Horizons in STEM Higher Education Conference Proceedings

Making Connections, Innovating and Sharing Pedagogy

28th – 29th June 2023, hosted by Swansea University
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Exciting Conference Prize Competition!

As part of this event, we are thrilled to announce three exciting prizes to recognize outstanding contributions by our esteemed participants.

Two prizes will be awarded for the best session delivered on Day 1 and Day 2, respectively. These prizes aim to celebrate captivating presentations that engage, enlighten, and inspire our diverse audience.

An exclusive prize will be awarded for the best poster, celebrating visually compelling and thought-provoking research.

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<td>Rachel Hilliam, Emma Steele, Carol Calvert and Di Haigney.</td>
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<td>10:40 - 11:00</td>
<td>GPA inflation</td>
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<td>Yifu Wan</td>
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<td>10:40 - 11:00</td>
<td>STEM and belief in UK and USA Higher Education: A new perspective on Equality, Diversity and Inclusion</td>
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<td>Lucy Peacock and Tiffani Riggers-Piehl.</td>
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<td>10:40 - 11:00</td>
<td>Smoothing the bumpy road of student transition</td>
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<td>Cressida Lyon</td>
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<td>10:40 - 11:00</td>
<td>Unique data sets for robust and fair online assessments</td>
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<td>Alison Hill, Nicholas Harmer and Steven Porter.</td>
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<td>11:00 - 11:30</td>
<td><strong>Break for coffee</strong>&lt;br&gt;<strong>Room: Science Central, Wallace Building</strong></td>
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<td><strong>Active Learning</strong>&lt;br&gt;<strong>Room: Glyndwr A</strong>&lt;br&gt;<strong>Chair: Sarah Roberts</strong>&lt;br&gt;<strong>Sustainability, Climate Education and a Net Zero Future</strong>&lt;br&gt;<strong>Room: Glyndwr B</strong>&lt;br&gt;<strong>Chair: Peter Esteban</strong>&lt;br&gt;<strong>Digital Learning Technologies</strong>&lt;br&gt;<strong>Room: Glyndwr C</strong>&lt;br&gt;<strong>Chair: Neil Williams</strong>&lt;br&gt;<strong>Pedagogy Research</strong>&lt;br&gt;<strong>Room: Glyndwr D</strong>&lt;br&gt;<strong>Chair: Susan Pawley</strong></td>
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<tr>
<td>11:30 - 11:50</td>
<td>Incidence of a pedagogical intervention based on active learning and critical thinking in solving problems of Mechanics Physics in Engineering students. <strong>Ignacio Laiton</strong>&lt;br&gt;Embedding Sustainable Development Goals in Postgraduate Programmes <strong>Noha Saleeb</strong>&lt;br&gt;Virtual Laboratory Teaching: A Blended Approach <strong>Denise Rooney, Frances Heaney, Carmel Breslin, Steffi Thomas, Marwa Aly, Aoife Newman, Ronan Bree, Bernard Drumm, Brian Murphy, Aoife Morrin, Blanaid White and Eric Moore</strong>&lt;br&gt;Situational Awareness in Aerospace Engineering Education <strong>Jason McFadzean and Patricia Xavier</strong></td>
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<tr>
<td>11:50 - 12:10</td>
<td>Embedding retrieval practice in undergraduate Biochemistry teaching using PeerWise <strong>Nigel Francis, Tanya Higgins, Ed Dudley, Owen Bodger and Phil Newton</strong>&lt;br&gt;Cultivation of disconnection: STEM, self, others and planet <strong>Patricia Xavier and Nathalie Al Kakoun</strong>&lt;br&gt;Community, Relevance and TALENT: A STEM specific network for digital and pedagogical transformation <strong>Lucy Hamilton and Hayley Whitefoot</strong>&lt;br&gt;STEM Integration: novel pedagogy or unlikely fantasy for the United Kingdom? <strong>Rory McDonald</strong></td>
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<td>12:10 - 12:30</td>
<td>Collaborative programme design and active learning in Aerospace Engineering design modules <strong>Yuying Xia and Jase Mcfadzean</strong>&lt;br&gt;Why engineering for sustainable development initiatives will fail. <strong>Gabrielle Orbaek White</strong>&lt;br&gt;Institute of Coding in Wales Micro-Credential Digital Skills Bootcamps <strong>Casey Hopkins and Faron Moller</strong>&lt;br&gt;Picture is worth 1000 words – Developing students’ visual communication skills by creating information sheets <strong>Ralitsa Kantcheva and Bethan Davies Jones</strong></td>
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<td>12:30 - 13:30</td>
<td><strong>Lunch</strong>&lt;br&gt;<strong>Room: Science Central, Wallace 1st Floor</strong>&lt;br&gt;<strong>Workshops</strong>&lt;br&gt;<strong>Room: Glyndwr 124</strong>&lt;br&gt;<strong>Room: Glyndwr M</strong>&lt;br&gt;<strong>LearnSci parallel session</strong></td>
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<td>13:30 - 14:30</td>
<td>Exploring how to embed sustainability in curriculum in a natural way</td>
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<td>Martin Braun</td>
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<td>14:30 - 14:50</td>
<td>Training and assessing students in seeing “the big picture” in complex</td>
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<td>mathematical processes and linking to employability scenarios.</td>
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<td>Maire Gorman</td>
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<td>14:50 - 15:10</td>
<td>Group Project in Bioinformatics, an example of authentic assessment to develop</td>
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<td>a wide range of professional skills for PGTs</td>
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<td>Celine Petitjean</td>
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<td>15:40 - 16:00</td>
<td>Connecting Undergraduates with Research in Mathematics</td>
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<td>Elinor Jones, Paul Northrop and Nicholas Grindle</td>
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<td>Auto-marked data interpretation examinations: Can we eliminate marking whilst continuing to assess students’ higher-level cognitive skills? Jo Stewart-Cox</td>
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<td>16:00 - 16:20</td>
<td>Enhancing students’ understanding of Intermolecular Forces using IMFs cards</td>
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<td>Erlina Erlina, Maria Ullah and Azwa Fadilla Wafiq</td>
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<td>What is known in literature about online exams in higher education in general, and in particular in Physics and Maths Martin Braun</td>
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<td>Learning to be leaders: the transition from post-graduate student to research leader Ann Grand, Victoria Pearson, Joanna Shelton, Iain Greenlees and Snezana Levic</td>
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<td>Who are our students? Their learning journeys, in 400 words.</td>
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<td>Hilda Mulrooney, Alison Kelly, Marwa Morshed, Kashfia Nizum, Aneesha Joseph, Baria Uppal and Phothiny Nesanathan**(online)</td>
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| Travel time between rooms |

<p>| 16:30 - 17:30 | Poster session                                      |
|              | Room: Science Central, Wallace Building, first floor |</p>
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<th>Time</th>
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<tr>
<td>9:00 – 9:20</td>
<td>Registration</td>
<td>Room: Science Central, Wallace 1st Floor</td>
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<tr>
<td>9:20 - 9:50</td>
<td>Plenary 2 – Joe Charman and Jack Bengeyfield</td>
<td>Room: Glyndwr D</td>
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<tr>
<td>9:00 - 10:20</td>
<td>Active Learning</td>
<td>Room: Glyndwr A</td>
<td>Chair: Peter Esteban</td>
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<tr>
<td>10:00 - 10:20</td>
<td>Making workshops work</td>
<td>Women into Tech: understanding barriers, making connections</td>
<td>Ella Taylor-Smith, Sally Smith, Carron Shankland and Mario Kolberg</td>
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<tr>
<td>10:20 - 10:40</td>
<td>The gamification of learning in a Medical Science curriculum</td>
<td>The Role of Enjoyment in Life Sciences Higher Education</td>
<td>Catherine Mansfield and Kate Ippolito</td>
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<tr>
<td>10:40 - 11:00</td>
<td>Assisting Transition and promoting active learning: a case study of a first-year Engineering module</td>
<td>Together from the Start? Exploring student sense of belonging following a residential field trip at the start of their university journey</td>
<td>Emily Bell, Celine Petitjean and Rose Murray</td>
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<tr>
<td>10:00 - 10:40</td>
<td>Equality, Diversity and Inclusion</td>
<td>Room: Glyndwr B</td>
<td>Chair: Patricia Xavier</td>
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<td>10:20 - 10:40</td>
<td>Laboratory, field and practical work</td>
<td>Room: Glyndwr C</td>
<td>Chair: Aisling Devine</td>
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<tr>
<td>10:40 - 11:00</td>
<td>Transitioning, Student Support and Academic Mentoring</td>
<td>Room: Glyndwr D</td>
<td>Chair: Suzanne Wells</td>
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<tr>
<td>10:00 - 10:20</td>
<td>Do students still want overseas field courses?</td>
<td>Wendy Harris</td>
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<td>10:20 - 10:40</td>
<td>Live fieldwork broadcast- a student co-production partnership</td>
<td>Janine Maddison</td>
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<td>10:40 - 11:00</td>
<td>Being free to fail: a new approach to developing confidence and competence in practical skills</td>
<td>Sarah Aynsley, Nazim Ali and Rebecca MacKenzie</td>
<td>Gaining deeper understanding of the female decision-making process for the selection of Mechanical Engineering at degree level in the UK, to counteract its low uptake. Jennifer Thompson, Chloe Morgan, Andrew Rees and Katie Hebborn</td>
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<td>Pedagogic Research</td>
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<td>Employability work-based learning and apprenticeships</td>
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<td><strong>Chair:</strong> Simon Bott</td>
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<td>Cengage parallel session</td>
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<td>11:30 - 11:50</td>
<td>Using a design thinking approach to re-imagine provision of large first-year bioscience modules</td>
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<td><strong>Hilda Mulrooney, Gemma Shearman and Nigel Page</strong></td>
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<td>11:30 - 11:50</td>
<td>Blended field courses: Using collaboration tools to integrate physical and online access to fieldwork</td>
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<td><strong>Trevor Collins, Yesenia Arroyo and Anita Marshall</strong></td>
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<td>11:50 - 12:10</td>
<td>Enrichment workshops to encourage awareness of employability skills</td>
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<td><strong>Janet Haresnape and Ruth Gilbert.</strong></td>
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<td>Digitally Focused Pedagogy Cengage</td>
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<td>How educational technology solutions build confidence by equipping students with the skills and competencies needed to advance their careers in STEM.</td>
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<td><strong>James Coates, Sue Prain and Cengage Faculty Partners</strong></td>
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<td>Developing Higher Learning Skills through Remote Practice-Based Learning</td>
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<td><strong>Maxim Lamirande, Foroogh Hosseinzadeh, Anne-Marie Gallen, Helen Lockett and Rafael Hidalgo.</strong></td>
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<td>Development of an at-home practical to overcome a control theory threshold concept</td>
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<td><strong>Haziqah Shahari, Becky Selwyn and Joel Ross</strong></td>
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<td>Undergraduate Engagement with Outreach</td>
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<td><strong>Simon Bott</strong></td>
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<td>Attitudes to Science in an Interdisciplinary Programme</td>
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<td><strong>Derek Raine and Sarah Gretton</strong></td>
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<td>Editing the green gene: a report on implementing a Masters-level unit-based CRISPR genome-editing research experience</td>
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<td><strong>Zoë Burke and Neil Brown</strong></td>
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<td>12:00 - 12:30</td>
<td>Integrating an e-portfolio into the curriculum to allow students to track skills development</td>
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<td><strong>Becky Thomas, Rebecca Lewis and Siobhan Swindells</strong></td>
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<td>12:30 - 13:30</td>
<td>Lunch</td>
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<td>13:30 - 14:30</td>
<td>Questions, Stories, Pictures, Decisions: A streamlined framework for embedding work-readiness curriculum into STEM teaching</td>
<td>Graham Cole</td>
<td>Using computer tools to support molecular biology labs Philip Leftwich</td>
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<td>13:30 - 14:30</td>
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<td>Assessment</td>
<td>Transitions, Student Support and Academic Mentoring</td>
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<td>Chair: Wendy Harris</td>
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<td>Chair: Suzanne Wells</td>
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<td>14:30 - 14:50</td>
<td>Embedding employability through a framework of authentic assessment and training support in the undergraduate research project</td>
<td>Stephanie McDonald and Lee Parkin 57 12</td>
<td>Postcard Project: an investigation into engagement and retention on a level one module Theodora Philcox and Elouise Huxor</td>
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<td>14:50 - 15:10</td>
<td>Developing transferable skills with final year Biosciences students using design sprints and assessment co-creation</td>
<td>Joanne Gough and Alan Goddard 15</td>
<td>Purposefully creating an online community amongst students Cath Brown and Susan Pawley</td>
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<td>15:10 - 15:40</td>
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<td>Break for coffee</td>
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<td>15:40 – 16:10</td>
<td>Final Plenary – Prof Phil Newton</td>
<td>Room: Glyndwr D</td>
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Plenary 1, Opening Keynote (Wednesday 28th, 9.45am)

**Success for All**

A journey through how we can support our students to be successful, challenge our preconceptions and address awarding gaps, through to the importance of compassionate leadership which supports space for pedagogy and innovation to empower educators and underpins success for all our staff and students.

