, R. Gabriel and C. G. P. Berdanier, Front. Psychol., 2023, 14, 1– 16.

6.2.2 – Are we literate? Exploring how views on feedback amongst chemistry staff influence their undergraduate course design

Dr Charlotte L Sutherell, Imperial College London
c.sutherell@imperial.ac.uk

Feedback is contentious within higher education: it is considered crucial for student development but satisfaction with feedback practices remains low amongst students and staff.[1] Recent feedback research has shifted from viewing feedback as teacher-student transmission to a learner-centred process that emphasises dialogue and student action.[2] In this new paradigm, educators require teacher feedback literacy: the attitudes, knowledge, and skills enabling them to design environments and processes that help students take up and generate feedback effectively. [3]

This talk describes a qualitative interview-based investigation into attitudes amongst chemistry teaching staff towards feedback, exploring the alignment of views with the concept of teacher feedback literacy and how this influences undergraduate course design.

Key findings highlight the value placed on feedback for learning by staff and recognition of the impact of emotion and relationships to effective feedback, despite continued prevalence of transmission-centred views. Potential disciplinary signature feedback practices within chemistry were identified, including laboratory work as an area involving greater intentional design to build student engagement with feedback processes. I will discuss challenges of disciplinary approaches in chemistry, including the value and emphasis placed on informal, verbal dialogic feedback. Finally, routes to embed feedback literacy and sustainable feedback design are considered.

[1] Price, M., Handley, K., Millar, J. & O'Donovan, B. (2010) Feedback: All that effort, but what is the effect? Assessment and Evaluation in Higher Education. 35 (3), 277–289

[2] Sutton, P. (2012) Conceptualizing feedback literacy: knowing, being, and acting. Innovations in Education and Teaching International. 49 (1), 31–40.

[3] Carless, D. & Winstone, N. (2020) Teacher feedback literacy and its interplay with student feedback literacy. Teaching in Higher Education. 28:1, 150-163

6.3 – Playful learning, 80MS02

6.3.1 – Meme making for reflection and retention of knowledge

Dr Felicity Carlysle-Davies, University of Strathclyde
felicity.carlysle-davies@strath.ac.uk
Dr Helen Tidy, Teesside University; Dr Rachel Bolton-King, Nottingham Trent University / Staffordshire University; Dr Carrie Mullen, University of the West of Scotland; Leisa Nichols-Drew, De Montfort University; Dr Ruth Croxton, University of Sunderland / Northumbria University; Kimberlee Moran, Rutgers University

Traditionally lectures have been used to transmit knowledge with little time for students to reflect fully on their learning. This presentation will detail the findings of research used meme making as a vehicle to allow students to reflect on, and absorb, lecture information.

Forensic Science students from seven universities were asked to create a meme which summarised a piece of information they had learnt during the session, this allowed students to express their creativity alongside reflecting on the taught session. The memes were shared in real time with the class using Padlet, with all students able to upload anonymously and also to 'like' the memes that were uploaded.

It was found that this process ultimately led to better retention of fact as well as a more inclusive and varied learning environment, with overwhelmingly positive student feedback.

This presentation will also reflect on the experience of implementing the memes from the perspective of the lecturer and the insights the process has provided on the elements of sessions that students are retaining the most.

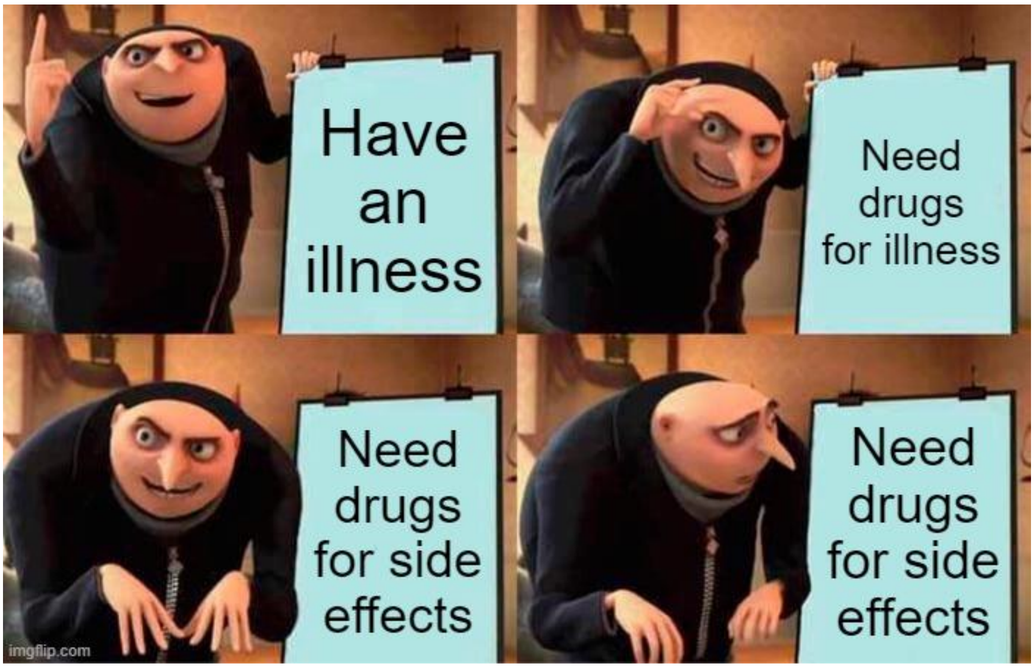

Image 1. An example of a meme generated by a student after a lecture on the prescribing cascade and polypharmacy

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6.3.2 – Using Comic strips as an educational tool for learning about the stages of ‘respiration’ and promote team-work

Dr Shelini Surendran, University of Surrey
s.surendran@surrey.ac.uk

The purpose of this presentation is to investigate the effects of comic strips on enhancing students learning and attitudes about cell respiration within the biochemistry module that I teach. Students (n=62) developed comic strips using illustrated scenes and dialogue from online generators such as pixton and cava. I will report back on the insights gained from this experience: What students and lecturers like and don’t like, challenges and opportunities, and the rationale behind its current form and our plans for the future. I will show how to make a comic strip online with a hands-on demo, whilst discussing the rationale behind some of the design decisions.

