VicePhec 2019

University of Bristol, August 22nd and 23rd 2019

Handbook

Welcome

Thank you for registering for VICEPHEC19 and welcome to the conference. This event has always been a great opportunity to network, catch up and share new and exciting developments in the field of education. We hope that the programme this year continues on the success of previous conferences. And if this is your first VICEPHEC, then a very special welcome to you! You are joining a fantastic and supportive community of educators, and we look forward to hearing about the great work you are doing.

Within the pages of this document you will find details about the schedule, logistical information regarding venues and travel, as well as each abstract for all presentations, workshops and posters taking place during the conference. There may be additional information made available during the conference so please keep your eye on the live version of this document, on Twitter (@VICEPHEC19) or listen out for announcements during the sessions.

Don’t forget to tweet during the conference, and use the #VICEPHEC19 hashtag. Remember that it's best practice to only tweet a photo of a title slide, as some participants may be presenting results that haven't yet been published.

If you have any questions before or throughout the conference please speak to one of the team - they’ll be wearing the black lanyards.

Finally, enjoy yourself!

Chris

Chair of VICEPHEC19

Contents

Code of Conduct

The ViCEPHEC19 committee values the participation of everyone and hopes that all attendees have an enjoyable experience. Accordingly, all attendees are expected to show respect and courtesy to other attendees and staff, both in person and in their online interactions.

ViCEPHEC19 is dedicated to providing a discrimination and harassment-free conference experience for everyone. Discrimination on the basis of, for example, gender and gender identity, sexual orientation, disability, physical appearance, marital or civil partner status, gender reassignment, race including colour, nationality, ethnic or national origin, religion, belief, disability, being pregnant or having a child, age, and level of intellectual/professional attainment will not be tolerated. Harassment includes offensive communication related to gender and gender identity, sexual orientation, disability, physical appearance, body size, race, religion, sexual images in public spaces, deliberate intimidation, stalking, following, harassing photography or recording, sustained disruption of talks or other events, inappropriate physical contact, and unwelcome sexual attention. We do not tolerate harassment of conference participants in any form. Participants asked to stop any harassing behaviour are expected to comply immediately. Exhibitors at sponsor booths or similar activities are also subject to the anti-harassment policy.

All communication should be appropriate for a professional audience including people of many different backgrounds. Sexual language and imagery is not appropriate for any conference venue, including talks. Be careful in the words that you choose.

Be kind to others. Do not insult or put down other attendees. Behave professionally. Remember that harassment and sexist, racist, or exclusionary jokes are not appropriate for ViCEPHEC19.

If a participant engages in behaviour that violates this code of conduct, the conference organisers may take any action they deem appropriate, including warning the offender or expulsion from the conference with no refund.

Thank you for helping make this a welcoming, friendly event for all.

[This Code of Conduct was forked from the XRM2018 and PyCon 2017 Codes of Conduct which were forked from the Geek Feminism wiki, created by the Ada Initiative and other volunteers, which is under a Creative Commons Zero license, with further material drawn from the Royal Astronomical Society Code of Conduct, under a Creative Commons Attribution 3.0 unported licence]

Name Badges and Pronouns

To improve inclusiveness at VICEPHEC19, we are creating mechanisms through which you and others can indicate which gender pronouns you use on your name badge. Currently, we are providing space on your name badges in which to write your pronouns. In doing so, we aim to:

- Make it easy for you to know which pronouns to use for someone you just met, especially if you're unsure about their pronouns.
- Make it easy for people to communicate their pronoun sets to others, especially for people who use uncommon pronouns or who have recently changed which pronouns they use.
- Prompt conversations among delegates about gender, and raise awareness that gender is complicated.
- Create a welcoming environment for people of all genders.

In addition to **she/her/hers** and **he/him/his**, other pronoun sets include **they/them/theirs** and **ze/zir/zirs**. Each of these pronoun sets includes subjective, objective, and possessive cases. When a pronoun is used as the subject (object) of a sentence, the subjective (objective) case is appropriate; the possessive case, on the other hand, is used to show possession. For example,

Subjective: **[She, he, they, ze]** is/are giving a presentation on Friday.

Objective: I asked **[her, him, them, zir]** to meet me at the poster session.

Possessive: That laptop is **[hers, his, theirs, zirs]**.

Gender can be fluid, and many of the people you will encounter at VICEPHEC19 will fall at various places across the spectrum. Some people may use gender pronouns that are unfamiliar to you and/or may not align with your own (often subconscious) assumptions or expectations. Referring to a person with pronouns other than those used by that person is an example of misgendering. To reduce instances of misgendering at VICEPHEC19, please use the pronouns indicated on attendees' name badges. Note that some people may choose not to state their pronouns on their name badges. In these cases, it may be appropriate to ask which pronouns the person uses – **never assume someone's gender**.

If you have questions or suggestions related to gender pronouns or how we can all contribute to environments that are inclusive of people of all genders, there are several resources at VICEPHEC19 that you may find helpful. The conference Code of Conduct can help guide us in our interactions, and provides an avenue for reporting and investigating potential violations.

[This guidance for use of pronouns has been adapted from the American Association of Physics Teachers in use at their National Meetings.
https://www.aapt.org/Conferences/sm2018/upload/AAPT_pronouns_letter_FINAL.pdf]

Quick Reference Guide

Preparing your contributed presentations

General Advice

Presenters should aim to make their talk, poster or workshop accessible to all, and speakers should make use of the microphones provided. Please be aware of the ViCEPHEC19 code of conduct when preparing your material.

Plenary Talks

The time allotted for the plenary/keynote sessions is 45 minutes for the presentation, and a further 5 minutes for questions. Plenary speakers may either use their own devices or the University of Bristol networked PC. If you wish to upload your presentation in advance, you may do so - please send your file (powerpoint or pdf preferred) or a dropbox/cloud storage link to vicephec-19@bristol.ac.uk.

Contributed Talks

The time allotted for contributed talks is 10 minutes for the presentation, and a further 3 minutes for questions. The presentation in its final form (or a dropbox/cloud storage link) should be emailed to vicephec-19@bristol.ac.uk by Monday 19th August. All presentations should be in either powerpoint or pdf format.

Oral bites

Oral bites must not overrun 5 minutes, and presenters should aim for as few slides as possible. The presentation in its final form (or a dropbox/cloud storage link) should be emailed to vicephec-19@bristol.ac.uk by Monday 19th August. All presentations should be in either powerpoint or pdf format.

Posters

Posters should be either A0 or A1 size. The boards are metal, and we will provide magnets for fixing.

Workshop Material

Any material to be printed should be sent in by Monday 19th August. If you have any other logistical requirements, please liaise with the LOC as early as possible.

Key locations

Maps and travel information can be found on the University of Bristol's webpage at http://www.bristol.ac.uk/maps/

Conference venue

The conference will take place in the School of Chemistry at the University of Bristol, mainly in lecture theatres 2 and 3, the east Foyer, and the tearoom. To get to the lecture theatres, on entering the School of Chemistry turn left at the Porter's Lodge, and walk along the cloister to the East Foyer. The lecture theatres are in front of you, and the foyer is where registration will be and where the posters will be displayed.

The full address is: School of Chemistry, University of Bristol, Cantock's Close, Bristol, BS8 1TS, U.K. An interactive map is at https://goo.gl/maps/ZZaG7x9C9m8WUqkQ9

Accommodation

Accommodation will be at Clifton Hill House, which is a 15 minute walk from the School of Chemistry. The address is: Clifton Hill House, Lowe Clifton Hill, Clifton, BRISTOL, BS8 1BX, U.K. An interactive map is at https://goo.gl/maps/pUD8Yd8tWtQ7ivXH6

Conference Dinner

The conference dinner will be at Brown's Restaurant, 38 Queens Road, Clifton, Bristol, BS8 1RE. This is a five minute walk from the School of Chemistry, and is between the conference venue and the accommodation.

WiFi access

Internet access is available via Eduroam and the UoB Guest networks. Full instructions on how to set up access for apple, windows, linux and android devices can be found at:

https://www.wireless.bris.ac.uk/visitors/

Contacts/Help during the conference

You can contact the local organising committee:

- By email: vicephec-19@bristol.ac.uk

In Case of Emergency

Dial 112233 from any networked phone on campus to report emergencies to the University.

Timetables

	Wednesday	Thursday	Friday
09.00		Registration and coffee	Poster session, with coffee and pastries
09.30			
10.00		Welcome Keynote 1: Dr Jane Pritchard	Keynote 2: Dr Dylan Williams
10.30			
11.00		Oral bites 1	Oral bites 2
11.30		Coffee	Coffee
12.00		Talks session 1	Talks session 3
12.30			
13.00		Lunch	Lunch
13.30			
14.00		Workshops	Keynote 3: Dr Ross Galloway
14.30			
15.00	Satellite meetings		Close, and goodbyes
15.30		Coffee	
16.00		Oral bites 3	
16.30		Talks session 2	
17.00			
17.30		Close	
18.00			
18.30			
19.00			
19.30	Dinner at Pizza Express, Clifton Village	Conference dinner Browns restaurant	
20.00			
20.30			
21.00			
21.30			
22.00			
22.30			
23.00			

	Location	
Workshop 1	Chemistry Lounge	Peer Instruction: What, Why, How? **Patrick Thomson (Ross Galloway & Anna Wood facilitating)**
Workshop 2	Lecture theatre 3	Work those examples – Mathematical teaching strategies drawn from cognitive load theory **Simon Palmer**
Workshop 3	W415, Chemistry	Decolonizing the Science Curriculum **Lara Lalemi, Katherine Haxton, Nazira Karodia, Paul Taylor, and Neil Williams**

	Talks session 1	
	Lecture theatre 2	Lecture theatre 3
Thursday		
12.00	1: **Gráinne Walshe** An investigation into student mathematical preparedness for university level physics and engineering degrees	5: **Barry Ryan** Empowering and improving peers of all types, including academic staff, through the inter-institutional use of PeerWise; an Irish case-study.
12.15	2: **Dr Emma Pittard** Review of the Reformed Physics A Level Requirements	6: **Anna Roffey** Peer Assessment: marks out of 10. An analysis of student perceptions vs. attainment.
12.30	3: **David Sands** Causal reasoning, mental models and hypothetico-deductive reasoning in the teaching of physical sciences.	7: **Dylan Williams & Richard Blackburn** GoFis(c)her: A Student-designed Card Game in introductory Organic Chemistry
12.45	4: **Helen Heath** Coursework or not coursework? That is the question.	8: **Dylan P Williams** “Spectroscopy Unlocked”: A Chemistry Escape Room Educational Activity

	Talks session 2	
	Lecture theatre 2	Lecture theatre 3
Thursday		
16.30	17: **Anna Bertram & Carmen Tomas** Evaluative Judgement in Chemistry Practical Projects	13: **Tina Overton** 'That won't work with my students!' Understanding teachers' resistance to change
16.45	10: **Barbara Villa Marcos & Richard Blackburn** Lab360: improving undergraduate laboratory safety practice through the use of an immersive, high-fidelity simulation	14: **Dr. Alison Voice** Enhancing Student Problem Solving: Using Peer Collaboration and Spaced Repetition
17.00	11: **Claire McMullin** Establishing a Fourth Core Strand of Chemistry: Computational	15: **Charles Harrison** One shot to teach everything you ever wanted?
17.15	12: **Jenny Slaughter** Recognising the Impact and Achievements of Graduate Teacher Assistants, in STEM subjects, through Tailored Training and Peer-Mentor Support Pathways Mapped against the UKPSF.	16: **Jenny Burnham** Exploring how students use their campus in their learning

	Talks session 3	
	Lecture theatre 2	Lecture theatre 3
Friday		
12.00	9: **Craig Campbell** Development and Implementation of an Integrated Interdisciplinary Practical Chemistry Course	24: **Joel Loveridge** Undergraduate leadership in outreach events
12.15	18: **Beverley Allan** Investigating the impact of co-developing an assessment rubric with Foundation students on their perceptions of and engagement with feedback	22: **Katherine Haxton** Social, Economic, and Political Contexts for Chemistry Through Sustainability.
12.30	19: **Katerina Ridge and Saima Islania** Staff-Student Research Partnership project: Maximising student participation - factors that affect dialogue	23: **Walther Schwarzacher** International Mentoring – a new opportunity for physics undergraduates
12.45	20: **Dr Julie Hyde** Employability and workplace preparation and practices	21: **Susan Matthews and Paul McDermott** Developing an Innovative Trans-National Education Approach to the Teaching of Natural Products Chemistry

Oral bites 1	1: **Charlotte Clark** Investigating the Effects of Formative and Summative Assessment in an Undergraduate Teaching Laboratory
	2: **Victoria Hilborne** Imagine images for formative assessment.
	3: **Dr Kristy Turner** Reading habits of undergraduate chemists from pre-application to Year 4.
	4: **Lara Lalemi** Decolonizing the Science Curriculum
	5: **Barry Ryan** Does academic mentoring in chemistry education practice and research burn the candle at both ends?