Nicky King is Associate-Pro Vice Chancellor for Education in the Faculty of Environment, Science and Economy at the University of Exeter

**Bio**

Nicky King

During her career she has worked across STEM at Exeter. As Senior Tutor in Biosciences Nicky led transformative change in student support and as Director of Studies for Natural Sciences she was key in the development of the innovative interdisciplinary curriculum which has widened access to the sciences and been sector-leading in its approach to embedded interdisciplinarity.

In her current role as Associate-Pro Vice Chancellor she has championed compassionate leadership and developed new ways to support education and pedagogy within the faculty. Nicky is also Chair of the Society for Natural Sciences and developed their ground breaking accreditation framework which embeds an interdisciplinary ethos at its heart. She is passionate about interdisciplinary science and championing those who teach and study Natural Sciences through her role with the Society for Natural Sciences. She is committed to broadening student opportunities both through widening access to university and understanding predictors of success in order to address awarding gaps.

Nicky is Principal Fellow of Advance HE and a National Teaching Fellow

N.C.King@exeter.ac.uk
Bridging the gap between theory and practice using open-ended bite-size laboratory design approach

The dynamic of how students learn in engineering education is changing. Context over content has become a significant paradigm shift in promoting experiential learning of students within HE. Historically, engineering labs often serve as the gateway for encouraging student engagement and the active synchronisation of theory with practice. However, a significant drawback of lab work in HE is that lab scripts are often static and repetitive without any clear cut to improving the students' experiential learning. Hence, most students could end up racing against time to finish large chunks of instructional material without the contextualisation of the learning objectives stipulated within a given module.

To address this problem, the authors have recently developed a new lab work for second-year electrical engineering students mainly centred on an open-ended bite approach. The design approach aimed to help demystify the 'black box' nature of engineering lab hardware, often leaving the user without a clear understanding of fundamentals and applications. The proposed lab work was broken into small bite-size steps, with open-ended questions being raised to stimulate creative and intuitive thinking within each student pair. Students were cleverly signposted to a vendor's website to fetch actual data of a real DC motor. Subsequently, simple stepwise equations were provided to compute the core parameters of the motor. Next, students were offered simple instructional steps to run simulation exercises. The students are then expected to compare, contrast, and reflect on the simulation results compared to the vendor's performance scorecard (accessible on the datasheet). The expectation is that the students would reflect on their measurements for any given motor parameters; for example, they use parameters specific to their DC motor to measure core parameters, including resistance, inductance, and motor constants. By reflecting holistically, there should be the realisation that there is a difference between actual and ideal values from manufacturer's datasheets.

To further enhance the contextual learning experience of the lab work, a practical case scenario of the speed response of an automobile was posed to the students. The students were then instructed to design a simple control system using the parameter estimation from the previous exercise in an open-ended manner. The last activity aimed to translate the parameter estimation and simulation tasks into a simple breadboard construction exercise. Here, the student programmed an Arduino board to regulate the speed of the DC motor and the results were then correlated with the initial simulation exercise.

Overall, this new lab design approach has successfully run for three academic years, and student feedback is generally positive. Students particularly liked the hands-on nature of the lab work and the open-ended approach. Moreover, students have gone from being given a black box and simply operating it to get results, to beginning to...
construct their reflective learning portfolio. And thus, having a much better understanding of the physical hardware (a DC motor in this instance) and its real-world applications. We noticed an improved engagement with the lab work. The lab work was assessed via a reflective blog, lab diary and technical report.

**Key words**

Contextual, learning, Active, engagement, open ended
Simulations as an assessment for learning

Nigel Francis
Dave Ruckley
Thomas Wilkinson

Cardiff University
Swansea University

franisn10@cardiff.ac.uk

The use of simulations as a teaching tool in higher education has risen dramatically in the last few years, not just because of the switch to remote and blended teaching enforced by the pandemic but also due to the steady increase in student numbers (Francis et al, 2022). Simulations provide an effective link between the theoretical concepts taught in lectures and the applied, real-world scenarios experienced in the lab, resulting in authentic learning experiences (Serrano et al, 2018) based on Kolb’s (1984) experiential learning theory. Their use allows students to conceptualise and explore experimental techniques to drive a deeper understanding of laboratory practice, which better prepares them for laboratory experiences (Novak, 2003; Blackburn et al, 2019).

In this study, we describe the development and use of an open-access, bespoke, interactive simulation that has been used both formatively and summatively as a tool for learning. The simulation allows students to interact with a virtual representation of a piece of laboratory equipment and to design a simple experiment before applying their knowledge through interpreting raw experimental data (Bassingdale et al, 2021) to diagnose a series of patient scenarios.

This simulation has been used on two cohorts of students (>250 students) over the last two academic years with good success. This highly authentic assessment was generally well received by students, allowing them to showcase their knowledge in a wide range of different ways that moved well beyond simple recall. The assessed elements of the simulation, which included opportunities for in-assessment learning, used a much broader range of the mark scheme compared to the previously used multiple-choice quiz and served as an excellent discriminator of student ability. Crucially, the simulations permitted students with a range of specific learning needs to engage effectively with the material to create an inclusive assessment (Francis et al, 2022).

We have also had the opportunity to de-bug technical issues. The development of such simulations is time-consuming and despite extensive testing, some students did experience technical difficulties the first time it was used, which needed to be resolved while the assessment was ongoing. Another limitation of simulations is the lack of kinematic skill development, which can only be developed in hands-on classes. In conclusion, simulations have a key role in enhancing the student experience and learning cycle when used as a supplementary resource alongside hands-on laboratory-based experiences that develop the kinematic skills required by a scientific practitioner.

Key words

eLearning, Simulations, Digital education,
‘I can’t really say as my course is 90% male’: students perceptions of gender impact on computing and engineering degrees

In UK higher education, the majority of computing and engineering students are men. HESA (2023) records the proportion of women studying ‘Computing’ and ‘Engineering and technology’ as 22.78% and 20.47% respectively. Lack of women is a problem for both sectors, which need more skilled employees and also diversity to create appropriate products and systems. Opportunities are also missed for influential and well-paid work for women. Plus women computing students express feelings of isolation (Taylor-Smith, Smith and Fabian 2022). This study focuses on the perceptions of STEM students (of any gender), exploring whether they feel that gender has had an impact has on their experience of their course.

The data comes from an online survey of undergraduates studying computing, engineering, and the built environment. From a larger survey looking at student engagement, three questions underpin this study: Students were asked to specify their gender and asked the closed question ‘Do you think gender has had an impact has on your experience of your course?’ [Yes / No /To some extent]; followed by the open question: ‘Please could you tell us a little more?’

Most students who answered the question (n=255) chose ‘No’ (85.5%); 9% felt gender might have an impact ‘To some extent’; and 5.5% said ‘Yes’. However, the response was itself gendered (p<.001), with female students much more likely to suggest gender has an impact (27.6% chose ‘Yes’ or ‘To some extent’) and male students much less likely to recognise its impact (8.7% chose ‘Yes’ or ‘To some extent’).

The open question responses were analysed using reflexive thematic analysis (Braun and Clarke 2020), identifying thematically organised patterns across the whole, heteroglossic dataset (Braun et al. 2020). After exploring and coding the data, themes were developed and refined, then mapped, visually and intuitively. Mapping indicated two poles of opinion: the theme ‘No impact: all genders treated equally on course’ contrasted with the two themes ‘Gendered interactions and discrimination’ and ‘Male-domination causes difficulties’. A more neutral theme, ‘My course is mostly male’, stated or lamented the gender imbalance. Most instances of sexism described, such as men talking over or down to women, were not STEM-specific, though male domination could be experienced as intimidating and isolating.

Building an understanding of where students experience isolation or discrimination because of their gender will help us to support appropriate initiatives. These findings will be explored further in focus groups with students. While we plan to extend opportunities for confidence-building, networking, and mentoring for women and non-binary students, it may also be helpful for all students to get further training in communication and collaboration, oriented to support inclusion and diversity.

Ella Taylor-Smith
Sally Smith
Khristin Fabian

Edinburgh Napier University

e.taylor-smith@napier.ac.uk

Key words
Women, gender, computing, engineering and technology
Students’ belief identities are often overlooked in efforts to promote equality, diversity and inclusion within STEM fields; UK university diversity initiatives prioritise closing participation gaps for female and black and minority ethnic (BAME) students. Yet, 2012-16 data indicate that students from Christian, Jewish, Sikh and spiritual backgrounds were underrepresented in UK STEM university disciplines compared to non-religious students (Aziz Foundation 2018). Meanwhile, in the US, research has revealed a significant relationship between university STEM study and the development of students’ religious or spiritual characteristics and interfaith competencies. As university STEM applications hit a record high, little research has considered belief diversity (defined as the diversity of religious, spiritual or non-religious traditions, positions or worldviews) in STEM.

The 2022-23 mixed methods project, STEM and Belief in UK and USA higher education, addresses this gap. Drawing upon survey data from more than 9,000 UK and US university students, as well as interview data from 20 UK STEM university students across a diverse range of disciplines and belief perspectives, the paper will present some of the project’s key findings around three questions: 1) How are UK and US STEM students’ worldviews and attitudes to belief diversity shaped during their STEM studies? 2) How do UK STEM students perceive and experience the climate for religion, spirituality and worldview in their university STEM departments? and 3) What are the implications of our learning for fostering STEM university experiences inclusive of belief diversity?

This project is the first of its kind in the UK to provide avenues to improve the experience of STEM students from diverse belief backgrounds, promoting inclusive participation and retention in higher education STEM disciplines. The presentation will position the project’s findings against comparative US research to demonstrate similarities and differences among student experience of worldview diversity in two Western higher education environments. Closing with recommendations, the presentation seeks to inform how institutions and higher education STEM practitioners might enhance inter- and intra-faith relations among students, better equipping them to relate respectfully to those with a different outlook from their own during their STEM studies.

Lucy Peacock
Tiffani Riggers-Piehl

Coventry University
University of Missouri

lucy.peacock@coventry.ac.uk

Key words
Inclusion, Religion, Support
Students who study statistics modules at the Open University do so from a range of educational backgrounds and are studying on a range of qualification pathways such as Economics, Data Science, Computing, Mathematics and Statistics, and others. Each module must work at scale, and we cannot provide different modules for the students who study the different qualifications. This means that each module must simultaneously provide support for students from across the differing qualifications. For example, on M248 Analysing Data, which is a second-year undergraduate statistics module, we have been looking at different ways to support students who are studying statistics as part of a non-statistics qualification. This work has led us to consider the question of whether statistics anxiety might affect the students in different ways depending on the qualification they are studying.

There are many existing scales for measuring statistics anxiety but these are not particularly current or relevant for online and distance learning. In the early stages of this project, we have been developing a scale to measure statistics anxiety across our students, based on seven key factors, such as engagement (including online and statistical software engagement) and support (focusing on how distance learning students might seek support with their studies). The factors were identified from an extensive review of the existing assessment tools. This talk will outline our approach and current progress. The seven key factors will be presented and initial findings from piloting scale, including staff and student focus groups will be presented.

Emma Steel  
Rachel Hilliam  
Carol Calvert  
Di Haigney

The Open University  
emma.steele@open.ac.uk

Key words  
Statistics, Statistical Anxiety, Student support
**Smoothing the bumpy road of student transition**

Starting university is a key transition point for students. Developing academic and scientific knowledge is just the start. Students also must develop digital skills, social skills, self-care, confidence, and independence. Successful navigation of this bumpy road of transition is found to increase student retention, and appropriate guidance in the first few weeks is important.

A well organised programme of induction activities within the first few weeks of university can help to smooth the transition process and develop a sense of community within a degree programme. This study aimed to improve and support student transition for Biomedical Sciences students at the University of Bath by providing additional induction activities.

In 2022-23, several activities were introduced in these key initial weeks, including a campus treasure hunt of key locations; a digital skills session to increase confidence with university software; a Wellbeing session; and a Study Skills session. These sessions provided informal opportunities for students to get to know one another and staff, to become more familiar with the campus and the location of support services available, to increase digital confidence, to know where to go for help, and where to find additional resources if needed.

The efficacy of this approach was evaluated by online polling / questionnaire at the end of each of the sessions. Student feedback indicated that they found these sessions useful, that they increased student confidence and nurtured a sense of community on the Biomedical Sciences programme.

In conclusion, the induction activities that were introduced in 22/23 have contributed to student transition and the student experience, smoothing the bumpy road of student transition.

**Key words**

Transition, digital skills, community building, student support
GPA inflation

GPA inflation, also known as grade inflation, is a phenomenon in which students are awarded higher grades than they actually deserve. It occurs at all levels of education and has been observed in many countries, especially in Asia and North America. In recent years, grade inflation has also become increasingly prevalent in educational institutions in the United Kingdom and Europe.

The reasons for GPA inflation are multiple. Students require higher GPAs to secure better opportunities when competing for admission to the next level of study. Teachers and module convenors benefit from better assessment reports and feedback from students, which can aid in their future career paths. This results in higher praise from students and their future development, which in turn can help universities receive more applicants and achieve higher rankings. In summary, all departments benefit from higher grades in the short term.

While there may be some immediate benefits to GPA inflation, it can lead to serious long-term defects. Diluting academic standards can decrease the overall quality of education and make it challenging for employers and graduate schools to accurately assess a student's skills and knowledge. Additionally, unrealistic expectations for future performance can lead to disappointment and frustration when students are no longer able to achieve high grades without putting in significant effort. This can result in a lack of motivation and complacency towards their studies, further undermining the quality of education.