6.4 – Criticality and inclusivity in STEM education, ~~32MS01~~ 39MS02

6.4.1 – A proposed imposter phenomenon intervention for undergraduate physics students

Dr Ewan Bottomley, University of Aberdeen
ewan.bottomley@abdn.ac.uk
Prof Vivienne Wild, University of St. Andrews; Dr Antje Kohnle, University of St. Andrews; Dr Paula Miles, University of St. Andrews; Dr Ken Mavor, University of St. Andrews

Following an extensive quantitative study of identity and belonging in undergraduate physics students, a small qualitative follow-up found that women named imposter phenomenon as a key factor influencing their experience. Women believed this to be a barrier to their progression in physics and perceived it to be experienced more by women than men. Previous research also finds women in astrophysics to report greater levels of imposter phenomenon than men (Ivie, White, & Chu, 2016). However, the experience of imposter phenomenon is ubiquitous, with both men and women experiencing it to some degree (Caselman, Self, & Self, 2006). Despite its ubiquity, the topic is rarely discussed with undergraduate students. Based on the work of Walton and Cohen (2011), we created a short intervention aimed at (1) creating a sense of social support for those feeling the effects of the imposter phenomenon, and (2) normalising conversations around imposter phenomenon in an undergraduate cohort. This intervention was delivered to everyone regardless of gender. Feedback from students during the session, and from semi-structured interviews following the session, indicated that they found the intervention helpful.

Caselman, T. D., Self, P. A., & Self, A. L. (2006). Adolescent attributes contributing to the imposter phenomenon. Journal of Adolescence, 29(3), 395–405. https://doi.org/10.1016/j.adolescence.2005.07.003

Ivie, R., White, S., & Chu, R. Y. (2016). Women's and men's career choices in astronomy and astrophysics. Physical Review Physics Education Research, 12(2), 020109.

Walton, G. M., & Cohen, G. L. (2011). A brief social-belonging intervention improves academic and health outcomes of minority students. Science, 331(6023), 1447-1451. DOI: 10.1126/science.1198364

6.4.2 – Re-measuring Schrödinger: inclusive leadership in quantum mechanics

Dr Claire Davies, University of Exeter
c.davies3@exeter.ac.uk

This session discusses themes that some attendees may find distressing.

This talk summarises my reflections on a discussion of Erwin Schrödinger's predatory behaviour [1] that I have included in the Quantum Mechanics course for second year Physics, Natural Sciences, and Combined Honours Mathematics and Physics students since I took over the module's leadership in autumn 2022. I explain how I link the discussion to the concepts of measurement in Quantum Mechanics and I provide rationale for the discussion. This includes drawing on findings from a recent Bullying & Harassment survey conducted by the Royal Astronomical Society, the rates of harassment reporting within our department, and other attempts to quantify the impact harassment has on the retention of women and minoritised groups in Physics (and elsewhere). Finally, I share feedback I have received from students about approaching these subjects within the module and the impact this has had on them.

[1] Humphreys J. 2021, "How Erwin Schrödinger Indulged His Lolita Complex In Ireland", The Irish Times

Friday summary panel 15:00 - 15:45, 03MS01

Join us for a panel session including the day's invited speakers Prof Gita Sedghi and Dr Matt Mears and other invitees and submit your questions. Themes for the panel discussion can include inclusivity and diversity in Physics and Chemistry Education and other emergent themes from your discussions with colleagues throughout the day.

See posters around the venue and the reverse of your printed programme for speaker details. Submit your questions to our panel and vote on questions using the QR code, or at **pollev.com/vicephec24**.

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Poster Abstracts

P1 – PERIODIcally Season 2: Investigating the Experience of People who Menstruate Within STEM Careers and Education

Charlie Simms, University of Oxford
charlotte.simms@trinity.ox.ac.uk
Manami Imada, University of Oxford; Josie Sams, University of Oxford; Elba Feo, University of Technology Sydney; Sofia Olendraru, University of Oxford; Charlotte Oliver, University of Oxford; Felicity Smith, University of Oxford; Michael O'Neill, University of Oxford; Charlie Simms, University of Oxford

PERIODically is a podcast created by Chemistry students at the University of Oxford. Season 1 focused on the impact of periods on undergraduate chemists.1 Following the incredible conversation generated by Season 1, Season 2 broadens the scope of discussion to include a diverse range of menstrual experiences from PhD students to senior lecturers within STEM. Topics of discussion include: endometriosis, polycystic ovarian syndrome, the menopause, perimenopause, and infertility.

In order to explore these wider experiences, Season 2 adopts a more collaborative format. Invited guests (all professional scientists) are interviewed by the PERIODically hosts. By listening to how menstruation is situated within a wider context, Season 2 provides an interesting perspective on how the professional structures of STEM fields can sometimes pose barriers to inclusion.

This conference poster will share some of the themes explored during Season 2 of PERIODically, and provide the audience with a chance to reflect on concrete actions which might be taken to improve the education and employment of people who menstruate.

PERIODically can be found on all popular streaming platforms, such as Spotify, Apple Podcasts, and Amazon Music. Season 2 has been generously funded by the RSC Equality and Diversity Fund, the Oxford Department of Chemistry, the OXiCFM CDT, and the Oxford MPLS Division.

1. E. Feo, S. Olendraru, M. O'Neill and C. H. Simms, Trends Chem, 2023, 5, 789-791.

P2 – Enhancing Student Performance: Insights from 1st Year Undergraduate Physics Laboratory Module

Mark Chester Jude Emmanuel, King's College London
mark.chester_jude_emmanuel@kcl.ac.uk
Dr Bozidar Butorac, King's College London

In this study, we analysed performance of first-year undergraduate students in the Physics Laboratory Module. Our analysis focused on five short reports and three long reports. We noticed that for the whole cohort, the mean and median marks have increased only slightly across the 3 long reports. For the short reports, mean/median marks have stayed almost the same. We found a positive correlation between reviewing feedback and the improved quality of students' subsequent reports. There are many reasons that could affect students' marks. Firstly, engagement with the feedback was decreasing throughout the year. Secondly, some students who receive feedback on their first report may not fully use or understand the feedback provided. Also, the quality of feedback is an important factor that needs to be considered. If the feedback provided to students is not clear, doesn't contain some actionable suggestions or fails to address key areas of improvement, then its impact on subsequent submissions will be limited. The difference in quality and amount of feedback given among different markers can influence the results. Finally, for some students, improvement might have plateaued as they approached their potential writing proficiency. Further research needs be done to see how feedback could be improved.

[1] Donovan, P., 2014. Closing the feedback loop: physics undergraduates' use of feedback comments on laboratory coursework. Assessment & Evaluation in Higher Education, 39(8), pp.1017-1029.

[2] Shute, V.J., 2008. Focus on formative feedback. Review of educational research, 78(1), pp.153-189.