Oral bites 2	6: **Kajal Pindoria** Presentation bingo: a novel intervention for group presentations
	7: **Richard Blackburn** Using infographic creation as tool for science communication assessment and means of connecting students to departmental research
	8: **Richard Blackburn** Flipped problem classes to assist case-study teaching of synthesis
	9: **Suzanne Fergus** Exploring the study habits of some of our successful students, what can we learn about learning?
	10: **Claire McDonnell** Development of an Online Course to Enhance Teaching Practice in University Science Laboratory Classes

Oral bites 3	11: **Michael Seery and Claire McDonnell** Disseminating innovative practice in chemistry education – a compilation of guidance from UK, Ireland, and Australia
	12: **Dr Julie Hyde** Design of a three year laboratory programme for international delivery.
	13: **Saskia O'Sullivan** The importance of universities and schools supporting school teachers' continual development for student learning and the chemistry 'pipeline'.
	14: **Andrew McKinley** Hacking the Chemistry Code
	15: **Alison Hill** Embedding mathematics into the Curriculum

Extra sessions

Satellite meetings

IoP Higher education group: How can we help physics students flourish?

Wednesday August 21st, 14.00 – 16.00

Followed by the IoP Higher Education Group AGM.

Enderby room B16/17, HH Wills Physics Laboratory, Tyndall Avenue, Bristol.

RSC HE Chemistry Teaching network: Next Steps.

Wednesday August 21st, 15.00 – 17.00

Chemistry Lounge, School of Chemistry, University of Bristol

Laboratory Teaching Discussion Group

Thursday August 22nd, 13.00 - 14.00

Room W415, School of Chemistry

RSC Higher Education Group AGM

Thursday August 22nd, 17.30-18.30

Room W415, School of Chemistry

Keynote lectures

Lecture Theatre 3, School of Chemistry

Dr Jane Pritchard

Oxford Brookes University

Courage and Challenge: Teaching and Learning

Designing and delivering teaching and learning requires elements of courage and confidence on the part of the lecturer to be able to provide high quality challenging learning for all learners. However, challenge and difference can raise concerns that it may not be liked by all and how we measure the quality of teaching and teachers can perpetuate a more bland diet and 'traditional' educational practice. My role as an educational developer (all this century), I feel, is to enable staff to be able to enact excellent teaching and assessments that may sometimes not instantly be liked or familiar to all learners, but bring about excellent learning and learners. It is absolutely key that our teaching and assessments practice are underpinned by evidence-based educational research. We can then justifiably ask our learners (and our teachers) to step outside the familiar and show how through our teaching and assessments we give our learners the opportunities to embrace the curiosities and intrigues of the disciplines. The teacher may need to be courageous to teach and assess in ways different to their own experiences and our learners may need to be courageous to embrace sometimes new forms of learning. However, courage and challenge are not just individual teacher attributes but are needed by departments and institutions to enable degree programmes (and not just single units or sessions) to bring about a more coherent and academically challenging education.

Dr Dylan Williams

School of Chemistry, University of Leicester

Context and Problem Based Learning: An Integrated Approach

The Department of Chemistry at the University of Leicester has been using context and problem based learning (C/PBL) in chemistry teaching since 2007. The integration of C/PBL into teaching at Leicester has improved the retention rate of first year students. The varied modes of assessment for C/PBL activities have also led to an improvement in the transferable skills of Leicester chemistry students.

This talk will discuss the practicalities of developing and integrating context and problem based learning (C/PBL) activities into a physical science programme, highlighting potential challenges as well as aspects of good practice. The session will include examples of C/PBL activities developed at Leicester. The session will conclude with some discussion of the impact that C/PBL has had on the student experience at Leicester.

Dr Ross Galloway

School of Physics and Astronomy, University of Edinburgh

Active learning and the flipped classroom: myth and reality

The concepts behind active learning are far from new, and the flipped classroom is becoming a familiar fixture in educational circles, but just how consistent are our shared understandings of these ideas? Some persistent myths continue to circulate: for example, that the flipped classroom necessarily involves video lectures, that in this age of Google you don't need to know anything that you could also look up, and that there is no space in the classroom for an authoritative voice explaining things. I don't believe any of these assertions are true, and there is considerable evidence against them. Perhaps the most damaging false dichotomy is that there is something called 'traditional teaching', and something else called 'innovative teaching', and that these are distinct and necessarily in conflict. I will discuss why that isn't true either, and present some compelling data from studies of active learning lectures to argue that 'sage on the stage' and 'guide on the side' can peacefully coexist, in the same room and in the same person. I will conclude by outlining what I think the evidence suggests should be the role for the expert instructor in an active learning classroom.

Workshops

Peer Instruction: What, Why, How?

Chemistry Lounge, School of Chemistry

Patrick Thomson (Ross Galloway & Anna Wood facilitating)

University of Strathclyde and University of Edinburgh

patrick.thomson@strath.ac.uk

What?

Peer Instruction is a large-scale active learning technique first developed by Harvard physics professor Eric Mazur in the 1990's, and has since gained traction across the physical sciences and beyond. It challenges students with conceptual tests, which are solved alone and then again after a brief but vital peer discussion. It can be used as part of a flipped classroom, or as a drop-in enhancement to a traditional lecture series.

Why?

Peer instruction is both quick and effective, and can dramatically enhance student understanding and knowledge retention. Extensive educational research has been conducted around the effectiveness of peer instruction, its mechanism of action, and best practices for implementation. Peer instruction can be run with clickers or flashcards, but has been transformed by bring-your-own-device (BYOD) polling.

How?

The session will cover the research evidence and theoretical underpinnings, but will focus on the "how-to" of Peer Instruction, with practical strategies, software tools, and potential pitfalls. Participants will have an opportunity to create their own questions and resources during the session.

The emphasis of the workshop will be on helping you to explore ways to use Peer Instruction that work for your particular context, from initial dabblings to pilot implementations or wider adoption. If you're interested, or just keen to find out more, come along to chat with colleagues who have used the technique in a range of ways and intensities in physics and chemistry.

Participants will need to bring a smartphone, tablet, or laptop computer to be able to participate fully in the session activity.

Work those examples – Mathematical teaching strategies drawn from cognitive load theory

Lecture theatre 3, School of Chemistry

Simon Palmer

Carr Manor Community School, Leeds

simon.palmer.d@gmail.com

Leading educational expert, Dylan Wiliam, has described Cognitive Load Theory as "the single most important thing for teachers to know" and I would agree. Cognitive Load Theory has revolutionised how I teach maths in science. As a physics teacher I have made significant improvements in the mathematical confidence of my students across different ability and year groups, thanks to my engagement with this research.

Cognitive load theory takes take into account the limitations of student working memory and long term memory and from this provides a framework to develop teaching strategies to more effectively teach students. This session has a simple premise – How can I use this research on cognitive load theory to better teach mathematics within physics or chemistry? During the session we will unpacks teaching strategies tested in decades worth of empirical studies including: example-problem pairs, faded examples, goal-less problems and student self-explanations. Then based on this research and my own experiences in trial and error we will attempt to understand when best to use each strategy and how to combine them in our teaching or lecturing.

By the end of this session you will know how and when to use the following techniques:

- Worked-example problem pairs
- Faded examples
- Goal-less problems
- Multi-choice questions to develop student's self-explanation

This session is relevant for anybody who teaches mathematics within their subject. The examples presented are for GCSE and A level content, however much of the supporting research on cognitive load theory has been carried out with university level students.

Decolonizing the Science Curriculum

W415, School of Chemistry

Lara Lalemi*[1], Katherine Haxton[2], Nazira Karodia[3], Paul Taylor[4], and Neil Williams[5]

[1]University of Bristol; Lead presenter, [2]Keele University, [3]University of Wolverhampton, [4]University of Leeds, [5]Kingston University

Students are increasingly calling for the curriculum to be decolonized.[1] In its broadest sense "Decolonizing the Curriculum" is focused on enabling students to see themselves reflected in the curriculum, enhancing inclusion and preparing students to contribute to a globalized world.

The aim of this workshop is to have a conversation about the lived experience of BAME students and the hidden biases within science pedagogy. This will lead onto an exploration of what educators can do to help decolonize the science curriculum.

Workshop Structure

- **Introduction** (20 minutes): Definition of what is meant by colonization within the world today and a historical timeline of a scientific discovery where BAME contributions have been ignored. This will include the personal testimonies of some BAME PhD/Postdoc students.

- **Group activity/discussions** (50 Minutes): Groups to discuss what aspects of the chemistry and physics curricula can be decolonized and how this might be achieved. Potential subject areas include Medicinal Chemistry, Physical Chemistry/Physics, Environmental Chemistry, Sustainable Chemistry and Medical Physics. Pre-workshop exercise and discussion will highlight examples of where colonization has been intertwined with modern scientific knowledge and practice. The discussion will seek to define what is meant by "Decolonizing the Curriculum" and why it is needed.

- **Individual exercise-Inclusive curriculum Framework** (20 minutes)**:** The Inclusive Curriculum Framework tool[2] developed at Kingston University will be introduced. The framework can help module leaders ensure their content, pedagogy, assessment and feedback are accessible and allow students to seem themselves reflected in the curriculum. Delegates will have an opportunity to start completing a template for one of their own modules and to think of some changes they might make based on discussions earlier in the workshop. Delegates will be encouraged to write a reminder postcard with an action for themselves

(1) Harriet Swain. 2019. The Guardian. [Online]. [Accessed 30 June 2019]. Available at: https://www.theguardian.com/education/2019/jan/30/students-want-their-curriculums-decolonised-are-universities-listening

(2) Our inclusive curriculum - Equality, diversity and inclusion - Kingston University London. [Online]. [Accessed 30 June 2019]. Available at: https://www.kingston.ac.uk/aboutkingstonuniversity/equality-diversity-and-inclusion/our-inclusive-curriculum/

Contributed talks

Talk 1: Gráinne Walshe & Ciara Lane

University of Limerick

Grainne.Walshe@ul.ie, ciara.lane@ul.ie

An investigation into student mathematical preparedness for university level physics and engineering degrees

This paper will outline initial findings from an investigation into students' mathematical preparedness for STEM education at tertiary level in the Irish context. The study addresses the issue of student retention by investigating the perceptions of three stakeholders – teachers, students and lecturers – on the mathematical preparedness of students for studying science and engineering at tertiary level. Several factors may impact on student progression, but for science and engineering students, their level of mathematical knowledge on entering university is crucially important (HEA, 2016). In this paper, we will describe the rationale and design of this pilot study at an Irish university, and findings from phase one of the study, comprising surveys undertaken with first year students, and with lecturers teaching first year students. Findings from phase one have indicated that students and staff have conflicting perspectives of student mathematical preparedness and that the school mathematics curriculum does not adequately prepare students for science/engineering at third level. They also indicate that there is a relationship between affective factors, subjects taken at school, and perceptions of mathematical preparedness among first year physics and engineering students. The second phase of the study will be outlined, in particular, the design of targeted support for students of a first year physics module that aim to address some of the gaps in student mathematical preparedness that have emerged from phase one.