Our talk will focus on comparing university education in the UK and China by cross-comparing several grade reports from different universities and different years. In addition to this, we will analyse the impact of grade inflation on equality and diversity. Finally, we will present several feasible approaches to address and ultimately erase grade inflation.

Yifu Wang  
University of Leicester  
yw523@leicester.ac.uk

Key words  
GPA inflation, Academic standards, Diversity, Study motivation
Biochemistry
Smart Worksheets
and unique data
set generation by
Smart PDFs

Steve Porter
Nic Harmer
Alison Hill

University of Exeter

s.porter@exeter.ac.uk

At the University of Exeter, we teach enzyme purification and kinetics practicals to ~500 students annually. Students work in teams to purify an enzyme, investigate its kinetics and perform inhibitor studies. Students gather and analyse their practical data to determine kinetic parameters. Originally, assessment was via paper-based group submissions. However, some students contributed little towards their group’s work. To change to individual assessment, ensuring every student engages and learns how to handle data for themselves, we have created Smart Worksheets with Learning Science, which self-mark and give instant feedback. The introduction of the Smart Worksheets and the move away from group assessment to individual assessment has led to a significant improvement in the marks with the mean rising by around 10% (p<0.001; Kruskal-Wallis test with Dunn’s multiple comparison test). A major contributor to this increase, is that students learn from the instant feedback and do not repeat their mistakes as they might have done in paper-based assessments.

There are occasions when students can’t collect their own data or when their data are incomplete. While we could release a class dataset for them to analyse, this would risk students colluding as the expected answers would be identical. Instead, we developed Smart PDFs as a straightforward way of issuing unique data sets so that every student gets their own data set. All students download the same Smart PDF, enter their student ID number, and the Smart PDF computes a unique dataset. The Smart PDF contains a Javascript that uses a historical data set and transforms it by using the student’s ID number to seed an algorithm based on prime numbers and remainders. We designed the algorithm to embed a security “watermark” into the data set so that we can verify that students are using their own unique data and not sharing answers. We have worked with colleagues to develop Smart PDFs for generating unique datasets on other modules e.g. Plants and Bioinorganic Chemistry. Together, Smart Worksheets and Smart PDFs have allowed us to switch to automated, collusion-secure individual assessment in a way that minimises the marking burden on staff.

This presentation will be part of the LearnSci Teaching Innovation Awards session.

Key words

Assessment, Laboratory assessments, Unique Data Sets, Smart PDF, Smart Worksheet, Learning Science
Active Learning (Wednesday 28th, 11.30)

Incidence of a Pedagogical Intervention Based on Active Learning and Critical Thinking in Solving Problems of Mechanics Physics in Engineering Students

Developing problem-solving skills, as well as critical thinking skills in students of any educational level, is considered both a considerable shortcoming in education, and one of the key objectives of education, in addition to being considered within the skills necessary for education in the twenty-first century, as can be evidenced in OECD documents, UNESCO, among others. The objective of the research presented in the current work is to identify the incidence of the application of a pedagogical intervention, based on active learning methodologies, such as flipped classroom, thinking routines, ICT among others, in the ability to develop critical thinking skills, reflected in the willingness to solve problems of mechanical physics in engineering. A pedagogical intervention applied during several semesters in the classrooms of a higher education institution in Bogotá, Colombia, is planned in detail. A modified set of problem situations is designed, as a data collection instrument, a coding system is also built with the aim of translating the data and performing the respective quantitative analysis. It is intended to make the comparison between an intervened group and a control group, identifying the expected incidence.

Ignacio Laiton

Escuela Tecnologica Instituto Tecnio Central ETITC

ilaiton@gmail.com

Key words

Active Learning, Critical Thinking, Solving Problems, Higher Education
Embedding Retrieval Practice in Undergraduate Biochemistry teaching using PeerWise

Retrieval practice is an evidence-based approach to teaching; here we evaluate the use of PeerWise for embedding retrieval practice into summative assessment. PeerWise allows anonymous authoring, sharing, answering, rating and feedback on peer-authored multiple-choice questions. PeerWise was embedded as a summative assessment in a large first-year introductory biochemistry module. Engagement with five aspects of the tool were evaluated against student performance in coursework, exam, and overall module outcome. Results indicated a weak-moderate positive but significant correlation between engagement with PeerWise and assessment performance. Student feedback showed PeerWise had a polarising effect; the majority recognised the benefits as a learning and revision tool, but a minority strongly disliked it, complaining of a lack of academic moderation and irrelevant questions unrelated to the module. PeerWise can be considered a helpful learning tool for some students and a means of embedding retrieval practice into summative assessment.

Nigel Francis
Tanya Higgins
Ed Dudley
Owen Bodger
Phil Newton

Cardiff University
Swansea University

francisn10@cardiff.ac.uk

Key words
PeerWise, Retrieval practice, Collaborative learning, Learning communities, Multiple choice questions
This presentation is focusing on the successful collaborative programme design and active learning approach in design modules delivered by Aerospace Engineering, Swansea University. Specifically, the restructure and development of three engineering design modules across all the three levels of year 1-3, will be introduced to show the detailed approach we adopted and the outcomes. Interactive and active learning and teaching innovations, such as visual reality supported design, flight simulation, model building and flight test, will be presented.

Learning and teaching in Engineering Design modules have been challenging for years, and the lack of connectivity and collaborations in curriculum design was seen as an important cause for these disappointing outcomes. To reflect these challenges, more active teachers’ involvement, students’ participation, and Industry partners’ contribution in curriculum design processes have been adopted. Since 2017/18 academic year, collaborative teaching programme redesign between EG-165, EG-263 and EGA-302A led by the three module coordinators has been implemented and continuously developed in the past few years. EG-263 has subjected to the major reshuffle as it is the key link module between fundamental introduction of design process in EG-165 and advanced design in EGA-302A. More teaching innovations such as Visual Reality supported concept design and VR-supported detailed design have been brought in. These improvements have provided the students with hands-on and immersive approaches in the design. Active teaching and learning approach in combination with practical work through flight simulation, model building and flight test, provide the students with the ‘real’ industrial design, manufacturing and testing process.

The collaborative teaching programme redesign and active teaching and learning approaches show a great impact. Creation of effective link which enables the students to have smooth learning curves between the three design modules from year 1 to year 3, which significantly improved the students’ learning experience and satisfaction. The survey results of the three modules showed the improvement in the module feedback data, which indicated the successful implementation of collaborative teaching programme design and active learning approach.

In the latest accreditation, the successful learning and teaching in Aerospace design modules were highlighted by the accreditation body as a successful example and the students were motivated, articulated and complementary about the programmes.

Collaborative Programme Design, Active Learning, L&T in Design Modules
This session will discuss the methods utilised within our postgraduate MSc programmes, in the field of construction and built environment, to embed the United Nations Sustainable Development goals within the teaching and learning of the students. This was adopted within the programme specifications, curriculum and learning outcomes of each programme module, which were aligned with the 17 UN SDGs. Our most recent programme validation was viewed as pioneering in adopting this methodology, especially for distance learning delivery mode, where students are professionals in the industry distributed globally in different time zones. This seminar aims to suggest how all the UN Sustainable Development Goals can be considered for alignment with different discipline modules, in addition to ways of inclusion within the curricula and assessment deliverables.
As part of the process of professional socialisation, students within a given discipline start to adopt the tools and practices relevant to them. They also start to adopt cultural norms and values, factors that are more hidden and subtle. While much attention is given to learning outcomes relating to skills and knowledge, it is rare to discuss the development of different values as part of a programme review of teaching and learning. This study adopts the Schwartz system of values to analyse interview and psychometric questionnaire data, to characterise the how different polarities of values (self-enhancement vs self-transcendence, and conservation vs openness to change) are each either reinforced or suppressed during STEM education. Tradition, a subset of conservation, is a feature of STEM education since we build on previous knowledge, using the frame of the scientific method to further collective knowledge. This makes sense, we cannot rewrite the rules to build this knowledge. The flipside of adherence to tradition is a risk of not being open to alternative ways of seeing and knowing, including frames of enquiry that may be more appropriate to our current global situation than the scientific method we are familiar with. The world is facing a climate crisis and is simultaneously economically locked-in to a society dependent on generating the emissions that are driving climate instability. STEM professionals, like all members of society, are part of the machinery that maintain our business-as-usual economic habits.

There is an uncomfortable tension between recognition of the reality of climate crisis, and how we manifest this as STEM academics through our teaching. This tension often leads to denial and distancing from the issue in the academic space. Some possible reasons for this denial is found in the data on values collected in this study on the identity formation of STEM individuals. We present data characterising the tendency to tradition and social desirability (a measure of wanting to please others), and consideration of the self-enhancement and objective framing underpinning predominant teaching methods in STEM education. We argue that our habits of traditional STEM education of learning traditional methods, could serve to disconnect STEM individuals from their own values, from concern for others, and from appreciating our own complex entanglement as part of nature on this planet.

Methods, including more-than-human thinking and engaging emotion are discussed that can could offer to rebalance STEM education methods. These methods have potential to equip individuals to work in STEM while consciously interconnected both politically and environmentally, rather than conceiving themselves as neutral observers standing outside the world and dispassionately looking in.
Why engineering for sustainable development initiatives will fail

Gabrielle Orbaek-White

Swansea University

g.d.orbaekwhite@swansea.ac.uk

Engineers are often lauded for their role in the development of some of the most important and widespread innovations in human history. From water sanitation systems to refrigeration to mobile phones to trains and cars and airplanes, the vast impacts of engineers on the world in which we live are undeniable. As humanity is faced with unparalleled challenges, from the climate emergency to rising inequality to Western political destabilization, there is a renewed emphasis on the role of engineering professionals to contribute solutions to global problems. However, there is increasing recognition that the way that engineers are trained through higher education is inadequate to prepare them to address these grand challenges. This talk aims to demonstrate how the epistemology and cultural ideologies, or the “episteme,” of engineering in the United Kingdom continues to act upon our practices and discourses within modern day engineering education, and shapes and constrains our ways of knowing, thinking, being, and acting. The episteme of engineering has shaped modern engineering education into a system that produces technically trained, yet depoliticized engineers, who tend to eschew or neglect their social responsibility. This talk aims to deepen our awareness and understanding of the structural forces that shape engineering higher education in the United Kingdom and how they play out in our modern context. I will present data from a critical ethnography to reveal how the discourses and practices of engineering continue to be steeped in coloniality and perpetuate Western, modernist narratives of the need for growth and technologically-driven development. I aim to demonstrate that approaches to curricular reform for sustainable development will continue to fall short without concerted efforts to decolonise our ways of knowing and doing in engineering. Finally, I provide some suggestions on pathways forward.

Decolonising, engineering education, critical, qualitative, sustainable development
Digital Learning Technologies (Wednesday 28th, 11.30)

Virtual Laboratory Teaching: A Blended Approach

There is an ongoing revolution in using digital technologies to enhance learning, with HEIs providing content on VLE’s, with many lecturers using apps to enable on-the-spot evaluation of student understanding and many institutions using online adaptive study tools based on MCQs. However, even though many studies have shown there can be educational benefits (Qing et al. 2022 and Yap et al. 2021), there has been a reluctance to move teaching laboratory skills into a virtual world. During the pandemic we were forced to adapt and teach our laboratory courses in a variety of new and virtual ways. Now we have broken the mould it is timely to consider what we learnt during the pandemic and what the future of laboratory education will look like. The advantages of virtual simulations in terms of accessibility and repeatability are obvious. Moreover, the students can have access to equipment or experiments that would otherwise not be affordable. Our initiative involves a consortium of scientists (MU, TUS, DkIT, UCC and DCU) working with up to 5,000 students, EdTech providers and Enterprise Partners over a 4-year period. Our objective is to carry out an evidence-based study to determine how best to use virtual laboratory simulations to enhance our students’ experience and better their learning outcomes in the experimental sciences.

Our initiative works with students studying the chemical/biochemical sciences from introductory to master’s level. We are determining how to incorporate virtual laboratory resources in different ways for students at different educational levels. We are studying the pedagogical value of virtual laboratories as resources for pre-laboratory preparation work and for post laboratory skill reinforcement experiences. Virtual simulations involving real-world scenarios enable the students to appreciate how the techniques they have learnt can be applied to different settings. We are exploring the potential of this educational approach to support teamwork, and development of transversal skills, including engagement with industry. Our work shows that the laboratories can prepare the students before they enter the real laboratory, so less time is required to go over routine techniques and the students become more independent. Students were positive about their experience of collaborative teamwork and reported that their understanding of concepts was reinforced by using virtual laboratories.

However, the approach needs careful implementation. Students can be frustrated by technological glitches or network efficiency and there is a post-Covid ‘screen fatigue’ (Yap et al. 2021). Moreover, as with many educational initiatives, the development of appropriate assessment methods and academic feedback approaches are key. This approach to make laboratories a more independent, inquiry-based learning environment requires good academic support and communication with the students.

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Day 1

Yap, Wei Hsum; Teoh, Ming Li; Tang, Yin Quan; Goh, Bey-Hing 'Exploring the use of virtual laboratory simulations before, during, and post COVID-19 recovery phase: An Animal Biotechnology case study.' Biochemistry and Molecular Biology Education (2021), 49(5), 685-691.