[3] Nicol, D.J. and Macfarlane-Dick, D., 2006. Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. Studies in higher education, 31(2), pp.199-218

P3 – Sustainable! - Impact of Laboratory Practice and Student Reflections

Dr Lorraine Gibson van Mil, University of Strathclyde
lorraine.gibson@strath.ac.uk
Dr Christopher Dodds, University of Strathclyde; Hannah Magowan, University of Strathclyde

Laboratories are known for their energy-intensive equipment, single-use plastics, and hazardous waste generation. But, they are arguably essential to a students' learning within UG chemistry programmes.

This poster will present the key findings of an UG project that set out to:

- Better understand current sustainable practice in our inorganic synthetic lab.
- Modify an experiment to improve its sustainable practice, without loss of intended learning outcomes.
- Survey an UG student cohort to hear their views of sustainable lab practice.

A holistic approach that integrates sustainable practice into laboratory operations was taken throughout the project and by doing so, the project aimed to not only reduce the environmental footprint of a laboratory experiment, but also to inspire a culture of sustainability among researchers, students, and staff. Laboratory practices, infrastructure, and culture were all reviewed to minimise environmental impact and promote sustainable operations and culture.

P4 – ChemQuest – The Education for Sustainable Development Game

Dr Lorraine Gibson van Mil, University of Strathclyde
lorraine.gibson@strath.ac.uk
David Stevens, University of Strathclyde; Dr Seb Sprick, University of Strathclyde; Dr Patrick Thomson, University of Strathclyde

Based on a workshop develop by Haxton (1), a final year UG project focussed on participatory learning approaches, to create an education for sustainable development (ESD) workshop. During the project an interactive game was created wherein students explored solutions to a globally recognised problem. Students worked in groups, each group receiving specific game cards allowing them to make choices across a range of solutions. The groups were given one set of game cards that related to one pillar of ESD -social, environmental, or economic. Working in 'silos' they negotiated to mutually agreeable solutions. The game then moved into a second stage. New student groups were created that mixed up the 'silos' and included representation from all three pillars. An additional challenge was presented that required students to renegotiate solutions using the full set of game cards.

Through interactive activities and group discussions, innovative solutions were formulated and, importantly, by the end of the game students understood the broader implications of their actions across all three pillars of ESD. The workshop fostered critical thinking, interdisciplinary cooperation, and a commitment to driving positive change, in the hope of empowering students to be catalysts for sustainable solutions in their communities.

This poster will present the outline of the participatory learning workshop and the results of a student survey that reflected on the students' awareness and perceptions of a systems thinking approach to solve real-world problems.

Haxton, K., No-win scenarios in dynamic mini-problem based learning for sustainability and social justice, ViCEPHEC, July 2023

P5 – Assessing teachers' conceptual knowledge gains using concept maps

Milena Vujanovic, University of Leeds and CERN
milena.vujanovic@cern.ch
Prof Dr Alison Voice, University of Leeds; Dr Rob Purdy, University of Leeds; Dr Jeff Wiener, CERN

Every year, CERN, the European Organization for Nuclear Research, organises professional development programmes for in-service high-school science teachers. The primary objective of CERN's teacher programmes is to increase the teachers' content knowledge, ensuring alignment with the latest advancements in particle physics and related domains.

This project seeks to discern the extent of gains in teachers' content knowledge and better integration of the newly acquired knowledge using the framework of playful tests, i.e. concept maps (CM).

CM are graphical representations of organised knowledge and they are constructed to answer a focus question (Novak & Cañas, 2010). Teachers are instructed to create a CM at the beginning of the 2-week-long teacher programme, at the halfway point after one week, and on the last day of the second week following the completion of the educational part of the respective programme. By comparing the teachers' maps, it is possible to track content knowledge gains throughout the programme.

The first results are promising as they showed the potency of CM as a powerful evaluation tool, facilitating the tracking and assessment of teachers' conceptual knowledge. A substantive growth in teachers' conceptual knowledge was observed and preliminary findings will be presented in ViCEPHEC 2024 poster session.

Novak, J. D., & Cañas, A. J. (2010). The universality and ubiquitousness of concept maps. Concept maps: Making learning meaningful,1-13.

P6 – Representation: Motivations for studying and staying in Chemistry

Dr Laura Hancock, University of Birmingham
l.hancock@bham.ac.uk
Luke Namadila, University of Birmingham

The RSC 'Missing Elements' report highlighted a significant lack of diversity in chemistry academia and industry, with underrepresentation of black and minoritised ethnicities at senior levels.[1] The report cites a number of interlinking reasons for this, including a general lack of representation for people from minoritised backgrounds ('you can't be what you can't see').

Currently, there are widespread efforts from the RSC and UK Universities to address this issue. This includes the inclusion of specific activities within degree programmes to highlight underrepresented chemists with the aims of increasing a sense of belong for people from all backgrounds.[2,3]

In this student-led project, we investigated University of Birmingham student perceptions of representation in chemistry, and how this related to motivations for studying chemistry at undergraduate level and continuing in chemistry post-graduation.

1. https://www.rsc.org/globalassets/22-new-perspectives/talent/racial-and-ethnic-inequalities-in-the-chemical-sciences/missing-elements-report.pdf (accessed 21-3-24)
2. C. E. H. Dessent, R. A. Dawood, L. C. Jones, A. S. Matharu, D. K. Smith, and K. O. Uleanya J. Chem. Educ. 2022, 99, 1, 5–9
3. D. P. Williams and K. Karim J. Chem. Educ. 2020, 97, 11, 4039–4043

P7 – A Snapshot of UK Pre-Lab Practices, and Instructor Perceptions of their Purpose and Effective Design

Dr Patrick Thomson, University of Strathclyde
patrick.thomson@strath.ac.uk
Dr Benjamin E. Arenas, University of Edinburgh; Dr Mairi Haddow, University of Edinburgh; Dr Anna Kirkham, University of Central Lancashire; Dr Cristina Navarro Reguero, Newcastle University

Pre-labs are a widely-used and powerful method of supporting and maximising laboratory learning. There have been many examples of good practice, many studies into the effectiveness of these practices, and efforts to produce a unified theory-backed framework for effective pre-lab design.1

Across the UK (and even within individual institutions), there are a wide range of pre-lab designs and activities in use. We wish to capture a snapshot of this landscape, looking at how widespread certain practices are, and whether they are over or under-represented at different academic levels.

Many lab heads or instructors are faced with challenges of limited time or resources and may also perceive certain practices to be more or less effective. Therefore, we also aim to explore the factors that influence instructors in the design of their pre-labs, and the rationale for choices they may have made.

This will allow us to explore the different pre-lab practices used in the UK, and the reasons these practices were chosen. We present our preliminary findings and invite delegates to contribute to the next phase of the work.