HEA (2016). A study of progression in Irish higher education 2014/15 to 2015/16. Dublin: Higher Education Authority.

Talk 2: Dr Emma Pittard

The Lifelong Learning Centre, The University of Leeds

e.c.a.pittard@leeds.ac.uk

Review of the Reformed Physics A Level Requirements

In early 2013 the former Secretary of State for Education, Michael Gove, asked the Office of Qualification and Examinations Regulation (Ofqual) to implement changes to existing Science and Mathematics A Levels leading to new 'reformed' A Levels. The Government stated that the purpose of taking A Levels is primarily for entry to university, and that change was needed to better prepare students for university courses. The Government also wanted these reformed A Levels to allow UK universities to accurately identify the level of student attainment and provide a benchmark of academic ability for employers. A summary of the key changes implemented in the reformed Science A Levels will be presented, together with the rational for these changes, with a focus on the new Physics requirements. 'Functional' questions from reformed Physics A Level papers will be reviewed, and exam data from the first three years will also be presented.

Talk 3: David Sands

University of Hull

d.sands@hull.ac.uk

Causal reasoning, mental models and hypothetico-deductive reasoning in the teaching of physical sciences.

Causal reasoning is central to the physical sciences, either when trying to understand a topic or when solving problems. The latter requires students to construct causal chains by analysing a system, its constituents and how they interact, and then develop the causal connections that will lead to the solution of the problem. However, causal reasoning is rarely analysed and rarely taught explicitly, even though there are well-defined theories of causal reasoning. The standard approach is based on formal logic and involves propositional reasoning using statements of the form, if A then B. Whether B is true or not depends on the truth of A and in ill-defined problems in particular, the condition A might not itself be well defined. In mental model theory, each proposition corresponds to a single mental model. In teaching, therefore, the proposition, whether explicitly stated as such or not, will determine the mental model but in problem solving the mental model determines the proposition. Although experimental evidence is scarce, it is possible that propositions constructed by experts miss out many of the vital steps necessary for students to develop an effective mental model. An alternative account of reasoning uses the hypothetico-deductive form , if … then … therefore, with the last step highlighting the implications of the proposition. In this talk, I show how this form of reasoning can help to identify missing steps, thereby aiding students in the construction of productive mental models, and illustrate how it can be used in teaching.

Talk 4: Helen Heath

University of Bristol

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Coursework or not coursework? That is the question.

We set course work is set to encourage students to actively engage with lecture courses as the course progresses. Students can then receive formative feedback on their work. Studies have shown improved performance when students complete coursework but with the amount of material available on the internet anecdotal evidence from students suggested that completing problem sheets could involve finding the answer rather than working it out. In the past two years we have used two different methods of "encouraging" students in our core Physics classes to complete coursework. In one case marks counting and in the other a pass/fail. Does the method used make a difference to the quality or quantity of the submitted work and the overall level of student engagement?

Talk 5: Barry Ryan

Technological University Dublin

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Empowering and improving peers of all types, including academic staff, through the inter-institutional use of PeerWise; an Irish case-study.

PeerWise is a freely available online platform that allows students to interact through creating Multiple Choice Questions (MCQs) for peers, as well as answering, commenting and rating these MCQs. PeerWise has been the subject of on-going research from more than ten years; however, previous PeerWise studies primarily focused on a single case; in our study we sought to investigate if PeerWise use could benefit students beyond a single classroom (or Institution) and if these benefits could be also be extended to the academics teaching the modules that used Peewise. Our research question was, therefore:

Can PeerWise be used to support asynchronous, multi-institution, student learning and staff development in third-level foundation chemistry?

An action research methodology, utilising mixed methods, was utilised. The presentation will outline the findings from the initial action research cycles and how these will inform subsequent cycles, focussing primarily on the impact on student learning and staff development. The triangulated data set explored includes the lived experience of the academics involved and their personal development through the design, execution and assessment phases, supplemented by social network analysis of the students interactions within the collaborative PeerWise ecosystem. Key emergent themes include the value of peer feedback and the first year students' perceptions of peer learning and will be unpacked and explored. Emerging from the action research cycles completed, we will present lessons learned that concentrate primarily on the differences in expectation between academics and student, and outline a new approach to managing students' expectations whilst simultaneously promoting staff development.

Talk 6: Anna Roffey

UCL

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Peer Assessment: marks out of 10. An analysis of student perceptions vs. attainment.

Peer assessment (PA), otherwise known as peer marking, is the process where students assess each other's work using a set of established assessment criteria. The feedback may be graded or descriptive, summative or formative. This assessment method is used throughout the undergraduate chemistry programme at UCL. Though the department has embraced this method, we had not yet investigated its efficacy in any systematic way.

Current PA activities in the undergraduate programme were analysed in terms of efficacy and student perceptions of the task. We aimed to understand how the current PA process could be improved and to find a method that would both enhance learning and meet student expectations in terms of assessment and feedback.

The first objective of this study was to investigate the link between student engagement in PA and the success of their studies. We used a first-year general chemistry foundation module as a case study. After analysing the PA of different cohorts of students over four years, we found that engagement in this module's process of peer assessment could not be used as a marker for overall student success in the module. The second objective was to investigate whether any socio-cultural factors from students' backgrounds impact on their perception of peer assessment. Perception, confidence, and engagement in the process were analysed through surveys and interviews. Our initial findings indicate gender, ethnicity and field of study are significantly determinant in student behaviour towards peer assessment. The implications of these results will be discussed, and recommendations made.

Talk 7: Dylan Williams & Richard Blackburn

University of Leicester

dpw10@le.ac.uk

GoFis(c)her: A Student-designed Card Game in introductory Organic Chemistry

The use of games in chemistry education is known to facilitate the development of engaging, active learning contexts that allow students to collaboratively develop their understanding of the subject. This study describes the student-led development and evaluation of a card game designed to introduce students at the early stages of chemistry degree programmes to organic nomenclature, methods of structure representation and simple functional group chemistry. The game was designed, evaluated and refined by a team of undergraduate students in the later stages of the degree programme.

The game is played in small groups (usually two or three players) and is loosely based on the established card game Go Fish. The activity was initially piloted with a foundation year cohort (n = 23). The impact was measured through the use pre- and post-tests and a questionnaire that measured student attitudes. Evaluation of the pilot revealed a small (4%) increase in the average student performance after playing the game. 87% of students agreed that playing the game was a useful learning experience but only 39% agreed that the rules of this initial version of the game were easy to follow.

A revised game was developed with rewritten rules. This version was evaluated with the first year chemistry cohort (n = 55). Student performance between the pre- and post-test showed a small (2%) increase. 82% of participants stated that they enjoyed playing the game and 67% agreed that the rules were easy to follow.

Talk 8: Dylan P Williams

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"Spectroscopy Unlocked": A Chemistry Escape Room Educational Activity

Games have proven to be an effective method of active learning and many different methods have been explored in the last decade: board games, card games, word games. "Spectroscopy Unlocked", a spectroscopy-based escape room has been developed as part of a BSc Chemistry pedagogic research project.

This spectroscopy escape room engages chemistry students in an innovative simulation activity that can improve inter-professional teamwork and communication; develop problem-solving skills and help students to familiarise with the laboratory environment. "Spectroscopy Unlocked" is designed for post-16/foundation level and covers basic principles of nuclear magnetic resonance and infrared spectroscopy, thin layer chromatography and mass spectrometry.

The tasks consisted of a combination of short laboratory experiments, structure determination activities as well as decoding and finding hidden clues around the room. The students were working in groups of up to four members and had roughly two hours to complete the entire escape room. They were shown a video clip that set up the scene and provided them with the initial instructions. Each activity included instructions on how to use the required equipment and/or perform the specific technique. The solution for each task provided the participants with a clue to find the instructions for the following activity.

The game has been tested on 29 chemistry foundation level students at the University of Leicester. A questionnaire was completed by the students and showed that 92% of students agreed that the escape room helped them to reinforce previous knowledge and the same percentage found spectroscopy/structure determination an enjoyable subject.

Talk 9: Craig Campbell

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Development and Implementation of an Integrated Interdiscplinary Practical Chemistry Course

Practical courses are considered a main staple of the undergraduate teaching experience in physical sciences. The teaching laboratory provides a unique teaching environment with a variety of aims and objectives, including:

- understanding safe working laboratory practices
- refinement of the manual skills and techniques for carrying out practical work
- development of time-management, organisation, team-working skills
- contextualisation of material encountered in lectures
- analysis and interpretation of experimental data

To coincide with the development of a dedicated Teaching Laboratory facility, we set out to overhaul the undergraduate Practical Course, constructing a new course with a different emphasis on both its delivery structure and substance. One novel aspect of our approach was development of key practical and analytical skills through a dedicated “Skills” Course, followed then by a set of “Choice” practicals. These Choice practicals revisit the key skills, but require higher level thinking and exploration of concepts related to the practicals.

Additionally, we set out to develop an integrated course that demonstrates the interdisciplinary nature of the chemical sciences, including use of computational analysis and application in biochemistry/drug discovery.

This talk will cover the process by which the course was redesigned, with a particular focus on the First Year course. This will cover the planning, development and implementation of the new course, which has recently been completed by the first cohort. Discussion of the challenges, successes, lessons learned, and aspirations for the next iteration of the course will be discussed.

Talk 10: Barbara Villa Marcos & Richard Blackburn

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Lab360: improving undergraduate laboratory safety practice through the use of an immersive, high-fidelity simulation

An interactive, immersive, 360 degree chemistry laboratory virtual tour has been developed to aid student familiarisation with our teaching laboratory environment and the unique safety challenges created by large group practical teaching. This talk shares our journey in constructing the immersive simulation, the lessons learnt from our pilots and of course the benefits of the final product to our students.

The simulation software was designed to feature interactive, flipped-teaching, of important aspects of safe practice. This includes: safe use of the fume hoods; personal protective and emergency equipment; hazard symbol recognition; PAT testing; solvent safety; chemical disposal; fire safety and safe use of glassware. The required features and 3D models were created using Microsoft PowerPoint and Paint3D, incorporating animation and hyperlinks to various interactive tutorial assignments.

A pilot study with various cohorts confirmed the usefulness, popularity and suitability of such a preparative resource. The sampled students commented positively on the simulation's accuracy, user friendliness and utility in promoting academic knowledge and its ability to provide experience of safe practice in advance of accessing the laboratory. Evaluations of student attitude and ability with and without Lab360 demonstrated statistically significant improvement in confidence towards the session(s) and knowledge regarding hazard prevention and risk assessments. A paired Wilcoxon t-test to evaluate the teaching of undergraduate safety, where the students answered 10 laboratory safety questions before and after using the resource, demonstrated the significant improvement after using Lab360 with 98% confidence.

Talk 11: Claire McMullin

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Establishing a Fourth Core Strand of Chemistry: Computational

With advancing technology, the importance of computational chemistry continues to grow. This topic should not remain for postgraduate education or higher, but holistically included in undergraduate curriculum at every stage to provide students modern transferable skills and prepare them for their future workplace. There are two branches of computational chemistry that we have focused on teaching our students; molecular modelling and programming. Both require students to be proficient in data analysis - an important skill to nurture. Our fundamental approach is based on understanding why certain methodologies are chosen to answer a particular chemistry question by knowing each method's limitations and then vitally linking results back to real chemistry scenarios.

This has been achieved by restructuring laboratory content to include a separate computational component as the fourth string in the normal inorganic / organic / physical trifecta. However, this does require investment in adequate hardware and software. Making the software available across the campus can come at a significant cost, yet it notably allows more flexibility for students in when and where they complete their lab exercises.

Furthermore, lecture units have been introduced and redesigned to provide more context and theory. Pitching the level of theory, trying not to prejudice student's thoughts on the topic, and teaching a diverse range of students (with computational experience) has been challenging. This will be discussed alongside our lab developments in the hope of helping others navigate similar curriculum expansions to make computational core.

Talk 12: Jenny Slaughter

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Recognising the Impact and Achievements of Graduate Teacher Assistants, in STEM subjects, through Tailored Training and Peer-Mentor Support Pathways Mapped against the UKPSF.