**Key words**

Virtual laboratories, Inquiry-based learning, Blended laboratory education
Community, Relevance and TALENT: A STEM specific network for digital and pedagogical transformation

Aims of session – In this session we will share the results of our investigation into the value of TALENT: a STEM specific network for digital pedagogical transformation in the Faculty of Engineering and Science (EPS) at the University of Leeds. We ask: ‘What is the value of a STEM-specific support network?’; ‘How, when and why did we make a difference?’; ‘What lessons can be learned for the future of pedagogical support groups?’

Link to theme – Addressing the conference theme of "Digitally focused pedagogy", we discuss how the development of Blended and Technology Enhanced pedagogy in the Faculty has benefited from the peer support, technical workshops, experience, and practise sharing facilitated by TALENT.

Background context – Launched in 2018 to fulfil the need to share practice in a Faculty context, the network now has 146 members, mostly academic staff from EPS. The six “founders”: Faculty DEAL, Faculty Senior Learning Technologist, a Deputy Head of School, two DSEs and a Programme Director engage in monthly strategic planning meetings. TALENT also facilitates inter-disciplinary collaboration with colleagues addressing challenges within assessment, digital accessibility, multimode teaching, Quality Assurance, learning analytics, and a sense of belonging. Students give their perspective at relevant events. TALENT operates through online channels, hybrid events, and informal networking between members.

Practice or methods – Analysing both qualitative and quantitative data, we discuss: 1) evidence of the success of TALENT, and 2) key reasons for this success.

1) TALENT is directly linked to an improved sense of community, increased job satisfaction, and heightened interest in pedagogy and scholarship.

2) Reasons for TALENT’s success include the immediacy of technical and community-based support during the initial COVID lockdown, the provision of a space to share and address frustrations with external drivers change, and facilitation of experience and practise sharing both within and between STEM disciplines.

Conclusion – While TALENT is not primarily a Digital Learning Technology based network, the incipience of COVID-19, the shift to online, and the subsequent escalation of digitally enhanced teaching, have magnified TALENT’s usefulness in this arena. This is reflected both anecdotally (in member comments, an institutional award, and the professional development of members) and in survey results and event attendance, which peaked during lockdown. Our findings reflect that TALENT’s success during this period was not only due to technical requirements of online and hybrid working (i.e. demand for developing digital competencies) but also due to the desire to maintain a sense community when remote working.

By establishing a STEM-specific network, and strengthening this network by facilitating relevant, democratic, inclusive and timely support with digital transformations, members are invested in TALENT as a space to
explore other aspects of pedagogy and scholarship. This is particularly important as the University moves through the 10 year ‘Curriculum Redefined’ initiative seeking to ‘develop an innovative, imaginative and sustainable approach to education’.

Transferability of findings - The success of this STEM-specific network may be useful other institutions seeking to strengthen community and peer support at Faculty level.

Key words

Digital, Network, Peer Support, Community, Transformation, Innovation
Institute of Coding in Wales Micro-Credential Digital Skills Bootcamps

Casey Hopkins
Faron Moller
Swansea University
c.l.hopkins@swansea.ac.uk

Micro-credentials are credited courses that provide learners with a new pathway to study higher education level courses, obtaining further qualifications, and enabling adult life-long learning.

During the 2021/2022 academic year, HEFCW funded a Pan-Wales project led by Swansea University titled “Institute of Coding in Wales Micro-Credential Digital Skills Bootcamps”. The aim of the project was for each Welsh University to prepare for the delivery of micro-credentials, by either delivering a micro-credential (credit bearing courses) or micro-provision (non-credit bearing) during the timeframe allocated. As a result of this project 6 micro-credentials and a further 10 micro-provisions were successfully delivered across Wales to 349 learners.

The aim of the session would be to focus on the approaches used in the 4 micro-credentials delivered at Swansea, presenting how the courses were developed and delivered, the challenges faced throughout and the results of the project including analysis of feedback from the diverse learners.

Finally, the presentation would end with a very brief outline of the future of micro-credentials, how they can help to contribute to a highly skilled workforce with desirable employable skills and assist with closing the digital skills gap.

Employability, work-based learning and apprenticeships
Using well-established links, the courses selected to be delivered were influenced by local employers. This meant employers engaged and encouraged their employees to upskill and even helped to drive career change to digital areas that currently suffer from a large skills gap.

Assessment & Digital Learning Technologies (Online, Blended, Technology Enhanced)
The micro-credentials utilised a blended learning approach, with pre-recorded videos, timetabled online live virtual sessions, seminars, group work and discussions.
Assessment also took a variety of forms with lab sessions, coursework and in-person exams (where appropriate).

As the project resulted in delivery of several micro-credentials it was considered a great success. Learner feedback was collected via module feedback forms and via a survey and interviews conducted by the external reviewer of the project, The Open University.
Analysis of the feedback, survey and interviews indicated that the blended approach was well received, with many learners stating they would complete further micro-credentials if they were offered.
Additionally, following the completion of the courses, some high achieving learners felt confident enough to enrol onto Degree programmes, in particular the software engineering degree apprenticeship programme, evidencing how micro-credentials could be viewed as a stepping stone into Higher Education.
Equality, Diversity and Inclusion
Learner diversity was also considered. 59.8% of the learners were male and 40.2% were female in the project overall. This can be considered a great success considering the national average for females participating in Computer Science at Higher Education level is typically ~20%. It can also be said that micro-credentials naturally widen participation as they are less intimidating for learners than a traditional full time degree programmes and also more flexible.

Key words
Micro-credentials, Pathway, Professional Learners, Gender Balance, Blended Learning
Situational Awareness in Aerospace Engineering Education

Situational Awareness (SA) (Endsley, 2015) is the reactive ability to perceive (think) about what is happening, comprehend (feeling & understanding) what needs to be done, and finally execute necessary actions within a complex environment. SA is critical to the operational safety and progression of engineering projects, as a sensemaking process for practical aerospace engineering. All engineering disciplines rely upon on well-trained, experienced practitioners to act as pivots for the ongoing success of practical projects and tasks. This paper explores the potential of SA as a pedagogic framework to aid learning the skill of working within complex socio-technical-environmental systems.

Expert practitioners who display enhanced Situational Awareness rely on a combination of both explicit (codified) knowledge from techniques and toolkits, and tacit knowledge gained through experience in the complexity of the workplace environment. Lecture theatres and online learning are simplified environments with less opportunity for engagement in complexity. In contrast, apprenticeships, industrial placements, virtual reality, and authentic assessment are examples of educational modalities that could be more conducive to development of SA.

Ongoing surveys, 41% of employers reported skills gaps in their professional workforce and 33% said that ‘complex problem-solving skills specific to the situation are a concern’ (Institution of Engineering and Technology, 2021). In engineering education, SA could offer a framework and set of tools to explore the gap between engineering science and the practical skills required by industry. SA can characterise how different engineering education modalities deliver skills associated with practice. This paper combines reflections of the lead author (a veteran UK Royal Air Force aircraft engineer, now teaching aerospace engineering in Wales), alongside a systematic review of literature on situational awareness and related terms contrasting with contemporary aerospace teaching paradigms. * I served thirty years as a Royal Air Force aircraft engineer. Fast jets, big jets, helicopters, including operations controller for a worldwide helicopter fleet. This enables unique reflection into my current position as an aerospace student/academic in the UK. I constantly experience parallels in what real life experience can provide to the intrinsic ethos and pedagogies within engineering education. Situational awareness appears to be a missing element that needs to be fed back and integrated within aerospace education *

Continued and future work involving longitudinal study tracking a student cohort over time, to sample and chart how students and academics perceive their situational awareness over time through difference educational modalities. Rather than SA playing a ‘bit part’ in the diaspora of aerospace education, SA could unify disparate elements of teaching and learning, and encourage the development of valuable cognitive and practical competencies.

Key words

Situational Awareness, Aerospace Education, Pedagogies

Jason McFadzean
Patricia Xavier
Swansea University
p.a.xavier@swansea.ac.uk
Science, Technology, Engineering and Mathematics (STEM) subjects can be seen as highly valued or prioritised within many education systems, including those of the United Kingdom, due to a reasoned need for STEM literacy in our sophisticated modern world (Department for Education, 2021; UK Government, 2014). Novel STEM pedagogies and perspectives have emerged in many settings in response to this focus and greater resource. ‘STEM Integration’ is one such novel pedagogy that sees STEM learning restructured to remove boundaries between subject areas and unify science, technology, engineering and mathematics learning experiences. This multidisciplinary approach can take many forms: unifying themes may be adopted in separate STEM subject lessons, two or more STEM subjects may be taught alongside one another in the same learning experience, or project-based learning may draw on real-world problems to contextualise and interconnect STEM subject curricula (English, 2016). Whilst taking many forms the underlying philosophy of STEM integrative pedagogy remains the same: that STEM subjects are interrelated in a manner that can be drawn on by educators to structure enriched learning experiences. Whilst a growing body of literature has explored the adoption of STEM integrative pedagogies in international settings comparatively little literature has examined the potential use of these approaches in the UK context.

In this presentation the potential adoption of STEM integrative pedagogies in the UK setting will be theoretically and empirically considered. First, a literature review on STEM integration will provide a rich outline of this approach to STEM learning and its use in international contexts. Having developed this foundation of understanding the potential adoption of this pedagogical approach in the UK will then be critically considered. Particular focus on the role of engineering in teaching and learning will be examined given identification in past literature that engineering often plays a crucial role in integrating science, technology and mathematics learning (Guzey et al., 2016). Engineering can be viewed as an inherent bridge between STEM subjects due to the use of scientific knowledge, technical competency and mathematical reasoning in the engineering domain (Lucas et al., 2014). The relative lack of engineering in UK curricula will be considered in relation to international literature as a potential challenge to the adoption of STEM integrative approaches. Finally, empirical data collected from over 900 secondary school-aged learners in England and Scotland will be examined to determine the readiness of young people to engage with engineering learning as a prerequisite to STEM integrative experiences. Identity and affective-cognitive engagement for science and engineering will be measured and reflections drawn on the potential application of STEM integrative pedagogies in the UK context. Future avenues of research into UK STEM integration will be explored.

Key words

STEM Learning, Pedagogy, STEM Integration
Picture is worth 1000 words – Developing students’ visual communication skills by creating information sheets

STEM teaching can be seen as didactic with the lecturer passing key facts onto the students who memorize and repeat these exactly when assessed. Facts can be presented as text, numbers, diagrams, or multi-layered visuals (Walsh & Ross, 2015; Martin & Gaffney, 2016). To ensure that our first-year medical sciences module teaching is not didactic, and students are actively developing their critical thinking and analytical skills (Bobek & Tversky, 2016) we created a unique information sheet assessment. Information sheets are a concise scientific message on a specific aspect of a currently important health-related topic. These use simple layout, limited text, and a set of clear visuals to explain to the general public facts based on research from multiple sources (Frankel, 2020).

Students are allocated in small groups and given training about information sheets along with the related principles of basic visual design. Student groups then create an information sheet on a topic of medical importance of their choice. Part of the submission is an explanation of reasoning about the group’s choice of data from related research, and copyright free visuals presented in their information sheet (Cook et al, 2015). Additionally, group members peer-mark each other’s contribution to their information sheet prior to instructors marking.

After the pilot in 2019 we have expanded the provided training by adding a session on successful group work and have further developed the related independent learning resources. During the last two years for many students access to quiet study time and common group working spaces has been disrupted due to unplanned commitments outside of their study. These disruptions due to the Covid-19 pandemic have prevented us from formally evaluating the impact of this teaching strategy in previous years.

Based on our past experience and students’ informal self-reporting this task results in an easier image analysis process as part of their studies, and in an increased use of visual exam revision techniques. Thus, an immediate benefit for students is the development or enhancement of their visual learning skills and revision strategies. We hope that as long-term benefits this teaching strategy will improve students’ skills in relation to analysis, critical reasoning, and group work. All of these benefits are crucial in the enhancement of a student’s employability in an everchanging and highly competitive job market.

The impact of this teaching strategy will be evaluated through a questionnaire after the completion of the information sheet task in April. We will use both open and closed questions to assess the impact on students’ engagement with available scientific images and their ability to create scientific images for their own studies. Questionnaire data will be used to explore the benefits of this teaching strategy in developing students’ engagement with scientific images as part of their formal and independent study practices. We will also discuss the possibility of transferring this teaching strategy to other STEM disciplines.
Day 1

Key words

Visual communication skills, medical students, information sheets
One of the strategic goals in many UK university is environmental and social sustainability which includes advancing related learning, skills development and action. This workshop supports relates to such a goal by exploring what it means to embed sustainability in a curriculum in a natural way. To this end it will take the participant on a treasure hunt starting with the unpacking of the ethical justification and progressing to the question of what environmental and social sustainability implies. We will also discover what the various aspects of what the term “embedding sustainability” means using the physics curriculum as an example and finish at our final destination where we encourage idea sharing on how we accomplish this in terms of, e.g., teaching materials, assessments and tutorials. We hope you can join us.

Martin Braun

The Open University

martin.braun@open.ac.uk

Environmental and social sustainability, hidden agenda, curriculum, embedding
What might a decolonised computing and IT curriculum look like?