(1) Agustian, H. Y.; Seery, M. K. Reasserting the role of pre-laboratory activities in chemistry education: a proposed framework for their design. Chemistry Education Research and Practice 2017, 18 (4), 518-532, 10.1039/C7RP00140A. DOI: 10.1039/C7RP00140A.

P8 – Chemistry on the bench: bridging maths, chemistry and critical thinking skills in undergraduate labs

Dr Melissa D'Ascenzio, University of Dundee
m.dascenzio@dundee.ac.uk
Dr Alan Black, University of Dundee; Dr John Pokora, University of Dundee; Bethan Forrest, University of Dundee

A modern take on the chromatographic separation of chlorophyll pigments.

The isolation of plant pigments using chromatography finds widespread application in public engagement activities and undergraduate labs. However, most of the methods used in these practical experiments lack the reproducibility and accuracy we strive for in chemistry labs, as the separation of pigments is often achieved by paper or thin-layer chromatography, while pigments are identified by colour or Rf.[1-2]

In this new laboratory protocol, we propose a rigorous methodology that allows students to experiment with a variety of techniques including UV-vis spectrophotometry, reverse-phase chromatography, and chemical reactions that can be performed safely on the bench using environmentally friendly solvents. In a follow-up workshop, students are challenged to apply their maths skills to calculate the ratio between chlorophyll *a* and *b* in their samples by solving a system of equations.[3]

This laboratory practical combines the appeal of colourful chromatography with reliable analytical methods that allow students to develop chemistry skills while working safely on the bench, engaging with complex mathematical concepts, and developing critical thinking skills. The poster will present an overview of the different components of this lab practical, the rationale behind their inclusion, and their potential impact on students' skills.

(1) Dias, A. M.; Ferreira, M. L. S. Isolation of Plant Pigments from Green and Red Leaves. In *Comprehensive Organic Chemistry Experiments for the Laboratory Classroom*, 1st ed.; RSC, 2017; pp 9-13.

(2) Madureira, A. M.; Ferreira, M-J. U. Thin-Layer Chromatography of Plants Pigments. In *Comprehensive Organic Chemistry Experiments for the Laboratory Classroom*, 1st ed.; RSC, 2017; pp 18-22.

(3) Porra, R. J.; Thompson, W. A.; Kriedemann, P. E. Determination of accurate extinction coefficients and simultaneous equations for assaying chlorophylls a and b extracted with four different solvents: verification of the concentration of chlorophyll standards by atomic absorption spectroscopy. *Biochim. Biophys. Acta - Bioenerg.* **1989**, *975* (3), 384-394. DOI: 10.1016/S0005-2728(89)80347-0.

[continued on the next page]

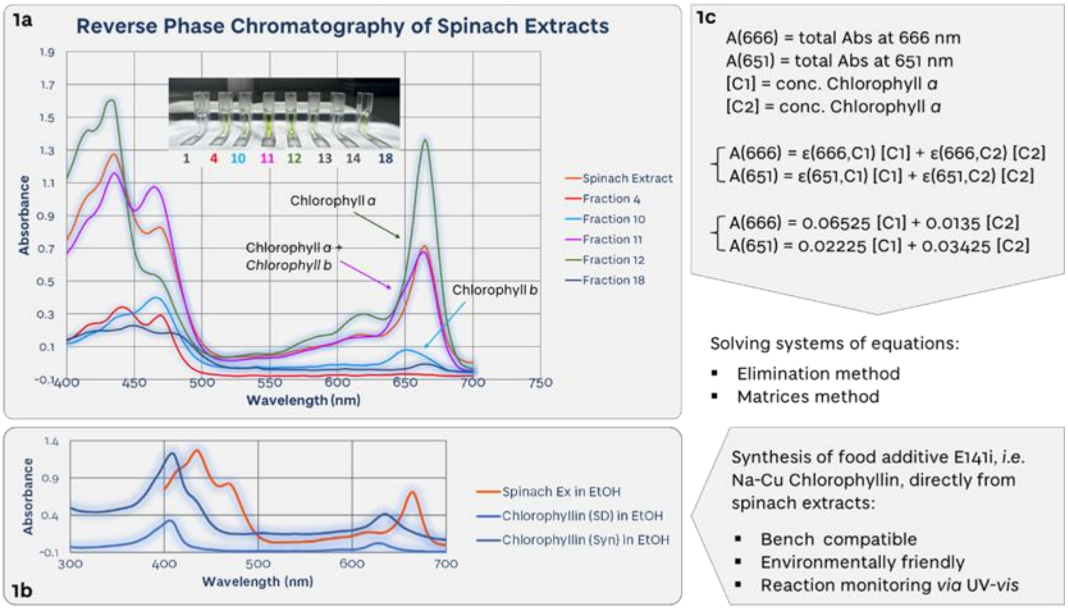

Figure 2a) UV-vis spectrum of spinach extracts (orange) superimposed with the spectra of individual fractions obtained by reverse-phase column chromatography. Complete separation between chlorophyll a and b can be observed in fractions 10 (light blue) and 12 (green), respectively; 1b) the successful synthesis of food additive E141i is assessed by UV-vis spectrophotometry by comparing the spectrum of the product of saponification and Mg-Cu exchange (chlorophyllin Syn) to the spectrum of spinach extracts (orange) and commercially available chlorophyllin (SD); 1c) system of equations used to calculate the ratio of chlorophyll a and b in spinach extracts in EtOH. The extinction coefficients were derived following the methodology developed by Porra et al.[3]

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P9 – Drug Discovery Bingo

Dr Katherine J. Haxton, Keele University
k.j.haxton@keele.ac.uk

Drug discovery bingo is a short engaging activity that provides 1st year chemistry students with a broad and simplified overview of drug discovery and what makes a molecule drug-like. This links to UN Sustainable Development Goal 3 (Good Health and Well-Being) and is part of our Sustainable Chemistry module 'Global Health' content. A set of bingo cards containing molecular structures and properties linked to Lipinski's rule of 5 (Ro5, likelihood of a molecule being orally bioavailable) were created from the ChEMBL database. A broad range of structures and Ro5 violations were selected with a very small number of 'bingos' or violation free molecules. In class, drug discovery is briefly introduced then students are given the cards of three molecules to check. Gamification of this through bingo ensures good engagement with the list of properties that relate to the Ro5. At the end, one or two students have 'bingos' and a discussion of the challenges of screening molecules can begin. This poster will summarize the activity and share the resources for those who wish to play along.