GTAs are essential for teaching and learning in the STEM subjects and have been shown to have a direct impact on student experience and retention. GTAs often have more face-to-face contact hours with students than Faculty members and when they do so, it is more likely to be in small group teaching modes with small staff:student ratios. Therefore it is only by engaging GTAs that practitioners can change the learning environment to be student-centred and inquiry-based.

Our presentation will discuss professional development opportunities for GTAs, and the barriers and challenges GTAs face in engaging with these opportunities. We will highlight the interventions we have put in place to support GTAs professional development and how we have sought to overcome barriers to engagement. We will also show how building a mentoring community is supporting GTAs seeking recognition.

The presentation will be of interest to anyone in the STEM disciplines working with GTAs. The training described has been implemented at Faculty level for all subjects under the Science and Engineering banner at the University of Manchester. Therefore we are confident the topic is broadly applicable for practitioners in chemistry and physics.

We will provide delegates with copies of the outlined frameworks, for critique during the session and as starting points for implementation in their own institutes.

Talk 13: Tina Overton

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That won't work with my students!' Understanding teachers' resistance to change

Research in primary and secondary education occurs mostly in universities, far removed physically and culturally from the regular classroom and practicing teachers. This is not the case in higher education where pedagogic research into undergraduate education is carried in the same institutions as the teaching occurs. Yet academics are often reluctant to accept research evidence related to their own teaching, preferring to rely on personal experience, opinion or prejudices. Some key findings from the literature will be described and reasons for relative lack of impact on teaching practices will be discussed.

Talk 14: Dr. Alison Voice

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Enhancing Student Problem Solving: Using Peer Collaboration and Spaced Repetition

Most people acknowledge that 'practice makes perfect' but how much do we really employ this idea in higher education? Probably we all use coursework or examples classes to give students practice of the current topic, and this is excellent. But most likely this is 'massed practice' (all at once after teaching each topic). In fact this is the way most text books are written, with questions at the end of each chapter pertaining only to the topics in that chapter.

But research into the function of our memory reveals the need for repetition to store information in our long term memory. And indeed further repetition is needed to stop us forgetting. The required timing (or spacing) of this repetition was first proposed by Ebbinghaus.

The research presented in this talk looks at ways to enhance students' problem solving skills, using spaced repetition and peer collaboration. A web-based question bank was provided to the students, with the facility to schedule the repetition of each question according to how well they could answer it. Unseen problems were then solved in fortnightly workshops, where students worked individually at first, to assimilate what they could bring to the problems, and then discussed the solutions together. Students were asked to record their answers to the problems before and after discussion, and submit their individual written solutions. Findings from this work will be presented.

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Talk 15: Charles Harrison

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One shot to teach everything you ever wanted?

Almost all education research and theory is linked to conventional teaching, with multiple contacts with learners and multiple opportunities for interventions. What if you only had one shot? This is the case for a huge amount of chemistry teaching and learning whether it be safety talks, outreach or conference presentations. These are often high stakes events which demand strong results and yet applying the theory of education is both challenging and rarely implemented.

I will use lessons learned from chemical safety training and outreach as a lens to view education theory and work out practical applications of the pedagogy for single contact events. The same lessons can also be used to guide how we make the best use of our first contacts with any group of learners. This talk will cover a broad range of theories and evaluate their effectiveness and draw out useful practice.

Talk 16: Jenny Burnham

University of Sheffield

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Exploring how students use their campus in their learning

This presentation will report the initial results of a cross-disciplinary study into the learning landscape at the University of Sheffield. The research asked students from Chemistry, Architecture, Education, the Information School, and Psychology to consider how they use the campus in their learning through a combination of walking-interviews and a campus map making task. The results were both surprising and unsurprising. Students typically see learning as something they do independently, working alongside others in silent study. They have a limited number of favorite places to study and do not seem to explore the campus to find more. The talk will outline some of the implications of the research with regards to the (un)healthiness of students learning habits and will make suggestions about how we as teachers can help with this.

The second part of the talk will cover how I got involved in the study, my reflections on what I have learned looking through the lenses of the different disciplines, and what I have learned about the practicalities of doing educational research by working with experienced social scientists.

Talk 17: Anna Bertram & Carmen Tomas

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Evaluative Judgement in Chemistry Practical Projects

A common theme in student feedback is a lack of understanding of assessment criteria; this is despite module convenors continually attempting to improve how they are presented. This year we redesigned a third-year laboratory module with an emphasis on evaluative judgement and engagement of students in synthesising module learning outcomes.

Evaluative judgement is the students' ability to make judgements about their own work and that of others (Boud et al 2018). The conceptual work on evaluative judgement provides a useful and integrative conceptual framework for instruction and learning.

The third year practical module requires students to work in teams to undertake mini-research projects. At the beginning of both semesters, before each project commenced a series of workshops was delivered. Activities were designed in which students were asked to reflect on skills already developed and those skills needing further development, these scaffolded exercises paved the way for students to synthesise module learning outcomes and to then consider how these could be assessed. Throughout these sessions 'Padlets' were used to gather student input and structure discussion. Devoting workshops to the understanding of module learning outcomes and assessment criteria has been extremely well received by students.

Students were invited to complete questionnaires before and after these interventions to indicate their confidence and understanding of the module learning outcomes and assessment criteria. Early evaluations show a positive impact on students' ability to understand criteria and expectations.

This short presentation will summarise these interventions and the headline conclusions from student feedback thus far.

Talk 18: Beverley Allan

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Investigating the impact of co-developing an assessment rubric with Foundation students on their perceptions of and engagement with feedback

The feedback provided to learners, on their skills and understanding, play a crucial role in the development of learners throughout their academic career. Previous studies have argued that for feedback to be effective in developing the learner, it is important that it is timely and contains concise, informative and clear instruction on how to modify the content for improvement and achievement of the associated learning objectives. For effective learner progress, good quality feedback requires active engagement with the feedback from the learner. However, several studies have found that learner engagement is with feedback is often poor and therefore of concern for the progress of the learner.

The aim of this research is to investigate whether the use of a purposefully developed rubric for providing feedback on chemistry practical reports, co-designed with the learners, with verbal feedback can improve learner satisfaction and engagement with feedback whilst maintaining high-quality feedback in a timely manner. The practical work forms part of the Foundation Science programme that is designed to prepare learners for progression onto a science degree course without having the required qualifications for direct entry. Recent analysis of learner access to feedback on the Chemistry module of the foundation course identified a lack of engagement with the detailed written comments provided, suggesting learners do not investigate the reasons for achieving a given grade. Consequently, they are not engaged with how to improve in subsequent assessments and it is hoped that the rubric / verbal feedback combination can improve the overall engagement.

Talk 19: Katerina Ridge and Saima Islania

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Staff-Student Research Partnership project: Maximising student participation - factors that affect dialogue

The 21st century has seen a widening participation of students in Higher Education. This project was a result of co-enquiry between a second year chemistry student and a chemistry academic into factors that facilitate educational dialogue. Observation had shown that although there were opportunities for such dialogue in lectures and tutorials and despite the wide theoretical endorsement of constructive, social learning by most lecturers, our students were generally hesitant to engage. This project sought to highlight practical ways to facilitate conversation within a learning environment. Data was collected from lecture observations, student surveys, focus group discussions and interviews. The researchers' insider positions as 'student' and 'lecturer' assisted their particular areas of research within the project. The student researcher led focus group discussions and interviews with student participants whereas the lecturer conducted lecture observations and discussions with colleagues. The results outlined a number of possible practical improvements. However, the surprising finding was the role that the introduction of 'dialogue about dialogue' between academics and students played in diminishing the usual 'barriers' between the two communities. In addition, that the staff-student research partnership allowed the development of common language between the two researchers and of trust and understanding that went beyond the confines of the project itself.

Talk 20: Dr Julie Hyde

The University of Sheffield (Chemistry Department)

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Employability and workplace preparation and practices

Many Universities offer a one year placement for MChem or BSc students during their third year of study. For the Universities who offer such programmes, it is generally felt that the students will be "more employable" after graduation. At Sheffield post-graduation employment rates are high, so how do we aim to make our students more employable?

Students typically join University programmes with some generic ideas of how to write a CV and cover letter but it is the "employability skills" that need to be developed during their studies to make a student "stand out from the crowd".

I will be presenting about my 10 credit employability module delivered to our undergraduate Year in Industry students that aims to bring out and develop such skills. Rather than extensive course work, students need to carry out short pieces of reflective by attending a number of industrial presentations we offer through the academic year. Students need to carry out group work, have meetings, deliver presentations, prepare posters and generally gain the skills to apply for their placement at the end of their first academic year of study. Badges are issued for students to show that they have gained a number of employability skills, these badges can later be included into their "Linked-in" profile. It is interesting to note during this academic year all of the industry students gained their placements during semester 1 of their second year, did the module help?

Talk 21: Susan Matthews and Paul McDermott

University of East Anglia

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On behalf of the UK:VN Higher Education Partnership Delivery Team: University of East Anglia, Nguyen Tat Thanh University, Institute of Tropical technology, Can Tho University of Medicine and Pharmacy, Thai Nguyen University of Science and Tay Nguyen University

Developing an Innovative Trans-National Education Approach to the Teaching of Natural Products Chemistry

Medical folklore and plant screening is a proven route for identification of new chemical entities with therapeutic potential[1]. Thus, the teaching of natural products chemistry and traditional medicine are important aspects of education for Pharmacists and Chemists worldwide. Therefore, the subject area can serve as a basis for the development of innovative transnational education (TNE) approaches.

In this project, we have developed two alternative modes of TNE, which enable students to experience cross-cultural learning without studying overseas. In the initial phase of this project we have prepared a series of open source multi-lingual videos to support natural products chemistry teaching. These resources have been incorporated into existing modules in both the UK and Vietnam.

We will present our findings from a mixed methods evaluation focusing on learning gain and student perceptions of the learning resources. A bespoke MCQ concept inventory[2] was used to assess distance travelled in conceptual understanding and (through a novel answer format)[3] an implicit measure of self-assessment accuracy was assessed. We will discuss this methodology as well as the student's calibration between actual performance and their confidence in the context of self-efficacy and learning development.

1 Eder, J., Sedrani, R., Wiesmann, C. (2014) Nature Reviews Drug Discovery, 13, 577

2Treagust, D. F., (1988) Development and use of Diagnostic Tests to Evaluate Students' Misconceptions in Science. Int. J. Sci. Edu., 10:2, 159-169

3 Michaelson, L. K., Bauman-Knight, A. and Dee Fink, L., (2004) Team Based Learning: A Transformative Use of Small Groups in Teaching, Stylus Publishing, ISBN: 157922086X

Talk 22: Katherine Haxton

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Social, Economic, and Political Contexts for Chemistry Through Sustainability.

Chemistry has a complex relationship with society: on one hand income generator and employer, on the other polluter and exploiter. Chemistry students must, through their undergraduate degrees, learn to place their core chemical concepts in the wider context of the societal, economic and political infrastructure. Teaching sustainability provides the ideal opportunity to do this by requiring students to consider the broader context of chemistry with reference to the UN Sustainable Development Goals, and other lenses. By refusing to accept chemistry as a 'neutral' subject, a position often taken when discussing science (that science is neither good nor bad, only the uses to which it is put), the contribution of chemistry can be critiqued and evaluated, and can be done so more broadly than through the 12 principles of Green Chemistry. Sustainable Chemistry provides an ideal opportunity to link skills, context, and real world applications. This talk will describe the evolution and evaluation of a Sustainable Chemistry module at Keele University over the past 6 years.

Talk 23: Walther Schwarzacher

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International Mentoring – a new opportunity for physics undergraduates

International mentoring is an optional course offered to third year undergraduates taking a Physics BSc or MSci degree at the University of Bristol. It involves undergraduates giving tutorials over the internet to groups of overseas school or college students studying level 3 (A-level) physics. The course gives the mentor the opportunity to develop teaching skills and improve their own understanding while communicating and explaining physics in a small group environment. They also gain a unique opportunity to learn about life in another country. The overseas students benefit both directly from the opportunity to gain a deeper insight into their physics curriculum, and indirectly from the opportunity to work with and ask general questions of a mentor from an initially alien background.