Decolonisation is a complex challenge for Higher Education Institutions and no less so for the discipline of computing and IT as there are many ways to frame and imagine what a decolonised technical curriculum would like look. At The Open University in the School of Computing and Communications we have started to debate new ways of knowing and to explore how to re-focus the teaching of the subject through a large-scale mixed methods survey of students from within School. 17 modules were surveyed with a total of 394 responses (10% response rate). The JISC online survey consisted of 12 quantitative questions using a five-point Likert scale and drawing on the Challenge Power and Diversity Represented constructs from Thomas and Quinlan’s Culturally Sensitive Scales. There were also 5 qualitative questions using free text.

How the session will be run

Introduction to the survey findings by sharing both qualitative thematic analysis outcomes and quantitative results based on SPSS analysis.
Small group work of addressing three questions:

1) What do you think it means to decolonise the computing curriculum?
2) How can we start?
3) What challenges do you foresee?
Short plenary to share group discussion and outcomes.

How the session will engage delegates

Delegates will have access to a selection of student survey responses as a prompt to their group discussion.
An educator resources pack sourced from OU modules and industry wide examples will also be available for critique.
For Question 1, proposed student definitions will be provided and the group will be asked to critically assess and decide which definitions, if any, are fit for purpose.
For Question 2, the group will be provided with internal OU and industry wide examples to critique in terms of their suitability as possible educator resources. They will be asked to identify other actions and to consider these in terms of timeline and impact.
For Question 3, tutor and student recorded challenges will be shared and the group will be asked to decide what the biggest challenges are and why.
All delegates will be invited to join the network of computing educators in HE focused on developing and sharing thinking and practice in this area.

Key words

Decolonising, Computing, IT
Gamification is gaining traction as a pedagogic tool with digital badging and leader board approaches being adopted in educational settings at various levels, and across a wide range of disciplines (Balci et al. 2022, Braxton et al. 2023, Fulton 2019, Hennah and Seery 2017 and Noyes et al. 2020). The effectiveness of digital badges, typically used to recognize skill or competency acquisition is reported to depend both on the type of badge and the stage of the learner (Abramovich et al. 2013). This presentation will discuss the impact of badging a series of practical and transferrable skills on students’ perception of success, identified by Irish Higher Education students as “developing skills to maximize employability” (National Forum 2019). Our project with students taking second and third year organic chemistry modules, focused not on mastery of a single technique, instead it targeted and regularly rewarded the development a series of microskills/competencies which were integral to the existing laboratory programme and assessment practices. For each skill short-term goals were set, and engagement regularly rewarded by transfer of a digital badge system via our VLE (Moodle); awarding criteria included online virtual training (LearnSci sims and in-house videos), quizzes, in class practical work and independent experiment reporting. Moodle Badges smoothly integrated with the activities and assessments assigned for each skill development and importantly facilitated automatic award. Openbadges.me and Badgr.com were also key enabling digital tools used respectively for badge design, and back-packing and sharing badges as a digital passport or on a social media profile.

The paper will describe skill selection and signposting, badge design, award criteria and implementation. It will share the student experience of how the project impacted on their learning not only in their knowledge, confidence and experience of the skills highlighted for development but also on their wider appreciation of the value of said skills/competencies for employment.

Day 1


Key words

Digital badging, micro-skill development, skill signposting, evidencing skills, enhancing awareness, employability, chemistry, STEM
Pre-arrival Hub to support and enhance student engagement, attainment and retention

Alexandra Moores
University of Kent

a.a.moores@kent.ac.uk

Literature indicates that students transitioning from Further Education to Higher Education do not instantaneously identify with their chosen University and are often dissatisfied with course content and structure clarity, including the use of Virtual Learning Environments (VLE). Additionally, the impact of COVID-19 pandemic has led to a lack of essential course materials not being covered prior to the start of their University course, a decrease in opportunities and resources, leaving students anxious when starting their degree programmes.

To support the transition and to increase retention of incoming students, the Division of Natural Sciences at the University of Kent have developed the Pre-Arrival Hub using the LearnSci Direct VLE. The Pre-Arrival VLE aimed to ensure student transitional success by following two core themes: Digital connectivity and Sense of Belonging. To drive digital connectivity the Pre-Arrival Hub was designed in a format and style that emulates the VLE Moodle Pages students would using during their degree. This ensured that students felt a level of confidence in using a site that hosts all learning materials for their course, as well as support sites, such as our Skills Hub and Student Hub. Students actively engaged with the Pre-Arrival Hub, where 189 students accessed content on multiple occasions. The Pre-Arrival Hub contained essential revision and learning resources students could access prior to term starting, including a numeracy skills Learning Science Smart Worksheet to help identify students understanding of mathematical problems. With 81 incoming students attempting the numeracy Smart Worksheet, we can instantly determine the level of understanding the new cohort has before they enter the University and can help guide the curriculum to best support our students. Furthermore, students can practise using Smart Worksheets prior to their use in the curriculum, offering a preparation tool.

To promote the sense of belonging, a key theme of our Student Success project, the Pre-Arrival Hub helped students build their identity before arrival through accessing the Student Handbook, a bespoke resource outlining essential information for students starting a course in the Division of Natural Sciences. Students were able to access their Welcome Week event timetables prior to the start of term, which significantly increased the attendance at our welcome week events. By attending Welcome Week events, and tracking attendance, we can longitudinally track further interventions and build reports that review impact and overall outcomes. By promoting students to feel part of their academic community, and that they ‘belong’, and are in the right place, academic retention, progression, and attainment will be positively impacted. Our Student Success project develops innovative interventions and activities to help support ongoing work in closing attainment gaps between certain cohorts of students. The LearnSci Direct platform complements this initiative by effectively tracking activity and completion of interventions, therefore supporting our understanding of the new student cohort.

Overall Pre-Arrival Hub, using the LearnSci Direct platform, is an excellent tool for offering students support materials, introduction to their
Day 1 courses, build their confidence in academic and social understanding and track engagement all prior to students starting their course.

Key words

LearnSci, Virtual Learning Environments (VLE), Retention, Transition
The History of Life film project

John Murry

University of Galway

john.murray@universityofgalway.ie

Digital story telling has proven a powerful tool for encouraging student engagement, particularly when it allows them to take control of their learning and present their ideas to much wider audiences. Despite this, the use of student-produced films as a pedagogical tool remains relatively underdeveloped. The History of Life film project at the University of Galway was created in an attempt to bridge this experiential gap for science students. Since 2011, final-year undergraduates taking the module History of Life have researched a significant theme related to the evolution of life on Earth and then produced a short documentary film for a general audience on their chosen topic. Working in small teams, the students storyboard, script, film and edit their film productions in just six weeks, before uploading them into the public domain on the History of Life Channel on YouTube: https://youtu.be/iK-X6OSF-bo

The vast majority of the students who make these short films have no prior training in film-making and there are no production budgets. The films are literally made from scratch with smartphones and laptops, and much of what appears onscreen is created by the students themselves. The value of this multimodal teaching approach is that it engages all of the major learning domains: cognitive skills are enhanced through acquisition, analysis and communication of knowledge, and practical skills are honed through deployment and use of technology. The students also develop key transferable skills (including team-working), and they find the overall learning experience enjoyable and novel: positively impacting on the affective domain [student feedback reflects this: https://tinyurl.com/mr3manrp].

The History of Life project is deeply rooted in the area of science communication, education and public engagement. It represents an innovative educational partnership between staff, students (the digital content creators) and the These student-produced films have reached a very large and diverse international audience on YouTube, with many positive and encouraging viewer comments. Several comments also indicate that these films are being used by educators. wider public.

A novel (collaborative) assessment approach for the films has been developed, which includes team (peer) evaluation and use of test audiences. Student feedback has also played a vital role in enhancing and refining the film-making programme.

Geology and palaeontology intrinsically possess a strong temporal narrative that is well suited for film. This approach could work equally well though with many other areas of science, which have their own narrative threads, and also in subjects with more abstract content (such as physics), where visualisation of concepts might enhance the learning experience.

The History of Life project was recently announced as a LearnSci Teaching Innovation Awards 2022 winner.
Key words

Science students, film-making, palaeontology, evolution, science communication, YouTube, active learning, transferable skills, teamwork
Unique data sets for robust and fair online assessments

The main knowledge/skills gaps for Biochemistry students are in mathematics and chemistry. We have used a number of approaches to address this including additional drop-in sessions, Q&A sessions and formative feedback. The key issue is student engagement and we have found the use of a Smart Worksheet very effective in upskilling our students’ data processing skills and improving their confidence. We use it formatively for the students to process data generated in the teaching laboratory. The calculations they perform are subsequently tested in their end of module exam and we noticed an immediate improvement in student performance in the data section (from 43-59% in preceding three years to 72%; p<2x10-11, Kruskal-Wallis test). The pandemic resulted in the temporary closure of the undergraduate teaching laboratory and assessments all moved online which presented a problem for us: instead of a one hour closed book invigilated exam, students now had 24 hours in which to answer their exam and access to their learning materials, the internet, and each other. How could we ensure that our exam was not susceptible to students sharing the unique answers in the data section of the exam?

We used bespoke laboratory videos, historical data sets and the Smart Worksheet to teach the students about the techniques, data collection and data processing. To ensure the exam was robust, we wrote an R script to generate individual data sets for every student (Harmer and Hill, J. Chem. Educ, 2021, 98:4094). To ensure the exam was fair, the data sets were based on a single historical data set, and we bounded each variable within limits determined by previous student-generated data. The R script also generated an answer file for the marker. Exam performance was unchanged despite the increase in time and it being open book, however, marking times were increased for the data section. To address this problem, we introduced automated marking this year. Students submitted their answers into an excel spreadsheet and the data was extracted to be marked by a R script. Once again, we can find no evidence of collusion. We have seen a drop in performance with the most common problems encountered being powers of 10 and units. This year’s exam was more advanced with every student asked for a different combination of answers. In addition, the exam duration was reduced from 24 to 3 hours which increased the time pressure.

In the talk we will discuss new results from a student survey and Focus Groups that are currently taking place examining the student experience of taking individualised exams. We are interested to understand whether they are concerned about other student’s behaviour in non-invigilated assessments, and whether personalised exams are perceived to be any different to more traditional ones.

Alison Hill
Nic Harmer
Steve Porter
University of Exeter

Key words
Assessment, Laboratory assessments, Unique Data Sets, Smart PDF, Smart Worksheet, Learning Science
Bringing Forensic Science and Crime Scene Investigation (CSI) to life through digital, innovative, interactive LearnSci Smart Worksheets in preparation for CSI practice and enhancement of learning and assessment as well as employability.

Rebecca Flanagan
University of Wolverhampton

University of Wolverhampton Forensic Science Lecturers with a professional practice background in Crime Scene Investigation (CSI) and Forensic Management identified a gap in available learning resources to support CSI practice teaching practicals for forensic science students within an academic university environment. A collaboration was established between the University of Wolverhampton and LearnSci, as a provider of transformative digital tools for science in higher education. As a result, Rebecca Flanagan, Lecturer in Forensic Science, worked with LearnSci to develop new innovative and interactive online learning resources for Forensic Science and CSI teaching. The objective was to develop resources for maximising CSI learning with limitations on practical scene house teaching/experience using new transformative digital LearnSci Smart Worksheets with forensic science simulation activities and an innovative, interactive CSI element that fulfilled Learning Outcomes (LOs).

Professional practice knowledge and experience were utilised to create a realistic incident scenario with accurate crime scene practices, including important crime scene management elements, as well as forensic assessment, sequential evidence recovery and priority evidence identification. An innovative 360 degree interactive crime scene was developed through collaborative working with continuous program design and development. Summary questions encourage critical thinking by the students regarding their processes for the ultimate objective of contributing to the criminal justice system through the provision of quality, impartial evidence. The exciting end-product was two interactive LearnSci Smart Worksheets that can be used as remote digital learning resources to supplement teaching, as well as a formative or summative assessments. The smart worksheets were then accessible as a trial Formative Assessment for students on the University of Wolverhampton Forensic Science BSc course at Level 5 in the CSI module. The impact on student learning and engagement was evident with promising findings from ‘Survey Monkey’ with 100% of students participating in the survey agreeing that the resources are intuitive with engaging interactive components, improved confidence of working in forensic scenes and skills and knowledge developed will be useful in the future, as well as agreeing that the activities were helpful to their learning. The future scope for this LearnSci resource includes further collaboration and development of additional forensic element activities, such as fingerprint and DNA recovery, or even forensic science specialisms, such as entomology and anthropology. This resource could be used nationally/internationally on Forensic Science courses to enhance teaching and learning, as well as being introduced in wider science education. The resource was found to enhance student skills, knowledge and experience in areas of critical thinking and effective strategy development, essential employability skill sets for Forensic Scientist or CSI practitioners.
Key words

Forensic Science, Crime Scene Investigation, LearnSci transformative digital tools for science educators, Interactive 360 degree crime scenes, Forensic Scene Management and critical initial actions, Information gathering, PPE, Health and Safety Risk assessment, Scene preservation, Forensic Assessment, Forensic Strategy, Priority Evidence, Sequential forensic examination, Enhancing student learning, Professional Practice, Employability skills
Personalising feedback at scale for first year undergraduate chemistry students

Student feedback is an invaluable part of the teaching and learning experience, leading to student success. Alongside this, we have found that undergraduate students frequently cite dissatisfaction with the provision of feedback in student satisfaction surveys and unit evaluations, for example with amount, specificity and timeliness. In addition, there are significant workload implications that hamper staff from providing timely and meaningful feedback to students. This is a particular problem for large student cohorts, where personalising feedback can be extremely challenging.