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P10 – Crabby about Politics: A Simulated Political Committee Inquiry

Dr Katherine J. Haxton, Keele University
k.j.haxton@keele.ac.uk

In 2021 a large number of marine crustaceans such as crabs and lobsters washed up on beaches in the Teesside estuary. There were many theories as to the cause including pyridine or heavy metal toxicity, algal blooms, and other chemical culprits. Site visits by the Environmental Agency took place and this culminated in a Parliamentary Inquiry in 2022. This activity contextualizes taught material on toxicology and introduces key ideas in environmental analysis/forensics to 1st year chemistry students. Prior to the activity, students learn about toxicology then in analyse authentic datasets in groups to prepare for a simulated committee inquiry. The datasets are large and complex and this gives students experience of handling uncertainty in data. The simulated committee inquiry involves students role-playing expert scientists, and staff role-playing politicians. This enables students to develop argumentation skills, presenting complex and ambiguous data to 'non-experts' and handling questions in a policy/political context. This poster will summarise the activity and share the resources, as well as critiquing the role of authentic ambiguity in chemistry teaching.

P11 – Role Play in the Teaching Labs: Boosting Engagement and Learning from Unexpected Results

Sam Trouton, University of Warwick
s.trouton@warwick.ac.uk
Dr Nikola Chmel, University of Warwick; Dr Russ Kitson, University of Warwick

In a previous study, the addition of role-play demonstrated a highly positive impact on a non-expository experiment in the teaching lab, resulting in a significant decrease in self-reported anxiety and improvements in student interest and engagement.

This study utilized a mixed-methods approach, including questionnaires, focus groups, and interviews with post-graduate demonstrators, to investigate two cohorts of students completing a non-expository, research-like experiment. Both the 22-23 and 23-24 cohorts completed the same experiment, with the 23-24 cohort incorporating a role-play element where student groups acted as consultancy agencies undertaking a research project.

Initial interviews revealed promising results, with demonstrators noting increased student engagement. However, these findings conflicted with survey data, which showed no statistically significant changes in student responses to the questions asked. Further analysis revealed a significant increase in the standard deviation of student responses, indicating a split in the cohort: already engaged students became more engaged, while less engaged students were dissuaded. This impact is tentatively attributed to an increase in cognitive load. Future work aims to identify the cause of this split and provide recommendations for the effective implementation of role-play.

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P12 – Piloting Peer Assisted Learning (PAL) in the Chemistry Department

Dr Michael M. Piperakis, University of Reading
m.m.piperakis@reading.ac.uk

Peer-assisted learning (PAL) is a commonly applied teaching and learning approach in the higher education sector. PAL often involves students from more advanced years (PAL leaders) facilitating small collaborative study groups consisting of students from lower years (PAL tutees). The approach is interactive and learning content is revisited, reinforced, and clarified through a range of activities that encourage peer discussion and evaluation. PAL enables the development of key skills, including the enhancement of student confidence and self-esteem and promotes a greater sense of belonging to the academic community.

The aim of this study was to examine how the undergraduate students (PAL tutees) experienced and evaluated our pilot PAL sessions; these were run for the first time in the chemistry department and covered one of the first-year core taught modules. The impact of the PAL sessions on their academic performance was also examined. Moreover, PAL leaders were asked to provide feedback on their experience of the process. The information gathered will provide a valuable insight into the further development and deployment of the PAL approach to other areas in our department.

Topping, K. J., & Ehly, S. W. (2001). Peer Assisted Learning: A Framework for Consultation. *Journal of Educational and Psychological Consultation*, *12*(2), 113–132. https://doi.org/10.1207/S1532768XJEPC1202_03

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P13 – Empowering Students to Critically Self-Reflect on Graduate Competencies

Dr Donna L Ramsay, University of Strathclyde
donna.l.ramsay@strath.ac.uk
Dr Lorraine Gibson van Mil, University of Strathclyde

Employability skills training is a critical and essential aspect of undergraduate chemistry degrees to ensure good graduate outcomes for students.[1] High quality learning and training opportunities need to be relevant and enabling to empower students to develop skills and competencies that meet the needs of future employers. Educators are challenged to ensure learners view the development of graduate attributes as essential training that leads to fulfilling graduate, industrial, or research-driven, career pathways.[2]

This poster will present the outcomes of a new workshop that was designed to invoke transformative approaches to learning, peer group working and self-reflection on emotional intelligence (EI) as a developing graduate attribute. Graduates who possess high levels of EI are more likely to thrive in the workplace, be able to collaborate more effectively, and better navigate human interactions.[3,4] The workshop challenged students to identify their own competencies and why this makes them deal with problems in a certain way. Perhaps more importantly, students had to recognise why others may act and/or perform differently to themselves in challenging situations. Armed with knowledge of why individuals act differently, they then presented new ideas on how they themselves could adapt to ensure effective outcomes in group tasks.

1. The Quality Assurance Agency for Higher Education, Focus on Graduate Skills, Students' Views on Graduate Skills, Sept 2019. https://www.qaa.ac.uk/docs/qaas/focus-on/focus-on-graduate-skills-student-views-on-graduate-skills.pdf, (accessed May 2024).

2. Brown, P., Hesketh, A. and Williams, S., The mismanagement of talent: Employability and jobs in the knowledge economy. 2004, Oxford University Press, USA.

3. Côté, S. and Miners, C. T. H., Emotional Intelligence, Cognitive Intelligence, and Job Performance, *Administrative Science Quarterly*, 2006, 51(1), 1-28.

4. Goleman, D., Working with Emotional Intelligence, 1998, Bantam Books, New York.

P14 – Improving Undergraduate Labs with Digital Sensors and Introducing the Lt Online Learning Platform

Tyler Cooke, Elana Patrick, and Dr Jenny Burnham, University of Sheffield
j.burnham@sheffield.ac.uk

Lt is the online learning platform from AD Instruments which brings active learning to practical education in combination with data acquisition using Vernier digital sensors.[1] AD Instruments has an established profile within physiology practical education, including at the University of Sheffield, and is developing a chemistry offering to complement this. Digital sensors tied directly to a computer recording variables such as pressure, temperature, voltage, conductivity, pH, and colour, give a more modern practical experience than traditional and analogue techniques, and they allow for the incorporation of talking tools that increase accessibility of practical work for blind and visually-impaired people.[2]

Undergraduate students, Tyler and Ellie, have reviewed our first year undergraduate course and identified areas for development. This poster will present their work improving practical activities and incorporating digital sensors, and show how practical teaching can be delivered using Lt. This fits within the University of Sheffield's Education priority to deliver rich, multifaceted and inclusive digital education.[3] Educators, particularly those from departments or superlabs teaching a mix of biology, chemistry, pharmacology, pharmacy, and neuroscience will benefit from seeing this work and learning more about this new to chemistry, online learning platform.