Talk 24: Joel Loveridge

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Undergraduate leadership in outreach events

Universities are under pressure to increase their outreach activities while improving undergraduate outcomes. This session will offer an insight into ways of achieving both simultaneously, by using outreach to develop undergraduates' leadership and other “employability” skills while also maximising academic learning opportunities.

In Swansea University's Chemistry department we give undergraduates the opportunity to take part in a range of outreach activities. One such programme is Spectroscopy in a Suitcase, a Royal Society of Chemistry initiative in which we deliver practical spectroscopy workshops either in schools or in our own labs. First year students deliver the bulk of these workshops, essentially teaching pupils material that they themselves were only taught a year previously, under the supervision of either a member of staff or a second-year undergraduate student.

This presentation will consider challenges and opportunities that arise from using undergraduate students for outreach activities, with a particular focus on skills development and how students view this.

Oral bites

Oral bite 1: Charlotte Clark

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Investigating the Effects of Formative and Summative Assessment in an Undergraduate Teaching Laboratory

We will describe the results of our study into the links between formative and summative assessment in an undergraduate Chemistry teaching laboratory. As part of our undergraduate laboratory course, students in their 1st year will have an opportunity to attempt 4 analytical approaches which will be appraised and feedback given from a demonstrator. Subsequently they will complete an assessed practical containing each of the same analytical methods, the mark of which contributes to their overall grade. Our study investigates the links between the two types of assessment.

Oral bite 2: Victoria Hilborne

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Imagine images for formative assessment.

There are many complex concepts and theories that students need to navigate throughout a chemistry course. Often the priority is to memorize facts and algorithms to pass exams rather than developing an adequate understanding. Students can also bring creative alternative conceptions, which hinder further learning. Visualization of the ideas behind chemical processes helps to effectively evaluate and learn concepts. Examples include Einstein's 'Elevator' and Heisenberg's gamma ray microscope. "A picture tells a thousand words", graphics are therefore a powerful tool to facilitate understanding of concepts. Presented are examples of graphics for formative assessment supporting exam revision.

Oral bite 3: Dr Kristy Turner

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Reading habits of undergraduate chemists from pre-application to Year 4.

Dr. Seuss said “the more that you read, the more things you will know. The more that you learn, the more places you'll go" however do our chemistry undergraduates really 'read' for their degree? Here we examine the type and frequency of reading in chemistry undergraduates and how it correlates with the expectations of our academic staff.

Oral bite 4: Lara Lalemi

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Decolonizing the Science Curriculum

Students are increasingly calling for the curriculum to be decolonized. In its broadest sense "Decolonizing the Curriculum" is focused on enabling students to see themselves reflected in the curriculum, enhancing inclusion and preparing students to contribute to a globalized world.

Oral bite 5: Barry Ryan

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Does academic mentoring in chemistry education practice and research burn the candle at both ends?

“A candle loses nothing by lighting another candle” (James Keller).

This quote epitomises academic mentoring; mentoring should not be an additional burden on already busy academics, but instead there should be a reciprocal benefit from the mentoring relationship. Academic mentoring aims to foster a guiding, supportive and coaching relationship between a mentee and a mentor; thereby creating a relationship where both parties gain from the symbiotic interactions over the mentoring period.

The Royal Society of Chemistry (RSC) Chemistry Education Research Group (CERG) aims to promote Chemistry Education Research at all levels of education and to disseminate these research findings. In order to support the continued personal development of all members of the group, and in response to an increasing general demand, CERG developed a bespoke mentoring scheme. In this scheme, mentors and mentees are aligned based on common areas of Chemistry Education Research interest (i.e. areas/topics a mentee would like support in which align to areas/topics from a self-identified corresponding mentor). Both mentor and mentee receive training and support from CERG and the RSC during the initial setting up and throughout the lifetime of the mentor/mentee relationship. Mentoring relationships are conducted online, are self-moderated by the mentor and mentee and are focussed on a clear set of outcomes.

The newly established RSC Chemistry Education Research Group Mentoring Scheme will be presented, along with initial findings from the first cohort of mentoring relationships. Attendees will be invited to engage with the mentoring scheme to support their research informed Chemistry Education practice.

Oral bite 6: Kajal Pindoria

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Presentation bingo: a novel intervention for group presentations

There is a growing body of research on the value and practice of peer-assessment and the use of innovative assessment designs in higher education. To date, there has been little research which investigates peer assessment in the context of innovative assessment designs. In this context, the impact of a novel educational intervention known as “presentation-bingo” for group presentations will be investigated. Students are asked to give constructive feedback in addition to marking which categories they saw were included in the presentations they peer reviewed. Based on how many of the categories in the rubric are marked as present a mark can be is assigned, patterns in what students felt was lacking can be determined and this data can be compared to the 4 examiners’ marks and comments to determine how well they were able to peer review the presentation. This aims to improve the quality of student research presentations by facilitating a mutual understanding between examiners and students as to what a good oral research presentation looks like.

Oral bite 7: Richard Blackburn

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Using infographic creation as tool for science communication assessment and means of connecting students to departmental research

Students were asked to each create an infographic based on one of their host department's research articles as a new exercise within the "science communication" training programme of the degree. Whilst infographics have been used as an educational tool by instructors, relatively few instructors have tasked their students with creation of one. The appeal of the infographic for the assignment was the combination of knowledge acquisition, summarization ability, scientific communication and information. It was also realized that by necessity students would have to limit the amount of text they used and would therefore have to think more carefully about the information they were reporting. To this end the task proved a useful way to distil out key information with students doing an excellent job of just selecting the key information to report. Furthermore, the activities insistence on using Leicester articles helped students relate to their department's research culture and the previously un-seen world of their lecturer's research focus. The assignment has also helped to contextualize why certain lecturers had been chosen to teach their allocated subject and helped the undergraduates recognize what research is associated to the traditional inorganic, organic and physical lecture themes.

Oral bite 8: Richard Blackburn

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Flipped problem classes to assist case-study teaching of synthesis

For an advanced-level module associated with designing drug syntheses, a set of homework tasks were created to help students prepare for their retrosynthesis exam. In short, students were asked to solve the next case study as homework, effectively writing the next lecture's notes in advance of the session using requisite knowledge and moderate instructor guidance. The contact sessions were now utilised to publically discuss the student's attempts with that of the instructor. The tasks were guided to begin with, with the level of independence being increased chronologically and completed answers and notes were generated in the contact sessions. This active learning environment saw a much broader coverage of organic chemistry than the traditional format and was enjoyable for staff and student. The seminar format also provided much needed opportunity to discuss the varied synthetic routes that were possible to the same molecule and the fact that various different reagent combinations existed for the same transformation. The format was highly successful in engaging and assisting students with the challenging topic of retrosynthesis, with the students who did the homework being very complimentary of the system. The collected feedback indicates effectiveness towards synthesis education and exam preparation with an increase in confidence with synthesis and retrosynthesis problems being reported. The provision of these activities may have also contributed to the increased attainment and the benefits apparently spread into other synthesis based modules they were taking at the same time.

Oral bite 9: Suzanne Fergus

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Exploring the study habits of some of our successful students, what can we learn about learning?

Bridging the gap between much modern scientific research in the areas of learning and memory to the classroom and real-life practical setting has emerged and grown in recent years. Effective learning tasks that improve long-term retention are defined by Robert Bjork as “desirable difficulties”. In this study 12 undergraduate students (7= female, 5= male) were interviewed about their specific approaches to studying. Using thematic analysis, the data was analysed to examine the common aspects among this group of students in their approaches to studying. The data was also examined to consider the extent to which empirically-supported learning strategies are used. The key results from this research study will be presented.

Oral bite 10: Claire McDonnell

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Development of an Online Course to Enhance Teaching Practice in University Science Laboratory Classes

Laboratory classes are an essential component of undergraduate science courses and have the potential to achieve many practical and theoretical objectives. Students must not only learn manipulative techniques, but also link theory to practice, solve a range of types of problems, interpret data, interact with staff and other students, and successfully navigate the laboratory itself. Learning in this situation can be greatly assisted by an educator who is able to guide students through this complex process. However, the effectiveness of this support can vary significantly.

To improve this, the European Chemical Thematic Network (ECTN) working group on Lecturing Qualifications and Innovative Teaching Methods developed an online course called 'Teaching in University Science Laboratories (Developing Best Practice)' – see details at; http://ectn.eu/work-groups/lecturing-qualifications-and-innovative-teaching-methods/online-course-for-lecturers/. The six week course is targeted at relatively inexperienced university teachers and comprises six modules, each representing approximately two hours work. For each module, participants are provided with videos and reading material as well as learning activities that prompt them to consider how the approaches and concepts discussed could apply to their own classes.

A Small Private Online Course (SPOC) was implemented on Coursera in December 2017 (60 participants) and again in November 2018 (144 participants from 22 countries, completion rate of 60%). Once evaluation of the second iteration of the course is complete, it is planned to evolve it into a Massive Open Online Course (MOOC). The evaluation of the two pilot courses will be discussed briefly, as will plans for the launch of the MOOC in late 2019.

Oral bite 11: Michael Seery and Claire Mc Donnell

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Disseminating innovative practice in chemistry education – a compilation of guidance from UK, Ireland, and Australia

In 2018, 30 chemistry educators from the UK, Ireland, and Australia responded to an invitation to contribute their knowledge on an aspect of their own work in the teaching of chemistry to a book celebrating the career of Professor Tina Overton [1]. The purpose of the book is to pay tribute to Tina's impact on the chemistry education community by mirroring her own good practice in sharing evidence-based innovation along with useful guidance. It is anticipated that it will become a useful source of information for those seeking to introduce innovative and effective practice in their own chemistry teaching settings.

Because it is recognised that there is an implementation barrier to adopting innovation, authors were tasked with reporting less detail about what they did and how it went, and instead sharing more of the 'how to do it' aspect. They were asked to be generous in implementation guidance and consider how others might adopt the approach in their context. To ensure that transferability was a focus, a condition applied by the editors was that any innovation must have been implemented at least twice.

In this oral bite, an overview of the pedagogic approaches applied within the book will be provided. Many align directly to Tina's main interests - setting the learning within a realistic context and the development of transferable skills within the curriculum.

1. Seery, M. K. and McDonnell, C. (Eds.), Teaching Chemistry in Higher Education: A Festschrift in Honour of Professor Tina Overton, Creathach Press, Dublin, 2019.

Oral bite 12: Dr Julie Hyde

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Design of a three year laboratory programme for international delivery.

It is starting to become very popular for Chemistry departments in the UK to offer joint degrees with universities abroad. A number of joint BSc programmes exist with China where students can start their university "partner" degree in their home country for three years and complete the final year in the UK. One particular challenge for chemistry courses is to deliver the laboratory abroad away from the home institution, it is unusual for UK staff to travel to China to deliver the practical component. I devised a three year practical laboratory programme to deliver in China to enable students to be fully integrated with the UK students when they travel to the UK for the final year of their degree. I have been spending approximately 3 months each year in China delivering this programme since 2012.

Delivering the practical component of a degree away from your home country, at your host university is still a fairly unique idea. Is this you – what should you do? Don't worry, help is at hand!

During this presentation I will introduce my "book chapter" which discusses the basics of setting up a laboratory programme abroad, delivering laboratory skills together with developing students scientific language so they can be fully integrated in the laboratory with the home students when they arrive in Sheffield. I will share some useful tips and advice and explain where you can find further support and guidance in the literature.[1]

[1] Hyde, J. (2019), "Design of a three year laboratory programme for international delivery", in Seery, M. K. and Mc Donnell, C. (Eds.), Teaching Chemistry in Higher Education: A Festschrift in Honour of Professor Tina Overton, Creathach Press, Dublin, pp 405-420.

Oral bite 13: Saskia O'Sullivan

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The importance of universities and schools supporting school teachers' continual development for student learning and the chemistry 'pipeline'.