A recently emerging field that may allow instructors to better provision student feedback, is that of learning analytics. Learning analytics collects digital data created by students as they interact with learning management system with the aim of evaluating student’s behaviours to inform various aspects of education, including more efficient provision of support to develop student potential. (Leitner et al. 2017)

This study explores the impact of learning analytics-based personalised feedback emails used at scale on students’ academic performance and student success. This study was carried out at a public research university, with large first-year chemistry cohorts, and the data were taken from six semesters from 2019–2021. Our data show that there is a positive association between feedback emails and academic performance and student success when compared to control conditions, and the implications of our findings will be presented.

Reference

Within an undergraduate physics degree, there are many transformations and progressions in thinking skills which we aim to facilitate as educators. One key progression is the transition from students solving single-step problems to tackling multi-step problems and derivations which draw upon a range of knowledge and skills. In teaching partial differential equations, PDEs (e.g. Diffusion, Laplace and Wave) there is the real danger that students can resort to learning solutions to specific problems with set boundary and initial conditions. When teaching this material, one of my key objectives was to broaden students horizons by showcasing to them how the techniques taught are useful for PDEs beyond the scope of those taught in the module. Similarly in teaching Y3 students to derive dispersion relations to characterize atmospheric waves I was conscious of students becoming fixated on particular derivations and not been able to utilize the skills in unfamiliar derivations which is a key degree classification discriminator. Hence, over the years I have adapted teaching philosophy to place emphasis in learning interactions (traditional lectures, online videos, workshops etc) on students been able to “describe in words” the overall processes we are discussing without reference to any mathematical equations or specific problems. Hence I have been emphasizing to students the key employability skill of been able to both “zoom in” on intricate algebraic details and subtleties but also “zoom out” on problems and hence “see the big picture”. Both these skills are vitally important and arguably should be assessed in different mediums.

I have found that follow-on examination questions in which students have been tasked with bullet pointing key steps within a process have effectively stratified students into clusters for a range of topics spanning different year groups. I believe the inclusion of such questions is vital in challenging student preconceptions that the key to mastering physics lies in the ability to memorize the full mathematical details of complex formulae and derivations. These types of questions were found to be incredibly useful during the lock downs early in the C19 pandemic when examinations were set as “open book” with 24 hour window for students to complete. Here a key challenge was ensuring that questions were set so that collusion could be identified which is challenging for “traditional” numerical type questions.

A new challenge now facing education is the emergence of ChatGPT. In this presentation I will present results of how students and ChatGPT performs for a range of “big picture” questions. I will also demonstrate how parallels between generic workplace skills and complex derivations can be drawn using the example of solving the Schrodinger equation for the Hydrogen atom. Overall, this ability to look at problems and challenges from different perspectives is also key for students effectively prioritising where they focus their efforts across assignments with different credit weightings. Having a “big picture” mentality is crucial for final year students who have to balance the competing demands of
Day 1
coursework due on short-timescale versus major project which happens over a longer timescale.

Key words
Mathematics, Description, Assessment, Student learning approach, ChatGPT
Students at master level needs to develop a wide range of professional skills to be ready to tackle very different challenges than the one they faced during their undergrads. Research has shown that authentic assessments, ADD Definition, helps students’ engagement, overall learning and skills development.

Group Project is a unit of the recent taught MSc in bioinformatics of the university of Bristol.

As unit director, I developed a unit that allow our students to work on their expert skills in bioinformatics, as well as to grow their employability and self-confidence through an authentic portfolio assessment.

Group project is designed in the form of a mock professional project where each group of students will be put in a typical situation of being given a dataset and a biological question to resolve with some pointers but a lot of freedom. Their goal is to analyse this dataset, solve the question, but also to present their whole work in a way that it reproducible and understandable by a non-expert, as they would to a group of collaborators or partner in a professional context.

To support our students acquiring these skills, I designed a program including lectures at the start of the unit, followed by weekly drop-in sessions to give them guidance and support regularly. This planning was also supported by formative assessments at set times to support them structuring their time, as much as for me to check if appropriate progresses were made by each group. During most of the unit, I use a coaching and mentoring approach to support students’ decision-making process, developing of their self-confidence and sense of expertise. I believe that this approach works particularly well as master level as students are already engaged and motivated, although sometimes still expecting the “right answer” to be given to them, and afraid of affirming their own expertise.

Group work is another potentially difficult part of this unit, particularly as our cohort is very diverse in many ways, but it is also the reflect of what will likely be their profession. To help them making the best of this diversity, we discuss this aspect of their work, and they are invited to reflect on it through their projects.

The final summative assessment is a portfolio of documents complementing each other, where students have the opportunity to express their own qualities and individualities in addition to showcase their newly learned bioinformatics skills.

I believe that the outcome of this design is a very authentic project and final assessment, appreciated by the students, despite its highly challenging nature. Student feedback has been excellent, formally through surveys, as well as informally through conversation where students reported that the experience of Group project allowed them to tackle a new and challenging task during their research project with confidence rather than panic.

I would like to present the details of this assessment, as well as the rational for this design as an example of authentic assessment at postgraduate taught level.
Day 1

**Key words**

Authentic, Assessment, Postgraduate
Deep Artificial Intelligence Chat Bots (e.g. ChatGPT/Microsoft and offerings from Google and Apple) are much in the news. They have been shown to be able to offer not only informative Chat but also longer answers to longer standard academic coursework. They thus present a fundamental challenge to traditional assessment techniques. Flipped Learning is a paradigm where students are introduced to material beforehand and then bring this knowledge to the Laboratory or Classroom to practically engage in applying it and thereby deepening their understanding of it. In the context of STEM a significant amount of learning activity is Laboratory based and assessment carried out in this context. Nonetheless, STEM assessment traditionally still contained elements where students were required to demonstrate command of their material with independent study that is now compromised with Deep Artificial Intelligence Chat Bots. With Flipped Learning, Deep Artificial Intelligence Chatbots are just another source of learning material. This material has to be learnt and operationalised. The focus on the pedagogical process then flips to the Face to Face with the Lecturers or Teachers, and this assumes that the knowledge has been acquired beforehand. That students now have Search Engine enhanced Deep Artificial Intelligence Chat Bots to access this knowledge just means that getting the material is made easier. Demonstrating their command of that material can then be assessed in the Lab or Classroom in a controlled environment where they cannot access any extra help. This has the potential to enhance the learning experience in the STEM context, given the vast amount of knowledge that these Chatbots can search, and thus the knowledge that students can acquire prior to their Laboratory or Classroom interactions.

**Key words**

Foundational AI, Flipped Learning, Deep AI, Machine Learning
"Personal tutor" pilot scheme on a Mathematics first year module in a distance learning environment

In this presentation we will be discussing a pilot project that involves introducing personal tutors onto a first year mathematics module in a distance learning environment. The OU does not currently have personal tutors, but simply module tutors to support the student with their module studies.

Personal tutors are present in some form in many higher education institutions (Lochtie et al, 2018), and a good personal tutor relationship has shown positive impacts on students (Yale, 2017). We intend that the introduction of personal tutors to this module will have a positive impact on the student experience, engagement, retention and success.

Nine experienced tutors have volunteered to be part of this trial and will be supported by a dedicated forum and regular drop-in sessions. They will also be recording overview data of their personal tutor interactions and reviewing the pilot at the end of the presentation. We will also survey students involved to receive feedback and evaluations of the scheme from a student perspective.

Any students joining the scheme, which is on an "opt in" basis, are allocated a personal tutor who they would not encounter as a module tutor. The personal tutors will offer additional support to students on more general study topics, such as study skills and time management, as well as signpost students to additional resources as needed and be a non-judgmental, listening ear. They can also provide more general ongoing support for students.

Reminders are sent at critical points in the module to target support to students at times when student engagement can otherwise decrease and motivation dip.

The key goals of this project are:
To improve student experience and engagement on the module,
To enhance students' mathematical and study skills,
To boost retention and attainment,
To develop a model for provision of personal tutors that could be rolled out more broadly for distance learners.

This presentation will introduce the ongoing pilot scheme and the tutor feedback so far

Key words

Personal tutors, Continuation and completion, Retention, Student experience
Open University students frequently cite time pressure as a challenge to successful study. This new eSTEeM project is underway to explore and evidence the impact of ringfenced writing time for students. Writing retreats are rarely used for undergraduate study but demonstrate positive outcomes for staff or postgraduate students. In addition to the usual planned tutorials and tutor support, tutors are offering student support in the form of mini online writing retreats to provide ringfenced writing time in advance of the deadline for their Tutor Marked Assignment (TMA). To ensure a valid comparison we are conducting a stratified study across nearly 7,000 students studying one of four Level 4 modules in STEM using control groups and comparing the resultant student outcomes. We have used predictive analytics to determine which students have a 0-70% chance of passing their module and have split these into control and test groups. The test group are invited to attend from their choice of writing retreat times ahead of each TMA cut off. The control group are simply reminded by email to work on their TMAs in advance of the cut-off date. The control and test groups have been evenly distributed based on their demographic dimensions. The anticipated benefit of this approach is an expected increase in TMA submissions and TMA scores for those students involved. This contributes to retention, continuation, completion and further student success.

During this oral presentation we will describe the work to date and particularly focus on the approaches taken to conduct a large-scale study with valid control groups. We will also focus on the approach taken to include module teams and Associate Lecturers in the study. We will share the results of the early data analysis of the study which has been ongoing since October 22.

Student support, Assessment, Writing retreat, Controlled study
Sharing of cross-institutional case studies to support success in lifelong learning and skills development in first year science students

There are real challenges for higher education institutions in equipping students not only with the skills that current employers require but the transferable skills that mean students can upskill and reinvent themselves throughout their working lifetimes. Preparation for an increasingly complex, digitally rooted and information-driven world requires people skills and abstract cognitive competences that enable the development of awareness of strengths and areas for development. Therefore, developing metacognitive skills through reflective strategies with students is important. There is evidence that engaging with reflection improves learning, and increases professional practice in relation to critical thinking, and dedication to effectively carry out their goals and actions.

Yet, in the STEM subjects including biosciences, there has traditionally been little emphasis on supporting students to highlight their own personal perspectives, opinions, feelings and awareness about their developing learning and skill sets. Here, we highlight approaches being taken by the Universities of Edinburgh, Leicester, and Kingston (London), to emphasise these aspects. Our approaches allow students to actively reflect on their learning and skills development as an integral part of their first-year experience. Each of our approaches has been developed independently but has a series of common features. Previous evidence suggests that students lack oversight and awareness of the vast number of skills they develop in higher education and the significance of these to their professional development.

Our innovative attempts are holistic programmatic approaches to learning and skills development and are delivered throughout the first year of each degree to support the transitional experience, as well as their personal development at this crucial stage of their education. The approaches for reflection are specifically designed to allow students to realise and recognise typical attributes associated not only with science programmes but also those skills that will support adaptive future career paths. All three institutions have allocated a substantive credit-bearing year-long portfolio element embedded into modules, where students can reflect on skills development. Common to all are informal diagnostic approaches including using technologies (e.g. Pebblepad) to capture and support success and allow us to formatively assess where intervention may be required. Each institution provides opportunities for students to actively engage, build evidence through various tasks, and articulate the skills developed.

The collaboration among the authors has also allowed us to learn about delivering reflective practice from different institutional perspectives. The differing demographics in our respective institutions allow for a case-study approach as we create case studies that can inform best practices in our and other institutions. Evaluations of our shared successes and challenges at each institution will be presented, along with recommendations for incorporating personalised approaches into the curriculum that support both individual and cohort successes through metacognitive and collaborative learning.
Day 1

Key words

Lifelong learning, Reflection, Personal development, Skills development
Embedding research within university curricula is now commonplace in many subject areas (O’Connor, 2017). In the mathematical sciences this change has been somewhat slower than for other disciplines (Russell et al, 2007), and the research activities are predominantly based on summer projects where students are directly engaged with research. For large cohorts of students, this is often impractical to implement. An alternative is to use published research papers and create structured student activities around these. However, mathematical subjects are more likely than other STEM disciplines to pinpoint cognitive difficulty as the principal reason for not exposing undergraduate students to research papers. Dietz 2009 notes that ‘even in the highest-level mathematics courses at undergraduate institutions, most students do not read mathematical research from professional journals.

We present a structured activity which engages first year students with recent research papers. This activity carries credit (15% of the module mark) and has been successfully running in the Department of Statistical Science at University College London for several years with between 250 and 400 students in each cohort. All students who take part are studying for a degree in mathematics, statistics, natural sciences, or a related subject and are registered for an introductory module in mathematical statistics.

The research papers chosen are authored by a member of academic staff in the department. No attempt is made to choose ‘easier’ or more applied research papers: they are deliberately challenging and students are told as much. Students work in randomly allocated groups with between five and seven of their peers, and each group is assigned a different research paper. Students are asked to read the paper and produce a one page summary of its content. To help with this, each group is permitted to interview its author – a member of staff in the department – for up to one hour. During this hour, students not only discuss the paper but also research in general: what does ‘research’ look like in mathematics, how does one get into research, where can research take us?

We will discuss the benefits of implementing such an activity on mathematical sciences degree courses – for staff as well as students – as well as the ‘cost’ of the activity in terms of staff time and administration. We will also consider students’ attitude toward the activity, the value of requiring students to tackle ‘hard’ activities so early in their university career, and the quality of the student summaries of the research as a measure of how much they understood of their allocated paper. Though the above case study relates to the mathematical sciences, there is no reason to suggest that such an activity, and our findings, won’t extend to other STEM disciplines.