[1] AD Instruments, Lt, https://www.adinstruments.com/lt, (date accessed 25th March 2024)

[2] Adaptation of Chemistry Experiments for Middle School Blind or Visually Impaired Students. Ibtisam Rashid and Dduha Chehadeh, Journal of Chemical EducationI, 2023, 100(6), 2262–2268. https://doi.org/10.1021/acs.jchemed.3c00016 : "Talking Tools to Assist Students Who are Blind in Laboratory Courses". Cary A. Supalo, Thomas E. Mallouk, Christeallia Amorosi, Lillian A. Rankel, H. David Wohlers, Alan Roth and Andrew Greenberg Journal of Science Education for Students with Disabilities, 2007, 12(1), Article 4. DOI: 10.14448/jsesd.01.0003 . Available at: https://repository.rit.edu/jsesd/vol12/iss1/4

[3]: https://www.sheffield.ac.uk/vision/our-pillars/education , (date accessed 28th March 2024)

P15 – Training students to be highly employable, professional chemists

Dr Michael Rogers, University of Strathclyde
michael.rogers@strath.ac.uk
Dr Sarah Walker, University of Strathclyde; Emma Kennedy, University of Strathclyde

How do we train our students to be highly employable, professional chemists? Undergraduate degree programmes have a wide variety of drivers, including requirements from QAA benchmark statements, RSC accreditation competencies and expectations from industrial employers. In addition, we need to motivate students to improve both their discipline specific and transferrable skills. Whilst the QAA and RSC components are well documented, the industrial expectations are much wider and student motivation evolves with time.

From a practical laboratory training perspective, we conducted surveys with undergraduates and industrial partners to identify a range of practical and laboratory related skills and competencies, including data handling, instrumental and synthesis skills. The major finding of this research was that industrial employers placed a greater emphasis than students did on many skills.

In response to these findings, we have developed a series of activities and related assessments to try and bridge the gap between employer and student expectations on skills such as: planning of laboratory work, research of relevant literature, critical understanding of experimental design and effective communication of data.

This poster will show the major findings of the surveys and detail the laboratory activities and assessments that have been implemented in response.

P16 – Analysis of Student Preparation for Practical Sessions in Undergraduate Chemistry Labs

Tyler Hughes, King's College London
tyler.1.hughes@kcl.ac.uk
Dr Dan Cornwell-Groves, King's College London

Laboratory teaching has a central role within any chemistry undergraduate programme in the UK. Despite this, many have highlighted and explored the challenges associated with laboratory teaching, detailing problems such as cognitive and sensory overload, which make effective student learning difficult in the laboratory environment.[1,2] In order to tackle these cognitive and affective challenges, chemistry departments often employ a variety of pre-laboratory activities, such as quizzes and videos, to better prepare students and to lower the in-laboratory burden.[3] The importance of student preparation for chemistry teaching laboratory sessions has been long established and the implementation of these activities is well reported.[4]

Understanding general student preparation habits, including the use of provided and self-found pre-laboratory activities, will ultimately help shape laboratory teaching in the future. This research aims to explore these habits for pre-laboratory preparation in order to better understand the hidden intricacies and to evaluate the factors which may be influencing student preparation work. This poster presents preliminary data collected during the 2023/24 academic year investigating the approaches used by undergraduate chemistry students to prepare for teaching laboratory sessions during their degree studies.

1. A. H. Johnstone, J Chem Educ, 1997, 74, 262–268.
2. A. Flaherty, J Chem Educ, 2022, 99, 1775–1777
3. N. Reid and I. Shah, Chem Educ Res Pract, 2007, 8, 172-185.
4. H. Y. Agustian and M. K. Seery, Chem Educ Res Pract, 2017, 18, 518–532.

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P17 – How to bridge the gap that university teaching staff face when it comes to sustainable chemistry education?

Dalia Taleb, Imperial College London
dt419@ic.ac.uk
Dr Laura Patel, Imperial College London

The poster I would like to present would be based on a summer research project that I will be undertaking with Dr Laura Patel. The research will aim to investigate how to bridge the gap that university teaching staff face when it comes to sustainable chemistry education.

Existing data shows that in schools there is a gap when it comes to what chemistry teachers feel comfortable teaching and what students expect to learn when it comes to sustainability (1). The poster will present the outcomes of similar data that will be gathered and shared from the thoughts of university students and staff. This would be collected via surveys and interviews that would take place before the date of the conference.

(1) Green shoots: A sustainable chemistry curriculum for a sustainable planet. Royal Society of Chemistry n.d. https://www.rsc.org/policy-evidence-campaigns/environmental-sustainability/sustainability-reports-surveys-and-campaigns/a-sustainable-chemistry-curriculum/ (accessed February 1, 2024).

P18 – CHEMmunicate: a new game to increase engagement and build scientific communication skills

Dr Cristina Navarro Reguero, Newcastle University
Cristina.Navarro-Reguero@newcastle.ac.uk
Dr Matthew N. Hopkinson, Newcastle University

Students´ overall experience and assessment outcomes are partly determined by their engagement with teaching activities provided by academic institutions. Studies have shown that feeling part of a cohesive learning community can influence student´s individual engagement. Gamification, or the incorporation of game mechanics in learning situations, provides strategies to increase students' motivation and develop their adaptability and responsiveness skills while enjoying themselves.

With the aim of encouraging higher engagement among new first year chemistry students post-COVID, we have introduced a new chemical drawing game; CHEMmunicate.

Across one semester we held 8 sessions with ca 15 students where two teams compete to draw chemical structures using yes/no questions (total 120 participants). At the end of the session having played 3-4 rounds, students were asked to fill out an anonymous questionnaire evaluating whether they enjoyed the game and found it useful for building their scientific communication skills.

The results showed that the overwhelming majority of students found the game fun and felt the session had benefits for their learning experience. In the presentation, instructions and tips for playing CHEMmunicate will be shared and its effectiveness in improving student engagement will be discussed.