The School Teacher Fellow is a recognised role within UK universities, with a secondary teacher seconded to a University for a period of time, typically a year, often to develop outreach activities, and to contribute their experience and expertise to the department's development of teaching resources for undergraduates, usually, although not exclusively, focusing on transition and the first year undergraduate course. The benefits to each party are many and varied, and depend on the exact diet of commitments agreed between the school, teacher and university. As an innovation, a school teacher was appointed as a full-time Specialist Junior Demonstrator, working in the 1st Year Undergraduate Lab. The role of Junior Demonstrator (JD) is a specific and well-established one within universities, required by departments on an everyday basis, and so the teacher has a clearly defined remit and becomes an essential part of the team from the outset. It is a placement suiting a teacher in the middle or latter part of their career to produce the greatest gain for teacher, school and university. This talk will focus on the benefits and challenges associated with this innovation, and provide a checklist for university departments seeking to replicate this model.

Oral bite 14: Andrew McKinley

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Hacking the Chemistry Code

The use of code in Chemistry is on the rise, with many departments recognising the need for students to gain a level of experience of coding to maximise their graduate prospects. However, there are many academics who do not feel sufficiently confident in their own coding ability to be able to implement chemical concepts through code.

It is however not necessary to "know code" in order to apply "computational thinking" to chemistry problems; indeed the creation of models within code can simultaneously improve understanding of chemical concepts as well as improving familiarity with code devices. The primary difference between these and other "virtual simulations" is that the code is plain to see, introducing novices to the concepts in coding and building familiarity with code to show what can be achieved. This will help to inspire students of other opportunities to use code and improve their coding literacy.

We are running a Chemical Concept Hackathon, with a view to establishing a continuing event. The principle aim is to put coding novices (students and academics alike) with experienced coders to develop coding models illustrating key concepts in chemistry. These models can then be used by students and staff alike to allow them to 'pull the levers' of the model to see the effect on outcomes.

We will illustrate a method through which such models can be used in a chemical context to generate interest in the community to establish a base for creation of open educational resources in this field.

Oral bite 15: Alison Hill

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Embedding mathematics into the Curriculum

Embedding mathematics into the Curriculum

A number of different strategies have been used to improve competency and confidence in mathematics in Biochemistry and Chemistry modules at the University of Exeter. The main knowledge/skills gaps for my Life Sciences-facing undergraduates are in mathematics and chemistry. For example, in a final year Medicinal Chemistry module, I noticed that students who had no post-16 maths qualification were underperforming. To improve support for these individuals, I devised a bespoke resource using NUMBAS [1], a browser-based e-assessment tool for mathematics. It embeds into the on-line classroom to provide practice in the mathematical skills required for the course, as well as interactive exam-style questions which provide instant formative feedback. This targeted approach has been successful at removing the maths-gap and performance on this module is no longer correlated with post-16 mathematics qualifications.

A different approach was taken for a second year Analytical Techniques module where a 'Smart Worksheet' was developed with Leaning Science [2]. This is used in the post-lab workshop to enter and process data and provides instant tailored feedback. The students were also able to use it as a revision tool to prepare for the examination. Student performance on the quantitative section of the exam increased from 43-59% (over the three preceeding years) to 72% ($p<2\times10\text{-}11$, Kruskal-Wallis test). Moreover the number of fails was reduced from a high of 22.5% to 1.9%.

1. www.numbas.org.uk

2. www.learnsci.co.uk/blog/2017/5/22/save-time-and-money-with-smart-worksheets-our-popular-digital-assessment-tool

Posters

Poster 1: Beverley Allan

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Investigating Learner Perceptions and Outcomes of the Flipped Classroom in Foundation Chemistry Classes

To develop a more inclusive and accessible learning experience for the diverse nature of foundation students, a flipped methodology was introduced to assess whether this could improve learners' understanding and attainment. Statistical analysis of exam performance provides some evidence that the fully flipped approach had a positive impact on attainment and the learners' perceptions for a simpler topic, but there is no evidence to suggest the same improvements for a more complex topic. From the analysis outcomes and the learner experience, it is suggested that the flipped methodology be used as part of a mixed methods approach to teaching.

Poster 2: Daniela Plana

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Teaching Periodic Trends in the International Year of the Periodic Table: Enhancing Student Engagement through Interactivity

On the 150th anniversary of its discovery, 2019 has been designated the International Year of the Periodic Table. Throughout time the use of this indispensable tool has only increased, with the trends contained within it enabling us to make predictions in everyday applications. Teaching aspects of the periodic table and its trends to undergraduate students is, however, not easy – it is difficult to convey its usefulness and power, due to some of the underlying concepts, which are often taught or better understood at higher levels. This often leads to quite dry teaching sessions and rote learning by the students, rather than fundamental understanding and appreciation of periodic trends.

An action research project was undertaken, which involved the progressive inclusion of interactivity in sessions and additional electronic resources in the teaching of periodic trends to 1st year undergraduate students. A series of initial lectures, with embedded questions/problems, was followed by a team based learning (TBL) session. Questionnaires completed by the students showed that whilst the session was liked and found useful, student answers heavily focused on its direct application to exam conditions. A further session was implemented which consisted of a short summary lecture, a mini-TBL session, and a series of puzzles and group activities. A second questionnaire showed that confidence levels increased, and interestingly, focus moved away from exams to understanding, links to other aspects of chemistry and enjoyment of the session.

Poster 3: Elizabeth Crilly

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What Does it Take to 'Do Physics' : Finding the Answers to Enhance Physics Uptake

Low uptake of physics in schools has a significant long term effect on the economy and global development. In spite of initiatives, numbers remain stubbornly low. Typically as in 2015-2016, 23% of state schools had no A level physics. 75% AS level students came from just 27% of schools and girls made up only 21% of the cohort(1). This impacts the numbers at university level.

Improved uptake and retention of physics students may be enabled by understanding the competences required for a successful foothold in learning the subject. Two decades of Physics Education Research confirms that we must examine the complex interaction of multiple learning factors – competences (2, 3). With subject knowledge as a given; these competences are in physics knowledge construction, knowledge transfer and meta-thinking, for subject learning and values, attributes and attitudes to create learning behaviours which enable academic success.(4-8)

Collecting data on this 'doing physics' from physics qualified adults in early, mid and late careers, in physics and non-physics employment is a new approach. Auditing this population is based on the premise that therein exists a wealth of physics learning experience that can be mined. And which has been distilled and refined by the reflective, self-assessment of the participants as they respond to competence variable indicators.

Quantitative and qualitative analysis of responses can produce profiles of successful physics learning; its diversity and mastery. Hence a means of improving education practice and changing the perception of physics as a subject for the few. Initial findings will be reported.

1. A level results 2015-2016 Government statistics [online]. 2015-2016. [Accessed]. Available from: https://www.gov.uk/government/statistics/a-level-and-other-16-to-18-results-2015-to-2016-revised.

2. RUSS, R.S. and T.O.B. ODDEN. Physics Educatonal Research as a Multidimensional Space : Current Work and Expanding Horizons. Physics Education Research- Getting Started in PER, University of Winsconsin, 2017.

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4. EYRE, P.D. High Performance Learning : How to become a world class school. London and New York: Routledge: Taylor and Francis Group, 2016.

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7. DOLIN, J. Fysikfaget i Forondring. Roskilde. thesis, Denmark, 2002.

Poster 4: Katherine Haxton

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ChemScapes: an Adaptable Chemistry Escape Room Challenge

Escape rooms are increasing in popularity and the basic premise lends itself well to outreach activities: complete tasks to obtain clues and escape the room. We have adapted the format for use in a laboratory setting, creating a set of challenges that lead to single digit answers that in turn can unlock a combination padlock and obtain the prize. The challenges can be tuned for any age group from early secondary to undergraduate and allow a chance to develop team working skills, deductive reasoning skills, and apply laboratory skills in an engaging and supportive environment. Strategic thinking is encouraged through a token system for seeking help, and perseverance is rewarded. Small tasks developed so far include thin layer chromatography, pH measurements, isomers, and microscale transition metal chemistry, and by using age and stage appropriate language, an inclusive yet challenging activity can be created.

Poster 5: Patrick Thomson

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The effect of a revision strategy and metacognition awareness intervention on first year exam performance

A whole-class “exam preparation” intervention was administered to a cohort of first year undergraduate students taking a general chemistry class, based on a combination of two prior results from chemistry and psychology undergraduates [1] [2]. The intervention consisted of a 1-hour teaching session, followed by a reflective survey. In the session, students were given a brief tour of bloom’s taxonomy to raise metacognitive awareness, then presented with several evidence-based revision strategies [3]. In-lecture, we polled students about which ones they had used before and were likely to use in the next month. Students were then asked to complete a reflective survey on the use of these resources, shortly before the onset of the revision period.

The lecture intervention was highly statistically significant ($p < 10\text{-}6$) for both overall mark (52% vs 68%) and failure rate (6% vs 28%). However, since the control group self-selected by not attending the lecture, it was not possible to discount the effect of non-attendance itself, which is a known predictor of struggle. A measure of prior attainment indicated there was still a statistically-significant difference between the control and intervention group, although not as strong (65% vs 71%, $p = 0.008$). Analysis is ongoing, although the exam failure rate decreased by 50% overall compared to the previous academic session.

No statistically-significant difference was observed with the reflective survey, although engagement was low (17% completed the survey) when compared to the strategy lecture (68% attended the lecture).

[1] https://pubs.acs.org/doi/abs/10.1021/ed300686h

[2] https://journals.sagepub.com/doi/full/10.1177/0956797617696456

[3] http://www.learningscientists.org/book

Poster 6: Patrick Thomson

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Introducing elements of inquiry into undergraduate chemistry labs

Inquiry-based labs are an emerging and popular way of teaching practical chemistry. They lead students towards independent research by inspiring critical thinking, curiosity, and a conceptual understanding of experimental processes. Inquiry labs need a base of knowledge, usually built upon a foundation of expository experiments that teach fundamental skills. As such, the first year of a teaching lab may well keep an expository structure, even when later years embrace inquiry learning.

In this work, we have shown that elements of inquiry can be introduced lightly and early in the curriculum, inspired by the approach of Szalay and Toth. In this work, a robust suite of existing experiments has had elements of inquiry introduced with a series of small, standalone modifications. Adaptation of existing experiments allows a tight control on the extent to which a student pushes into unfamiliar territory – particularly important for introductory labs, where unexpected results are likely to overwhelm or discourage.

The modified experiments confer many of the same benefits as an inquiry lab, such as students' sense of independence and control. The approach works best when supported by pre-lab exercises, for calculations or procedure-writing steps.

The approach builds on the prior work of Szalay and Toth introducing inquiry into a school curriculum, and we have shown that it can be used on a large scale in two different undergraduate teaching lab environments. In our pilot implementation, we placed a heavy focus on structured support for students, and conducted numerical and written surveys of students and postgraduate demonstrators to measure perceptions of the work.

Poster 7: Hayley Russell

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Evaluating a new framework for the re-design of prelab learning activities

Pre-labs are systems of preparatory exercises designed to supplement practical teaching activities, widely used in chemistry departments nationally. As an introduction to practical experiments, pre-labs range from lectures and discussions to interactive quizzes and videos. A recent review by Seery et al. (1) makes recommendations for the rational design of pre-labs, and this poster showcases our application of these principles to the lab components of a widening-access pre-entry summer school.

Pre-labs of the past have generally consisted of a patchwork of recipe instructions with little background information on the experiment theory itself, which may help students with the 'how' of carrying out the experiment but not the 'why'. The poster produced will provide data on the feedback from students on the redesign of several pre-labs within our summer school that will contain a high volume of supportive and a decrease in procedural information (1). Survey results measuring student experience and aptitude question results showing the effect on knowledge retention will be presented. A roadmap for suggested redesign of other pre-lab courses will also be featured, detailing why we followed our chosen methods and how these were implemented into our test course. Delegates will be encouraged to get involved in discussion of our ideas, possibly combining with their own, for future use, if relevant to their field. As our summer school is a widening access course, the findings of this project could be implemented in many teaching environments as it will aid students from various backgrounds and abilities.