Elinor Jones
Paul Northrop
Nicholas Grindle

University College London

elinor.jones@ucl.ac.uk

Undergraduate research, mathematics, assessment, active learning
Intermolecular forces (IMFs) are one of the abstract concepts in Chemistry. This concept is one of the most important topics to study because it underlies many other topics such as acid-base and colligative properties of solutions. Yet, most students find this topic hard to understand. Thus, educational games can be an effective learning tool to motivate students and enhance their engagement in the learning process. In this study, a card game (IMFs cards) was developed to enhance students’ understanding. Intermolecular forces in this study include London dispersion forces, induced-dipole dipole forces, dipole-dipole forces, and hydrogen bonding. The IMFs cards allow students to discuss the basic concepts of intermolecular forces in terms of definition, diagram of the forming interactions in microscopic, relative strength, and examples of molecules based on the steps of the game set.

One set of IMFs cards consists of 32 cards. The game was set to play in a pair. All students are arranged in pairs, then play against another pair. The game ended when the cards run out. Prior to the implementation of the initial trial, the IMFs cards were piloted to 8 senior chemistry education students who were at the end of their studies. The cards were then tested with 62 students (8 students in the initial trial and 54 students in the main trial) of the chemistry education study program who had taken basic chemistry courses. The pre-test was given to students before they play the game. Then, in the next two weeks, the post-test was administered. The average pre-test and post-test scores were 33.40 and 68.37 (out of 100) respectively. A statistically significant improvement was found in scores (p=0.001) which signified that the IMFs cards could help students to understand the topic. Those findings were supported by students' responses. After playing with the cards, students were asked to fill out the response questionnaire. The vast majority of students show a positive response to the card with 89.22 % (N=62) of them either agreeing or strongly agreeing with the statement of the questionnaire. This means the card has an attractive appearance, easy to play, enjoyable, and they found it a useful learning experience in differentiating the types of intermolecular forces.

Intermolecular forces, abstract concepts, cards-game, educational game
**Assessment (Wednesday 28th, 15.40)**

Authentic learning where students are required to develop mastery of realistic subject-specific tasks which demonstrate professional and transferable skills are a high priority for many university-level courses. Assessment of authentic learning can take many forms dependent on context, but what they aim to achieve is the same - an accurate assessment of the competencies of students against learning outcomes which are faithful to those needed within a real-world context.

Examinations as a mechanism of assessment are often retained within courses as an unavoidable necessity when dealing with large cohorts of students, but this assessment format can still place a high burden on staff in terms of marking within a short timeframe. This study investigated how data interpretation skills, a key authentic skill-set required by science students, can be assessed as part of an examination with questions turned into an auto-marked format utilising Inspera (an online assessment platform) in order to eliminate marking. A pilot end-of-module exam was carried out with a large cohort (247) of 2nd-year undergraduate Bioscience students, with the aim of more widely rolling out this assessment format to other modules as we begin teaching our transformed curriculum at University of Bath in 2023/24. Comparisons of student grades gained using this assessment format versus a more traditional essay-based examination format will be presented, as well as a review of student perceptions of their confidence and competencies of higher-level cognitive skills upon completion of the module when following this learning and assessment strategy.

Although the assessment format completely removed the need for staff time in terms of marking, devising authentic data interpretation questions using real or simulated data is of course a time-intensive task. When integrated as part of an authentic learning approach questions of this type, devised for both formative and summative assessment, can rapidly accumulate over time forming the basis of a question bank which can be re-used, adapted and shared between institutions. The principles used for this examination could be appropriate for any courses which have data to be interpreted.

**Key words**

Reduce marking, Authentic learning, Inspera, Data interpretation
What is known in literature about online exams in higher education in general, and in particular in Physics and Maths

When the Covid pandemic affected education, universities around the globe had to move not only their content delivery online, but also their assessments. Besides the fact that Covid caused significant upheaval in HE, this enforced experiment also afforded an opportunity to reflect on traditional, invigilated, closed book exams (ICBE) resulting in research and advice in this area. A systematic review of this academic and grey literature was performed concentrating on maths heavy physics examinations to investigate what guidance is given to exam writers, educators who prepare students for exams and HE examinees themselves.

The literature review results were divided into: Advice for examiners who need to provide an un-invigilated, open book exam (UOBE), discussions on cheating, advice for students and case studies. It was found that ICBEs were good at examining lower order cognitive skills, e.g. recall and understanding, but higher order skills, such as analysing and synthesising, are better examined with access to a larger range of resources. Guidance on making academic misconduct more difficult also suggested using higher order thinking skills in exam questions as responses to this type of tasks are more individual and getting outside help may be more difficult in a time constrained UOBE. Furthermore, literature encouraged reflection on the motivation for cheating and suggested that overly demanding assessment may encourage students to seek inappropriate help. The advice for students highlighted the need to prepare as thoroughly for a UOBE as they would for a traditional exam. Probably the thrust should change from pure memorization to students preparing their notes so that they can efficiently access their material to locate relevant parts for synthesis during a UOBE. Some of the case studies used statistical methods to investigate comparability of grades between UOBEs and ICBEs and some of the studies found them comparable, so a large shift of results may be due to other factors rather than the exam type. Other studies describe their approach and included stakeholder reflections.

The main recommendation to not use lower cognitive skills can pose a problem for maths heavy exams as they mainly assess how well an examinee has mastered these skills before building on them. However, it seems advisable to climb higher up Bloom’s taxonomy if at all possible. Also, it may be conceivable to break up exams into shorter sections that require individual uploading before access to the next part is granted to reduce the possibility of outside help. Furthermore, individualised maths type problems could be achievable by using different data sets for a question. Student advice should highlight the differences between UOBEs and ICBEs so that they can prepare appropriately.

Open book exam, closed book exam, physics, maths, exam preparation

Martin Braun
The Open University
martin.braun@open.ac.uk

Key words
Open book exam, closed book exam, physics, maths, exam preparation
Day 1

**Transitioning, Student Support and Academic Mentoring (Wednesday 28th, 15.40)**

**Accessible academic support: Are we barriers to student success?**

Student success is a key focus of Higher Education, defined by metrics such as progression, completion and award level. In fact, the associated outcomes of meeting learning objectives, acquiring relevant skills and competencies, student satisfaction and employability are arguably more impactful for students, based on features that are embedded within the delivery of a programme and its assessment strategies. A vast range of support strategies are utilised within and across programmes, faculties and universities to help students to meet these necessary criteria that will enhance their experience, skill set and chances of academic success. This study aimed to evaluate awareness, use and preferences for academic support in the Faculty of Health and Medical Sciences (FHMS) at the University of Surrey in order to determine whether current provision was recognised and relevant to the students and identify barriers to access of support.

Data collection consisted of an online questionnaire (MSForms) related to student perceptions of academic support, which was promoted via centralised routes of communication in each School in FHMS, such as email and on the University’s virtual learning environment. Demographic questions obtained details of age, gender, level of study and ethnicity and students were also asked if they had any health issues that affect their learning experience. Questionnaires were completed between November 2022 and January 2023. Responses were received from 221 students, with 219 valid completions of the questionnaire, from students representing all Schools. Responses were received from students across all levels of undergraduate study (Level 3 5%, Level 4 29%, Level 5 28%, Level 6 29%, Level 7 7%), with the majority (79%) of respondents reporting as female (male 18%, non-binary 2%).

Preliminary results demonstrated high to moderate awareness of academic support services (40%-95%) but reported use was notably lower (8%-43%). The most used sources of academic support were online formative tests (43%) and online discussion boards (41%), indicating greater uptake of more flexible and anonymous sources of support. Fewer than 20% of respondents had used lecturer appointments or consultation hours. In exploring reasons for not accessing support, the highest response was ‘I do not feel confident contacting staff for help’, reported by 36% of students and consistently at this level across all schools in the faculty. Preferences indicated a desire for subject-specific support (48%) along with formative online tests (44%) but also appointments with lecturers (39%) and personal tutors (37%). Identified support needs included academic writing (65%), understanding assessment criteria (57%), help with exam techniques (52%) and module content (48%), many of which would benefit from direct interactions with teaching staff, rather than the self-directed support offered online. The results demonstrate a need to break down barriers between students and staff and provide more personal, inclusive and accessible support that complements students’ use of remote support strategies.

Nicola Swann
Jennifer Oates
Charlotte McCarroll
Dynatra Subasinghe

University of Surrey

n.swann@surrey.ac.uk
Day 1

Key words

Inclusivity, Assessment, Academic Support
In the UK, universities and other higher education institutions have traditionally placed a high value on independence of thought, speech and practice. Research leaders have also customarily enjoyed a high degree of autonomy in how they lead their research groups and supervisors in how they supervise postgraduate students. However, in the twenty-first century, forces inside and outside higher education have greatly altered the context in which academic leaders operate. Marketisation, internationalisation, changing student expectations, new educational technologies and engagement through social media have had a significant impact on the relationship between supervisors and postgraduate students and on students’ expectations of the outcomes of their postgraduate experience.

AstrobiologyOU, a research group based at the Open University in the UK, was funded under the Research England Expanding Excellence in England programme from 2019–2023. The group brings together more than fifty colleagues – drawn from science, law, international development, commercialisation, education and engagement – who are working together to understand the scientific, governance and ethical challenges of addressing the fundamental question of ‘are we alone in the Universe?’ From the inception of AstrobiologyOU, its directors have aspired to lead collaboratively. This is a relatively uncommon leadership practice in academia and not one that organisations necessarily have the structures and policies to deal with.

Our research project therefore sought to understand perceptions of collaborative leadership and the impacts of this leadership model on post-graduate research students, the people who will become the next generation of research leaders. Through a series of semi-structured interviews with students, post-doctoral researchers, supervisors and researcher support colleagues, we examined perceptions of collaborative leadership and its impacts on postgraduate research students’ experiences. Then, using these data, we designed a series of scenarios that illustrated ways the University could enhance the experience of future postgraduate research students supervised collaboratively, which we examined in workshops.

Our results show that there are barriers to practising collaborative leadership. Students working with collaborating supervisors of different traditions and disciplinary expectations experienced challenges when negotiating institutional processes built on a model of working within a single discipline and institutional systems that are tuned to individual achievement. However, students considered that collaborative leadership supported productivity and personal development. It enhanced well-being and satisfaction and students’ sense of personal autonomy over their research. Importantly, students felt that the collaborative leadership model wasn’t just for the directors and senior colleagues but extended to them, enabling them to exercise leadership, whether in their own research, in roles assigned to them or in roles they had identified for themselves. In other words, it enabled them to take the first steps in the transition to becoming research leaders.
Key words

Collaborative leadership, postgraduate students, research leaders
Who are our students? Their learning journeys, in 400 words.

Progression and attainment of atypical students (e.g. mature, first-in-family, commuters), is a concern within higher education. Many non-standard students may have had unusual educational histories and experiences, resulting in specific self-perceptions as learners (e.g. imposter syndrome), with the potential to negatively affect their attainment in higher education (Parkman, 2016). While student-teacher relationships impact on student learning (Räisänen et al, 2016), and how students are taught helps them develop their independence as thinkers (Karagiannopoulou, 2010; Entwhistle & Smith, 2002), self-perceptions of capabilities as learners, based on prior educational experiences, could limit this. This project aimed to capture students' educational experiences to date, as well as their self-perceptions as learners, and their expectations and experiences of university in relation to their learning.

The project used a story-telling approach with a 400-word limit allowing students to describe their own learning journeys, similar to the approach taken by Hospice UK (www.hospiceuk.org/share-your-story) and more recently the Covid Chronicles by Radio 4 (https://www.bbc.co.uk/programmes/p08bq910).

The project, which had ethics approval, used both online and face-to-face data collection methods to maximise participation. It included a short questionnaire with three sections. One collected basic demographic information (e.g. qualifications on entry, first-in-family status, commuter status, age). The second section asked participants to rate their sense of educational self-efficacy using the educational self-efficacy tool adapted from the Harvard-Panorama Student Perception Survey scale Imperial College London (Gehlback, 2015). The final section assessed sense of belonging to the university by collating levels of agreement with a series of statements about belonging using a five point Likert rating scale (Ahn, 2017; Yorke, 2016). Participants were also asked to identify themselves as learners in three words. Finally, they were asked to describe their learning journeys in up to 400 words, online, on paper or audio-recorded and transcribed.

The project, which is ongoing, has collected data from over 50 undergraduate students to date. Quantitative data will be collated, coded and statistically analysed to identify the possible impact of demographic characteristics on educational self-efficacy and belonging scores. Qualitative data will be collated, and broad thematic analysis carried out. This project empowers students by sharing their experiences, acts as testament to the diversity of the student body and will help staff understand the range of prior educational experiences contributing to the self-identity and self-efficacy of our learners.

Key words

Educational self-efficacy, atypical learners, experience, belonging
Lab-work guide for determining the reaction rate and reaction order based on the colorimeter® application.