P19 – Investigating PeerWise as a means for fostering inclusivity in STEM Education

Gina Craig, Pippa Petts, and Dr Peter Swift, Durham University
g.p.swift@durham.ac.uk

A recent final year project in the Physics Department at the University of Durham has investigated student attitudes towards passive and active learning, and how the possible implementation of PeerWise [1] may aid student learning. In particular, use of such a learning technology may help neurodivergent students. PeerWise is a freely available tool which allows student to (anonymously) create and answer multiple choice questions. Duret *et al* have shown that the use of PeerWise leads to skill refinement, even outside academia, that can benefit neurodiverse students [2] and encourage the development of active learning strategies. [3]

This poster will present results from this project, including: results from a survey of students across all academic fields, allowing a comparison to be made between STEM and non-STEM subjects; and interviews undertaken with physics students, which have then been analysed thematically in the vein of Braun and Clarke. These show a preference for neurodiverse students to employ active over passive learning strategies and that these students find such methods a more effective way to learn. Data has also been analysed on student engagement with PeerWise from another department at Durham, to look at levels of student engagement with it as a revision tool.

[1] PeerWise (no date). Available at: https://peerwise.cs.auckland.ac.nz/

[2] Duret, D., Christley, R., Denny, P., & Senior, A. (2018). Collaborative learning with PeerWise. Research in Learning Technology, 26(0). https://doi.org/10.25304/rlt.v26.1979

[3] Bransford, J. D., Brown, A. L., & Cocking, R. R. (1999). How people learn: Brain, mind, experience, and school. National Academy Press

P20 – Aphantasia in Chemistry

Morgan Norris, University of East Anglia (UEA)
M.Norris.CHE@gmail.com
Prof Simon Lancaster, UEA

Aphantasia is the inability to voluntarily conjure images in a person's mind's eye. For my final year project, I produced and handed out a survey that looked into the occurrence of aphantasia within chemistry as well as the wider STEM community at the University of East Anglia, another factor in this project was to raise awareness for an issue that might not be very well known. As a chemist, topics like VSEPR, Newman projections and rotating bonds, all these topics ask the student to mentally visualise the situation. For people who are new to the topic and have difficulty visualising or can't visualise, these topics are much harder to get to grips with and take longer to work out which can have knock on effects with learning. Due to the recent recognition and coinage of the term *aphantasia* many educators do not know about it and therefore can't take it into account. The hope is that this will improve awareness in HE STEM community.

P21 – Assessment of Three-Dimensional Learning in an Undergraduate Chemistry Practical Course

Dr David Cheung, University of Galway
david.cheung@universityofgalway.ie

Experimental work is considered to be central to the practice of chemistry. Within teaching of chemistry practical work plays a number of roles, such as reinforcing theoretical concepts or the development of specific experimental skills. As for the theoretical component, across a chemistry degree programme the practical work should aim to cover the full breadth of knowledge, both specific to chemistry and more broadly sciences, and scientific practices that would be expected for a chemistry graduate. To assess this the extent to which this is true, the extended 3D-Learning Assessment Protocol [1,2] is applied to the practical component of a typical undergraduate BSc chemistry course. It is found that while the core chemistry concepts are well covered, some scientific practices, particularly those related to design and planning of investigations, are less represented. It is hoped that this identify where different scientific concepts and practices can be introduced into a chemistry degree programme and improve the design of a laboratory curriculum.

[1] Laverty, J. T. et al, PLoS One, 11, e0162333 (2016)

[2] Carmel, J. H. et al, J. Chem. Ed., 96, 423 (2019)

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P22 – Physics Education Research at The Open University

Prof Sally Jordan, The Open University
sally.jordan@open.ac.uk
Nicholas S. Braithwaite; Martin Braun; Sarah M. Chyriwsky; Judith Croston; Andy Diament; Kate Gibson; Mark H. Jones; Ulrich Kolb; Annika Lohstroh; Jonathan Nylk; Mark A. J. Parker; Ashutosh K. Pathak; Astra Sword; Sheona Urquhart; Gemma Warriner; Becca Whitehead; Christopher Wolfe; Cath Brown; Rachel Hilliam; Fiona Moorman; Susanne P. Schwenzer, The Open University; Holly Hedgeland, University of Cambridge

The Physics Education Research group at the Open University is a team of motivated practitioners utilising quantitative and qualitative methodologies to investigate the effectiveness of the teaching and learning of physics and astronomy in higher and distance education. Our research interests include (i) remote experiments and group work, (ii) remote assessment, and (iii) demographic differences in physics degree outcomes. We will present a selection of the latest findings in each of these areas:

(i) Team-working in physical sciences provides an authentic learning experience and develops valuable graduate skills. Recent work in this area has shown how peer-learning emerges from student interactions in online forums, and how online forums can be used effectively to develop programming skills for students of all varying abilities. We are currently investigating the importance of data ownership for the authenticity of the learning experience when students conduct experimental work remotely.

(ii) Online computer-marked assessment enables summative and formative assessment at scale. We have developed formative diagnostic quizzes based on free-text responses with sophisticated computer-marking tools to understand conceptual understanding in physics. We are also investigating the causes of anxieties in online exams and effective strategies to mitigate this.

(iii) Demographic differences in the rate at which graduates from different backgrounds are awarded good degrees are important measures of equity in higher education. Our analysis of physics degree outcomes in the UK is challenging long-held stereotypes and identifying causal factors in degree success.

P23 – Attitudes towards generative AI in physics and astronomy education

Dr David Millar, University of Glasgow
david.millar.2@glasgow.ac.uk

The rise of easily accessible generative AI systems built on language models (e.g. ChatGPT) has changed the way many students and teachers at university level approach their courses. The adaptation of some elements of physics and astronomy courses seems to be necessary in order to deliver education in the wake of AI. This study features surveys which aimed to probe opinions about gen AI in physics higher education in two cohorts: undergraduate physics students, and teaching staff. By comparing the responses of the two groups we can see how the attitudes differ between people on both sides of the university experience, in such areas as awareness of what constitutes academic misconduct and desire for generative AI to be used as a tool for learning. The results of these surveys can be used to enhance the student experience by addressing the needs of both students and staff.

P24 – How Explosive Chemistry Helps and Hinders Public Engagement

Dr Chris Armstrong, University of Hull
christopher.armstrong@hull.ac.uk

Almost every chemist will have seen a "mad scientist" type blow something up on a stage, and it likely cemented their love of the subject -- but does that perception help or hinder chemistry in the wider scheme? Especially to those undecided about the subject, it might look dangerous, uncontrolled, and off-putting.

In this project, undergraduate students have collaborated to create new demonstrations and interviewed and surveyed a wide range of participants with different levels of experience and familiarity with Chemistry, to determine their perceptions of explosive chemistry demonstrations. We have A/B tested different chemistry demonstrations, each exhibiting different activities. The results students have collected are helping us shape and develop new outreach activities by understanding how people react to our subject and our demonstrations.