(1) http://pubs.rsc.org/en/content/articlelanding/2017/rp/c7rp00140a#!divAbstract

Poster 8: Claire McDonnell

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Community Engaged Learning and Research Initiatives in Chemistry at Technological University Dublin

Since 2007, undergraduate chemistry students at Technological University Dublin (known as Dublin Institute of Technology prior to 2019) have been able to participate in community engaged learning activities. This involves students undertaking a real world project in partnership with a community group to address a need that the community has identified. Students gain academic credit for the learning outcomes achieved, which include reflection on their experiences. Participation in these activities has been shown to assist in the development of our students' problem solving, teamwork, organisation, digital literacy and communication skills. In addition, some final year undergraduate students have participated in community engaged research projects.

An overview of the projects that we currently implement will be provided, including two that were initiated in 2018-9. Two projects are community engaged learning activities. One is a Junior Scientist badge initiative for 10-12 year olds implemented in partnership with a local youth service and the other is a collaboration with an open prison in which our students prepare factsheets on the side effects of several drugs that are often misused. There are also two community engaged research projects. One is a collaboration with the Distributed Pharmaceutical Analysis Lab project run by the University of Notre Dame to perform chemical analysis of pharmaceutical samples from partners in the developing world. The other involves analysis of levels of heavy metals in soil from urban community gardens. We will also provide further information for those who would like to find out about implementing this approach themselves.

Poster 9: Rob Britton, Barbara Villa Marcos and Richard Blackburn

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Partnerships: Digital Innovation through student-staff-staff collaboration

Chemistry staff and students have jointly identified areas where the use of technology will make a positive contribution to the teaching and learning experience, whilst also providing continual professional development to the team. Staff have noticed the student contribution as a key method to understanding the problem area of the course/content and knowing how to pitch the solution at the correct level and in the correct language. The instructors can also capitalise on the greater technical ability, peer support/response and knowledge of popular media tools. The students themselves gain recognition from the university, feel valued, learn the subject and enjoy being more in control of their learning.

The 2019 projects are as follows:

- 3D printing to help students visualise molecular structure

Student understanding of threshold concepts is being greatly enhanced by following a created worksheet. By creating their own design and then printing their own models, they are better able to visualise molecules and structures more easily.

- Introducing the lab with an interactive 360 experience

We aim to help students familiarise themselves with the laboratory environment prior to the start of the practical courses. We are reducing the level of intimidation for the students at the start of their degree, particularly as students arrive at university with a range of previous laboratory experiences.

- Improving department induction through simulation.

Creation of a high fidelity, immersive, 3D render of the department is facilitating the transition to higher education whilst also giving the students an early emphasis on belonging and engagement.

Poster 10: Samuel Cahill

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X-ray Diffraction in an Integrated Chemistry Teaching Laboratory

The move to an integrated chemistry teaching laboratory and the purchase of a single crystal X-ray diffractometer to complement our existing powder X-ray diffraction equipment has enabled us not only to extend the scope of our X-ray practicals, but to incorporate the use of these techniques into the general practical course. Students are introduced to powder X-ray diffraction in the first year as a technique to identify crystalline solids. In the second year they collect and index powder patterns from unknowns, determine their cubic lattice parameters and Bravais lattice types, and use powder X-ray diffraction to follow the course of solid state reactions. As part of a study of structure property relationships for a series of mixed metal oxides students use a structural modelling program to calculate theoretical powder X-ray diffraction patterns and compare these with their experimental data. X-ray diffraction is combined with a solution calorimetry experiment to explore the structure and thermodynamics of solid solutions. Acquiring a single crystal X-ray diffractometer to add to our powder X-ray diffraction equipment means that students in the third year can, in addition to learning how to use single crystal x-ray diffraction, determine the structures of compounds prepared and studied elsewhere in the practical course, for example ferrocene derivatives and copper(II) acetate. With both powder and single crystal X-ray diffraction available students now carry out structure refinement using both powder and single crystal diffraction data.

Poster 11: Anna-Maria Maciejuk

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Chemclusion: Easier, Fairer, and Accessible

This study investigates factors that promote active inclusion in undergraduate chemistry among people with disabilities.

The project is working on:

1. Raising awareness about the barriers that exist for people with disabilities;

2. Providing practical and pragmatic advice, as to how these barriers can be reduced, in form of guidelines to assist academic staff and chemistry departments in supporting students with disabilities.

Participants were students with specific learning difficulties, mental health conditions, or other health conditions. Students, were interviewed to find out more about their involvement and strategies to study chemistry.

The preliminary outcomes show, that students, whose disabilities were diagnosed early in life were supported by their high schools and encouraged to study chemistry. Students who were diagnosed at the University, and disclosed their disability, found that this helped them to actively seek support and succeed. Chemistry students found the use of mind maps, animations and descriptions, on-line availability of lecture capture, well-structured reading lists, and lecture syllabus helpful in individual learning. Study groups, study buddies proved useful when revising for exams, as well as, especially for dyslexic students, who found it more practical to ask questions either their peers (group work) or approaching personal tutor and/or subject tutor after the tutorial and after the initial individual revision.

Many students, however, found it hard if they did not disclose their condition to a lecturer/tutor. Hence, the departments need to encourage a more open culture for disclosure, to identify and address the different barriers faced by people with disabilities.

Poster 12: Bunmi Ibrahim

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Can entry qualifications be used to predict students' outcome on a foundation year in Pharmacy programme?

Widened access in many UK Universities has allowed admission of students with non-traditional entry qualifications. One of the non-traditional entry routes to various courses at University is the foundation year. Previous studies have shown that students with non-traditional entry qualifications underachieve during their degree. However, a comparison of the academic performance of students that have gone through a foundation year programme is required.

This study investigated the relationship between entry qualifications and the performance of students on the foundation year in Pharmacy. Performance and progression of 44 students were investigated using internal examination results as an indicator. The entry qualifications of the students were A-levels (2Ds in Biology and Chemistry, being the highest grade and 1 U in one of the two sciences being the lowest grade). The students were taught in smaller groups of less than 17 to provide extra academic support.

The results showed that students with at least a D in Chemistry performed better than others in Chemistry-related modules and the same trend was observed for the Biology related modules. The overall average grade of the students was analysed using Cohen's D. This showed a large difference (1.27) between the two groups investigated, as expected. Surprisingly, the average grades were 66.73 and 58.42 for the 'higher achieving students' and 'lower achieving students' respectively. In future, the results of this study will be compared with those of students taught in larger groups. This could better inform ways to provide academic support and widen access for lower achieving students.

Poster 13: Jenny Slaughter, Saif Khan-Madni, Matthew Hamman & Nesrin Yuceulas
The University of Manchester

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Findensers – Greening the Teaching Laboratory by Embedding Sustainable Technology in Practice and Learning.

"Reflux" encourages reaction by heating a solution and requires a condenser to prevent solvent evaporation; conducting reflux, using condensers, is a key skill for undergraduate chemists. Traditionally a condenser with an external jacket of water provides the cooling. Water-cooled condensers use approximately 2 litres of water per minute, equating to 1,478,400 litres of water per academic year to teach practical chemistry.

To reduce water-usage, water can be recirculated or a chiller unit can be used. This requires a volume of cooled liquid to be pumped around the condenser using tubing and introducing the risk of leaks. An alternative solution is to use air-cooled condensers, in the form of long glass tubes or Findensers.

We will outline how the introduction of Findensers into teaching laboratories has had three key impacts: i) broadening the skills experienced in the laboratory; ii) helping students appreciate the impact of their actions and allowing them to make more sustainable choices; iii) reducing water-usage.

This talk will outline our investigations into the use of Findesers in the teaching laboratory setting. Our aim is to highlight the implications for other practitioners who might want to implement Findensers, including:

· Energy implications such as water saving and the apparatus lifetime;

· Safety implications, such as solvent containment and user safety;

· Learning implications, such as the choice of appropriate experiments, including the necessary scaffolding for a particular year group.

We will share our resources, which so far include on online practice manual and pre-laboratory quizzes aimed at first and second year chemists.

Poster 14: Jenny Slaughter

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Using personal skills mapping and reflective review to develop self-efficacy in student research groups.

Student-led educational research projects are a key part of chemistry and physics degrees in many HE institutions. This workshop reports on an approach to staff-student meetings specifically designed to incorporate reflective activities which encourage students to:

- work collaboratively;
- understand their transferable skills strengths and areas of development/weaknesses;
- decide on the remit and development of the group;
- determine the roles and responsibilities of staff and students within meetings.

The presenters will showcase two activities which were used to support students to move from being participatory to collaborative. Aligned with the Trajectory of Professional Development (Bianchi 2017), these activities are independent of context and applicable to other teaching environments where there is interest for students to transition from participating to collaborating and leading.

The 'Skills Mapping' activity will ask participants to discuss and identify the key skills for success, reflect on their own areas of strength and weakness and share them with the group. The collaborative and open nature of this activity requires participants to move from 'self' to 'group-reflection'.

'Reflective review using PMI' will exemplify how frameworks for reflection support students to explore the practical, cultural, curricula, assessment and academic implications in light of their own project work.

The workshop will provide participants with an understanding of how reflective activities in student-led educational research projects can be applied in different contexts and courses. Participants will benefit from experiencing reflective activities in action and discussion the use and impact of the activities. The workshop aims to enable participants to utilise the practice in their own setting.

Poster 15: Dr Kristy Turner

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A school based intervention to support a positive transition to undergraduate study - evaluating perspectives from all stakeholders.

A positive transition to undergraduate study can be key to student success across their studies. HE chemistry departments have made many adjustments in order to facilitate this but little is published on changes that could be implemented in schools. Here we outline an evaluation of the 'tutorial' work programme at Bolton School Boys' Division which aims to mirror some aspects of undergraduate academic work. Our evaluation takes on board the views of all stakeholders including students, parents, teachers, school managers and parents to judge the success of the intervention.

Poster 16: Andrew Worrall

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The Use of Mass Spectrometry in an Integrated Undergraduate Practical Course

Students arrive at university with an introductory understanding of mass spectrometry from their pre-university studies. However, mainly because of cost, their experience of practical mass spectrometry in most courses is very limited. We have found that compact bench-top mass spectrometry provides a relatively low-cost, student-friendly experience of this important analytical technique. We will describe a range of experiments developed for an integrated undergraduate practical course which illustrate how mass spectrometry can add an extra dimension of analytical chemistry to more familiar scenarios. We have developed protocols, inter alia, for the electrochemical synthesis of metal acac complexes, investigated the acetylation of ferrocene using a range of acylating agents and Lewis acids, the extraction of lycopene and carotenoids from tomato paste and the analysis of products from organic syntheses which have been designed by students. We have found that students have been able to use the mass spectrometer with minimal supervision, once trained, and the results from the analyses have resulted in an increase in student engagement with their laboratory exercises. Samples are introduced into the mass spectrometer either via a TLC plate or a direct-injection probe. The spectra resulting from these experiments are easy to interpret, showing clear and expected fragmentation patterns and easily observed isotopic abundance patterns for some metal-containing compounds.

Poster 17: Stephen Potts

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Welcome! Using Moodle to Ease New Chemistry Students' Transition to Higher Education

The transition from high-school to university can be particularly daunting for students, especially if they are coming from abroad. We designed a Moodle page for incoming students with a view to helping alleviate their anxiety and reducing their cognitive load during induction week by introducing enrolment and departmental information early. The page was built by a first-year undergraduate, who used her own and her cohort's experiences to design the content. Common questions were addressed, practice problems were provided and pre-reading and information about the department (including a virtual department tour and airline-style lab safety videos) was given. Students were automatically enrolled on the page as soon as they obtained their IT credentials in early September. They were asked to complete a quiz and questionnaires before induction week. The questionnaire gave insight into which features the students found the most useful, how confident they felt and what their expectations of university life were. The outcomes of the survey will be discussed and recommendations for similar pages will be made.