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P25 – Making diversity count: fixing the leaky pipeline

Dr Giorgio Chianello, Queen Mary University of London
g.chianello@qmul.ac.uk
Dr Tippu Sheriff, Queen Mary University of London

The RSC Missing Elements report has identified racial inequalities in the chemical sciences and the lack of progression of individuals from minoritised ethnic backgrounds to positions of seniority in academia and the chemical industry. Through partnership between the London-based universities Queen Mary University of London, Imperial College London and Greenwich University we aim to create permanent changes in culture in the UK chemistry sector by improving the recruitment, retention and progression of UG students from black and ethnic minorities ensuring a 'pipeline' of outstanding chemists that will significantly increase the diversity and enhance the impact of the chemistry community. This will be achieved by (1) making the chemistry curriculum more inclusive thus inspiring more students to undertake a first degree in chemistry and to aim higher, and (2) address the progression of students of minoritised ethnicities from UG to PG study, especially PhD programmes, by providing them with inspirational role models.

M. Resmini, R. Mokaya. Missing Element Report, RSC, 2022.

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P26 – Student-led development of an interactive online course in AI ethics and inclusion, to be trialled in Chemistry, as part of the University of Glasgow's Student Learning Development service

Dr Ciorsdaidh Watts, University of Glasgow
Ciorsdaidh.Watts@glasgow.ac.uk
Dr Lydia Bach, University of Glasgow

The core of our initiative is an online, interactive AI ethics course co-created by and for students, promoting dialogue on addressing AI inequalities affecting vulnerable and minority groups. Partly drawing from discussions at the *Lovelace-Hodgkin Symposium in AI Ethics* (https://www.gla.ac.uk/research/az/datascience/events/lovelace-hodgkinsymposium/) this course will highlight examples of AI bias and discrimination. Students will learn to advocate for inclusive AI practices, reflecting the University of Glasgow's emphasis on inclusivity and societal well-being in curriculum transformation.

Our student-led approach fosters professional growth, project management, and work-related skills, nurturing a sense of ownership and responsibility. The AI ethics course will integrate into the Student Learning Development Digital Skills suite (launching 2024/2025), ensuring accessibility across disciplines and years, and providing student support within a broader digital literacy framework. Several schools within the university have responded positively towards trialling the AI ethics course, in a discipline-specific manner, including the School of Chemistry.

P27 – How do we attract the chemists of the future? An international study on enablers and barriers to choosing chemistry degree programmes

Dr Frances Docherty, University of Glasgow
Frances.Docherty@glasgow.ac.uk
Amina Aminu, University of Glasgow

Despite a significant effort in the last decade to attract students to study STEM subjects, the number of students choosing to studying chemistry degree programmes has declined (1). This is of great concern to the global multibillion pound chemical industry as well as chemistry departments in secondary and tertiary education (2,3).

This international study investigates why students who are interested in STEM subjects choose to study chemistry or other sciences, in particularly biological sciences, beyond high school. To establish what motivates or deters them from studying chemistry, data was collected from first year science students in Scottish and Nigerian higher institutions of learning, specifically learners majoring in chemistry and biological science.

This talk will present our findings on what are the major factors that impact students' decision-making processes, and recommend strategies to cultivate inclusivity, enthusiasm and engagement in chemistry.

The research uses a mixed-methods approach and the advantages, limitations and effectiveness of the different methodologies employed will also be discussed.

This talk will be of interest to those looking to promote interest in the chemical sciences as well as a more general audience interested in educational research methods.

1. https://cen.acs.org/education/undergraduate-education/British-students-decline-study-chemistry/97/i40
2. https://www.rsc.org/news-events/articles/2019/sep/open-letter-from-industry-leaders/
3. https://edu.rsc.org/analysis/declining-university-chemistry-applications/3009543.article

P28 – An Investigation of the Cognitive Skill Development of Physics Students Through Different Assessment Types

Poppy Bennetts, University of Glasgow
p.bennetts.1@research.gla.ac.uk
Dr Nicolas Labrosse, University of Glasgow
Nicolas.Labrosse@glasgow.ac.uk
Dr Eric Yao, University of Glasgow
Eric.Yao@glasgow.ac.uk

The primary use of final degree examinations may contribute to a limited development of cognitive skills - if this is not balanced by other assessment types, students may lack sufficient opportunities for the development of different cognitive levels. Here cognitive levels are defined as 'Remember, Understand, Apply, Analyse, Evaluate, and Create' (Krathwohl and Anderson 2001). In 2021, Gates and Pugh found that physics exam papers at the University of Leeds included many questions which featured command words linking to lower order cognitive levels, predominantly 'Apply', with the higher order levels such as 'Evaluate' and 'Create' seldom appearing (Gates and Pugh 2021). This talk details an expansion of this previous research whereby core physics final exam papers from 2018-2022 at the University of Glasgow were analysed in terms of the cognitive levels linked with the questions' command words. The results were comparable to that of Gates and Pugh where 'Evaluate' and 'Create' were rarely present whereas lower levels such as 'Apply' were most prominent. Current research is also being carried out to investigate the cognitive levels present in other forms of assessment used by the physics and astronomy departments, as well as the levels developed by students in their own independent learning activities.

Gates, J. and Pugh, S.L. (2021). "The Application of Bloom's Taxonomy to Higher Education Examination Questions in Physics". New Directions in the Teaching of Physical Sciences. doi: 10.29311/ndtps.v0i15.3674.

Krathwohl, D.R. and Anderson, L.W. (2001). A taxonomy for learning teaching and assessing. United States: Addison Wesley Longman, Inc.

P29 – Experimental training course in balancing the technical profile of STEM students: development and implementation experience of an innovative educational initiative

Dr Aleksey Kozikov, Newcastle University
aleksey.kozikov@newcastle.ac.uk
Anna Tiuniakova, AT Training Class

In this presentation, we will share our experience in developing and implementing an innovative educational initiative aimed at improving the quality of interaction between academics and Physics undergraduates, while raising the students' involvement.

We will talk about the prospects for disseminating this experience to educators and leaders of STEM academic programmes, as well as for adapting the experimental training course for other STEM students. Possibilities for further expanding this educational initiative will also be discussed as a means to overcome the excessive imbalance of hard and soft skills in some STEM university programmes. We will trace the evolution of the educational initiative that emerged in response to the need for changing the approach to tutoring and realised as a training course for small groups.

After piloting and revision, we can assert that it is also able to effectively address the issue of insufficient soft skill development among STEM students. Such an imbalance not only reduces the effectiveness of learning, but also impacts students' university life limiting their access to academic support and their full integration into the university community. We anticipate that graduates completing this course will be better prepared to meet contemporary labour market demands and enjoy enhanced career prospects.

Thank you all for coming!

We hope you had a great time and get home safely!

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