Poster 18: Oscar Siles Brügge

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Using Numbas for e-assessment of undergraduate chemistry students

Mathematics is an integral part of any chemistry degree, and it is therefore important that first year students from various diverse backgrounds are all brought up to the same level of understanding. In our courses, this is usually done through a set of lectures and workshops and problems classes. We are now working towards creating responsive resources for our students to benefit from, and encouraging them to become more “active learners” as described by Biggs.

Numbas is a free and open-source web-based tool for creating online tests developed by Newcastle University, offering much more versatility than similar options included in many VLEs such as Moodle or Blackboard. We have started to use Numbas in our first year undergraduate mathematics module in the form of formative as well as summative assessments. This allows students to be given unique question sets, and be presented with personalized feedback instantaneously. In particular, summative coursework, which has previously been done via paper submissions, is now delivered and assessed completely digitally.

Poster 19: Dan Cornwell

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Video prelude lectures for a partially flipped classroom

In 2018, I challenged myself to produce video “prelude” lectures to create a partially flipped classroom. My rationale was to use these videos as a means to cover subject basics, allowing for more focus on advanced topics in lectures, and increased time for class discussions and active learning opportunities.

Inspired by YouTube science channels, I had grand visions of the videos involving me talking excitedly to the camera, interspersed with animations to illustrate the concepts. However, it soon became clear that there was a lot of challenge to this project:

- I had no professional equipment or software for producing the videos, little experience animating, and I am probably not the most natural screen personality – so what would the final videos look like?

- Would students watch the videos? Or would they see them as a gimmick and find another way to cover the basics?

- Would the videos be any use to students after the lectures they were linked to?

In this talk I will explain how I addressed all of these issues, and others I encountered along the way. Analytics will be used to give those all-important viewing figures from before and after the lectures, and from later on in the academic year. I will also discuss how I see this project continuing in the future, giving reflections on the positive aspects as well as what could be improved. Most of all though, I hope this presentation will encourage other educators to give video lectures a go!

Poster 20: Victoria Hilborne

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Laboratory demonstrator coaches: scoring goals.

Laboratory classes are fertile ground for active and social learning and operate in a constructivist framework. Studies on guided inquiry laboratory classes and of Graduate Teaching Assistant (GTA) training give limited evidence of the expected outcomes. Do GTA training programmes for guided enquiry deliver the necessary skills?

Training workshops for groups of 8 to 10 GTAs used role-play exercises to develop knowledge building skills rather than simply transmitting facts. The goals were to help students link new discoveries with prior knowledge, break down complex information, evaluate and interpret data. By discussing typical scenarios of student behaviour in chemistry laboratories, GTAs recognised their role as mentors and developed strategies for using diversity to support guided inquiry. Peer mentoring encouraged reflection and ongoing improvement in teaching practice. Training immediately preceded teaching in series of years one and two undergraduate organic, inorganic and physical chemistry laboratory classes. Questionnaire responses from both GTAs and students gave a measure of the effectiveness of the training programme. Answers to open-ended prompt questions highlighted successes and opportunities for improving the design of laboratory activities for guided inquiry. GTAs and students reported discussing data, experiment design and guiding students to the underlying chemistry concepts. The influence of GTA and student experiences of task driven laboratory activities were also apparent. An overview of the GTA training and questionnaire results shows how laboratory design and epistemological beliefs drive the success of guided inquiry.

Poster 21: Stefan Guldin

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qTLC.app - an educational platform to perform analytical chemistry with your smartphone

Thin-layer chromatography (TLC) is one of the basic analytical procedures in chemistry and allows the demonstration of various chemical principles in an educational setting. An often-overlooked aspect of TLC is the capability to quantify isolated target compounds in an unknown sample.

Here, I will present a suitable route to implement quantitative analysis in a lesson plan, exemplified by absorbance-based quantification of the colorant Sudan IV and fluorescence-based quantification of rhodamine 6G, a fluorophore widely used in biotechnology. Students conduct TLC experiments following established protocols, take pictures of their TLC plates with mobile phones, and subsequently quantify the different compounds in the separate bands they observe. Meanwhile, we have developed a web-app titled qTLC.app that allows to easily upload images and analyse them using a simple browser-based interface. The web-app is now in v2 and already tested by users across the globe. We believe that this is a useful tool for students and hope to see it widely implemented in classrooms and labs.

References:

1) A Toolkit to Quantify Target Compounds in Thin-Layer-Chromatography Experiments - N. Mac Fhionnlaoich, S. Ibsen, L.A. Serrano, A. Taylor, R. Qi and S. Guldin; Journal of Chemical Education vol. 95(12), pp. 2191-2196 (2018)

2) http://bit.ly/qtlc-video

3) http://bit.ly/rsc-eic-qtlc-article

4) http://bit.ly/chemistry-world-qtlc-article

Poster 22: Cristina Navarro

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Educational videos in practical chemistry courses

As shown in several decades of research, there are many benefits to using videos in education. We would like to exploit these benefits and produce authentic learning opportunities for our students. This is why we propose to design, make and disseminate effective videos for our chemistry laboratory modules to ensure students can work safe in the lab and learn basic techniques properly while inspiring and engaging with them through this student-centred learning activity. Students would be the ones designing and making the videos, under staff supervision. Additionally students will create pre-lab questionnaires to go with the videos to ensure that everyone comes to the lab prepared.

Poster 23: Patrick Bergstrom Mann

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Earth's Field NMR Spectroscopy in the Undergraduate Chemistry Laboratory

NMR spectroscopy in the Earth's magnetic field is a concept many chemists probably haven't considered, but is very much possible and an active, albeit niche, area of interest. The particular strength of Earth's field NMR (EFNMR) spectroscopy lies in its application in undergraduate teaching. EFNMR offers students a unique opportunity to consolidate their understanding of NMR theory through hands-on use of a simple spectrometer, which requires more thought than just picking a deuterated solvent. A number of experiments aimed at physics undergraduates exist but a detailed use of EFNMR for teaching chemistry undergraduates has not been reported.

We present a comprehensive, one-day practical for the introduction of low-field NMR, covering spectroscopy, relaxivity, and imaging experiments in the Earth's field. The concepts of free induction decay, pulse sequences, field homogeneity, relaxation times, J-coupling and magnetic resonance imaging (MRI) are all reinforced through a series of experiments carried out within an undergraduate chemistry laboratory. Students are required to alter parameters as they see fit in order to obtain data, ensuring their understanding of the underlying theory.

Students demonstrated achievement of the learning outcomes and their understanding of NMR strengthened as a result of the experiment. Feedback indicated that MRI was the highlight of the experiment for most students, both because of the visual impact and for the clarification of the relationship between NMR and MRI.

Our video demonstration encompasses the setup of two EFNMR probes in an undergraduate teaching laboratory and the full experiment as carried out by students.

Poster 24: Sweta Ladwa

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Development of GoPro Videos - Tools to Aid Chemistry Laboratory Teaching

The use of videos to aid and enhance laboratory teaching are becoming popular in the world of smartphones and tablets which are increasingly more visible in higher education. We have developed a set of GoPro videos which can be used to demonstrate core experimental techniques or specific experiments to be undertaken by undergraduate students in a laboratory environment.

From observations and discussions during laboratory sessions, students are often engaging with the content (primarily laboratory manuals) on a superficial level (surface learning), just following the instructions for an outcome. With these resources, we hope to encourage deep learning with a flipped approach; engagement with the material beforehand, so students know what to expect in the laboratory, in turn spending more time understanding what is happening in the experiment using a visual approach in addition to reading. It is hoped that students will engage with the 'why am I doing an experiment and what skills am I learning', rather than the 'I just need to get the material at the end' type of experiment. The videos will provide students with a 'first person' perspective; imagining it is their hands doing the experiment. This may help to enforce what is required for a session in the student's mind before even entering the laboratory.

The initial videos produced cover key chemistry practical skills, focussing on synthetic skills but these could be extended to other chemistry modules. Eventually, other laboratory-based modules such as physics could implement these types of videos for pre-lab activities.

Poster 25: Anna Kirkham

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Do online support resources support learning in forensic chemistry?

As the technology dependence of students increases and the first choice is to swipe right to look for a reference or additional support is online, it leads me to consider, what role do online learning resources have in formal teaching? Can they be included successfully in lectures, tutorials or practicals or can they be used as a prelab or prelecture activities or are they just a place where students can be referred to gain additional support out of contact time. The resources used in this study include Bestchoice, Mentimeter, Padlet, Peerwise, Blackboard, Khan Academy,and iMotion.

Here I describe the inclusion of a range of online resources into my first year semester two forensic chemistry module, for first year forensic science students. I will outline which resources my students engaged with, which they found most useful and why and which they found least useful and why. How my students interacted with prelab and prelecture resources.

Poster 26: Hanno Kossen

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NUMBAS for Chemistry – Changing Assessment of Numerical Skills

Throughout their degree and beyond, Chemistry students need to be able to apply mathematical concepts and manipulate equations. To develop these numerical skills, practice is required. Repeated practice boosts confidence with calculations, but its assessment can be time-consuming, prolonging the students' learning process. NUMBAS, an open-source e-assessment tool developed at NU, provides a platform that allows auto-grading of mathematical problems with highly flexible marking criteria.

NUMBAS offers the possibility to define variables that can be used in questions. Simple input code then allows randomisation of variables generating unique question data. Feedback can be deployed specifically to provide worked answers based on the given variables. Furthermore, adaptive marking allows for the use of student-entered data as variables in subsequent questions.

This poster summarises the development of NUMBAS for assessment in Chemistry. Adaptive marking was used extensively in the development of laboratory assessment, providing rapid, consistent and tailored feedback. Using NUMBAS allowed for the decoupling of the assessment of the quality of the generated data, and the correct handling of these in mathematical manipulations. Further developments include the generation of validated chemical formulae and the use of lists to associate physical properties to molecules and atoms.

Poster 27: Nicky King

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What's the point of A-level chemistry and physics?

Recent reports by the Royal Society and others question whether A-levels are fit for purpose and whether post-16 qualifications are too narrow and not preparing students well enough for university or the world of work. Exeter's Natural Sciences programmes have high tariff entry requirements and all students are required to study biology, chemistry and physics in year 1, but the entry subject requirements are just maths plus one science thus most of our students are studying at least one science at university without having taken that subject at A-level. We've looked at A-level subjects as predictors of success and found that the single biggest predictor of success in year 1 is the A-level maths grade, and whilst an A* in science correlates with above average performance in year one, there is no difference overall between student success with or without particular science A-levels. 43% of students then go on to take modules in years 2, 3 and 4 in subjects which they did not take at A-level. So what is the value of A-level chemistry and physics? And why do we persist with stringent subject requirements on entry?

Poster 28: Kajal Pindoria

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Presentation Bingo: a novel intervention for peer assessment of group presentations

There is a growing body of research on the value and practice of peer-assessment and the use of innovative assessment designs in higher education. To date, there has been little research which investigates peer assessment in the context of innovative assessment designs. In this context, the impact of a novel educational intervention known as "presentation-bingo" for group presentations will be investigated. Students are asked to give constructive feedback in addition to marking which categories they saw were included in the presentations they peer reviewed. Based on how many of the categories in the rubric are marked as present a mark can be is assigned, patterns in what students felt was lacking can be determined. This aims to improve the quality of student research presentations by facilitating an understanding among students as to what a good oral research presentation looks like.

Poster 29: Jenny Eyley

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Assessing the Foundations of Practical Work in Chemistry

What do we want our students to gain from introductory practical classes? Most teaching staff will answer this question with a long list of varied skills, such as teamwork, timekeeping, hazard assessment, planning and preparation. However, from a student's perspective, assessment usually focusses on their ability to analyse data or answer written theoretical questions.

Prompted by an increase in student numbers, we redesigned the laboratory component of our Foundation Chemistry module to focus on the varied skills required to be a practical scientist. We introduced new assessment criteria that explicitly encourage students to develop skills in preparation, timekeeping and teamwork, in addition to assessing their experimental results and understanding of the experiment. All assessment is completed within the laboratory session, reducing staff marking time and providing instantaneous feedback to students. In this poster I will outline the logistics of this new assessment method, share initial evaluation and thoughts on changes required for the future.