The lab-work activities are compulsory in chemistry course. This activity allows students to apply their knowledge and theories that have been learned. However, during the covid-19 pandemic, the lab-work should be done through blended learning. Therefore, the current lab-work guide should be modified to facilitate students directly in the blended lab-work activities. Developing the lab-work guide within the pandemic is the focus of the study. Therefore, the purpose of this study is to determine the feasibility of the lab-work guide for Determining Reaction Rate and Reaction Order Based on the Colorimeter® Application based on expert judgement and students’ response. The Colorimeter® Application utilised as photodetector in measurements of transmittance where the light can be measured based on its composition of primary colour intensity, namely, red (R), green (G), and blue (B) and the R, G, B measured values of the samples should be divided by the blank values. Then, the absorbance can be readily calculated using \( A = \log(1/T) \). From the absorbance value of the dye solution at the time of colouring variation could measure the final concentration of the dye solution through a straight line equation between the absorbance value and the colouring time. Thus, with the final concentration and time variation, it can easily determine the reaction order and reaction rate in the process of dyeing cotton yarn with Indigofera tinctorial L. Guided inquiry model is an inquiry-based learning model that involves the student actively participating and exploring, and taking a role as a scientist who seeks or solves a problem. Hence, the lab-work guide designed using guided inquiry model expected to aid the students in enhancing their creativity and scientific attitude in conducting experiments. This study employs a research and development (R&D) using 4D (Four-D) model, starting from define, design, develop, and dissemination stages. This research is limited to the development stage. The subject of this study was a lab-work guide which was tested on 6 students in the initial trial and 20 students of Chemistry Education Faculty of Teacher Training and Education (FKIP) Universitas Tanjungpura in the main trial. Data collection tools used are the feasibility assessment sheets and students’ response questionnaire. The results of the experts’ judgement using the Gregory test category closeness model indicate a very feasible with the validity value of 1.00 which in a very high level in terms of the feasibility of the content, language, and graphics. The result of the initial trial and main trial obtained an average percentage of 91% and 94% respectively with very good criteria. The results of this study imply that the developed lab-work guide is suitable to use in the lab-work activities. In addition, the lab-work guide has an attractive appearance and can be used in lab-work activities to support students' understanding of reaction rates' concepts.

Key Words:
Lab-work, reaction rate, colorimeter application, guided inquiry, university students

Azwa Fadilla Wafiq
Husna Amalya Melati
Erlina Erlina
Risya Sasri

Universitas Tanjungpura

azwafadillawafiq@gmail.com
In the biomedical sciences, it is critical that students consider the wider context in which knowledge has been built, to support them to identify and address long-held biases in biomedical research and healthcare. To address this, we have been working in partnership with undergraduate students to identify opportunities to decolonise and diversify teaching material. The findings have been captured in an “Emerging Themes” document, which has helped to create a dialogue between staff and students and shape changes within teaching content.

To complement this work, we undertook surveys and focus groups with students and teaching staff to understand attitudes towards decolonisation and diversification. Results revealed that both staff (n=71) and students (n=121) felt decolonising the curriculum was important, but this was more important to female respondents (p<0.001). The survey also revealed that students from minority ethnic groups felt less represented by the curriculum than white students (p<0.001), highlighting the need to develop a curriculum that is inclusive and representative for all students.

Qualitative data were distilled into three main themes, forming the 3Rs Framework: Rediscovery, Representation, Readiness. We propose that this framework could guide future work to decolonise and diversify the curriculum, in the biomedical sciences and beyond. We are now working with an animation company to make a video to disseminate this work to a broader audience. We plan to repeat both the surveys and focus groups after an interval of one year to monitor changes in attitudes as we refine our curricula.

Alice Robson
Bronwen Burton
Caroline McKinnon
Zafar Bashir
Amy Mosley
Lydia Miles

University of Bristol

a.robson@bristol.ac.uk

Key words
Decolonising, Diversifying, Inclusion, Equality
Evaluating the benefits of virtual laboratory simulations for Biomolecular Science students

Introduction: A key component of Biomolecular Science degrees is to support students’ learning of how to plan and perform a range of scientific techniques. Due to time, cost, and safety constraints, giving students hands-on experience with every practical technique is not always possible. To provide students with a well-rounded education we have introduced virtual lab simulations from Labster™ to supplement in-person classes.

Methods: First-year Biomolecular Science students at the University of Strathclyde attended an in-person practical laboratory class where they learnt the basic principles of an enzyme-linked immunosorbent assay (ELISA). Following this, students were encouraged to complete a Labster™ simulation about ELISAs. Elements of the lab class and the optional material in Labster™ were assessed by short answer questions (SAQ). In this study, the results of the students who completed the virtual simulation were compared to the students who did not.

Results/Discussion: In a class of 158 students, only 70 students (44%) fully completed the ELISA simulation. Of this, 91% (64 students) of students reported that they gained knowledge by completing the simulation. Students who engaged with the optional material achieved significantly (p=0.004, Students t-test) higher grades (median grade 64.5%) than the students who did not engage (60%) when assessed by SAQ. Interestingly, students who completed the simulations also receives significantly higher grades in unrelated pieces of assessment.

Conclusion: By completing virtual laboratory simulations, students reported increased knowledge about the technique and attained higher grades for related assessments. When properly integrated into the curriculum Labster™ could be a useful teaching tool but it remains a challenge to encourage students to engage with the additional guided material.

Key words

Virtual laboratory, Simulation, ELISA, Biomolecular Science

Shaun Bremner
University of Strathclyde
shaun.bremner@strath.ac.uk
Laboratory skills are fundamental to many careers that lead on from a range of science based undergraduate degrees and are particularly relevant to Biomedical Science degrees when preparing students for graduate employment. Therefore, it is important that the practical curriculum is employer-informed and that current approaches are evaluated in how successfully they develop students' practical skills, and that students are confident in their abilities. This study aimed to compare staff and students' perceptions of practical skills development in laboratory sessions across Biomedical Science degrees at the University of Lincoln, UK, and investigate how the delivery of practical laboratory sessions could further support skills development with regard to different individuals learning styles. Staff and student participants were surveyed using online questionnaires. 13 staff involved in teaching practical classes and 54 students from levels 4-7 (encompassing the BSc Biomedical Science course with or without Science Foundation Year, and the MBio Biomedical Science course; all IBMS accredited) completed the survey. Staff and students' perceptions were then compared using both a range of statistical approaches and by theme. Student confidence was seen to increase throughout the course, with students' confidence across all levels at the time of the survey significantly increased compared to their perceived confidence at the start of the course (Z score =5.19, P<0.001). Surveyed staff felt that students purely focused on results rather than laboratory techniques during practical sessions, whereas the students gave a more varied response with 63% focusing on results and 37% focusing on technique (X²=62, P<0.001). Both staff and students believed that direct practical assessments facilitate practical skills development more than indirect practical assessments and that the desired practical skills development would benefit from more direct practical assessments (P=0.23-0.94). When comparing the features of practical sessions that best develop students' practical skills, student participants valued help from staff the most, whereas staff participants rated undertaking relevant pre-work more highly. Additionally, 83% of students agreed or strongly agreed that their practical skills would have benefited from additional opportunities to practice skills in the first year, with basic laboratory skills practice being a key theme brought up across all levels, including students whose practical experience has been impacted by the COVID-19 pandemic and associated national lockdowns. Overall, this study found both similarities and differences in staff and student perceptions of how best to support practical skills development. There are a range of reasons for these differences, including staff perceiving the laboratory training provided by schools to be inadequate and pre-conceptions related to student learning styles. Investigating these differences could help enhance student laboratory skill confidence and future graduate employment.

Andrea Brader
Claire Walker
Beatrix Fahnert
Matthew Simmonds
University of Lincoln

25021057@students.lincoln.ac.uk

Key words
Practical skills, Laboratory skills, Students, Staff, Biomedical Science
Embedding Societal Impact into Engineering Education

Karin Ennser
Gabrielle Orbaek White
Swansea University

k.ennser@swansea.ac.uk

Key words
Authentic Assessment, Design Study Case, Societal impact of engineering activity, Teamwork

The Engineering Council has recently published the new version of Accreditation of Higher Education Programmes (AHEP version 4) with greater emphasis on societal impact of engineering activity. Engineers are expected to operate in a responsible way and ethical manner, recognise the importance of diversity and help ensure that the benefits of innovation and progress are shared equitably and do not compromise the natural environment or deplete natural resources to the detriment of future generations. The learning outcomes have a sharper focus on inclusive design and innovation.

This poster presents the design and implementation of a summative assessment for the master-level course on telecommunications. The course teaches optical fibre communications and enabling technologies. One of the learning outcomes is to acquire and apply knowledge and design transmission systems while considering the societal impact of engineering practice.

The assignment consists of a group design case study based on a real story of a recently installed submarine optical cable that brought high-speed internet connectivity to isolated areas. The students were asked to consider remote Pacific Islands with limited internet connectivity and design a high-capacity submarine optical fibre communication system to link them. The assessment outcomes came with some surprises and will be shared at the conference.

References

Authentic Assessment, Design Study Case, Societal impact of engineering activity, Teamwork
What do employers need their graduates to know about achieving a Nature Positive future in the environmental sectors?

Increasingly universities, like many sectors are being challenged to establish a strategy to achieve carbon zero by 2030. A major criterion becoming more and more prevalent in both Higher Education subject benchmarks and by societal demands, is enabling graduates to meet the needs of their future employers in terms of environmental sustainability and related competencies. This is particularly critical in the ecological and environmental sectors where the roles of graduate are specifically to create the environmental management plans to deliver Biodiversity and Environmental Net Gain and a Nature Positive future. Indeed, the role of the ecological consultant or the conservation biologists may have once been to prevent the loss of biodiversity and protect precious and declining habitats and species. Now, more ambitious and urgent legislation charges landscape managers and developers to not only prevent loss, but to commit to enhancing nature and the benefits this brings in achieving biodiversity gain and Net 0 Carbon targets. Ecologists and environmental leaders are at the heart of delivering these targets. This poster explores specifically what employers need their graduates to know about achieving this environmental sustainability within the environmental sectors.

The aim was to engage ecological and environmental managers in effecting ideally a ‘nature positive’ future by exploring prerequisites for the next generation’s ecology workforce. Information was gathered during a Chartered Institute for Ecology and Environmental Managers (CIEEM) Autumn 2022 conference workshop which surveyed participants on five key areas of next generation skills and knowledge requirements; policy and legislation knowledge, technical skills and knowledge and transferable skills. We present the findings of this workshop and highlight the most desirable and essential attributes required by ecology and environmental graduates to not only gain employability within the sector, but drive the sectors responsibility for delivering a Nature Positive future. With both the increasing demand for Green Skills jobs and the imperative need to evolve into a more sustainable future, aligning graduate skills with employer requirements within this particular sector has never been more critical.

Elizabeth Lakin
Laura Roberts
Swansea University
l.j.roberts@swansea.ac.uk

Key words
Environmental sector, Biodiversity Net Gain, Sustainability, Graduate Green Jobs
Revolutionizing Medical Science Education: Digital Pathology

Traditional pathology education relied on glass slides and light microscopes. However, the introduction of digital pathology has replaced this approach, offering students an opportunity to learn in a more interactive and comprehensive manner. The purpose of this poster is to discuss the benefits of digital pathology in medical science education as seen in Bangor University.

Digital pathology provides a comprehensive platform for visualizing disease pathology. Students can now study high-resolution digital images of blood films and pathological tissue sections, which have been previously captured, digitized, and archived. The images can be accessed remotely, and students can collaborate, view, and manipulate the images at any time. This approach has eliminated the need for physical slides, thereby reducing the constraints of working in a classroom and has encouraged collaboration and discussion, which fosters a deeper understanding of disease pathology. Furthermore, the use of digital pathology has improved the quality of student work, as it allows for more accurate and precise interpretation of diagnostic results.

Digital pathology is an excellent way to prepare students for the real world. The technology is being used in many laboratories worldwide, and students who have experience with it are highly sought after by employers. Thus, by using digital pathology in their coursework, students are equipped with the skills needed to excel in their future careers.

Dylan Jones
Bethan Davies-Jones

Bangor University

Dylan.jones@bangor.ac.uk

Key words
Digital pathology, Virtual Microscopy, Virtual Laboratory, Digital Skills, Employability Skills
Active learning approaches in Electronics for Engineering Foundation Year

Widening access in higher education is one of the key policy objectives across United Kingdom. The opportunity to undertake a foundation year support this aim. Students who may not meet the standard requirements for entry into university can spend one year developing the academic and soft skills needed to succeed in higher education. The typical entry level of engineering foundation year cohort consists of the students with Business and Technology Education Council (BTEC) diploma, insufficient A-levels in Science/Maths, relevant professional experience, and mature students. There is a broader spectrum of learning abilities and backgrounds that requires a course embracing different teaching and learning methods and approaches. The engineering foundation year cohort has over 200 students from different disciplines in engineering, which makes practical activities challenging to deliver.

This poster presents the pedagogy approaches undertaken to incorporate electronics laboratory sessions for a large cohort of students. The activities include the introduction to basic electronic circuits, design concepts and their applications, and associated assignments to assess the students' learning.

Roby Karan
Karin Ennser
Zaid Haymoor
Timothy Davies

Swansea University

k.ennser@swansea.ac.uk

Key words

Active learning, Laboratory work, Assessment
Building community and self-confidence through mentoring between PGTs and Post-docs

Taught Master students face specific challenges compared to undergraduate or post-graduate research students. They are out of the undergraduate community and almost professionals, but not imbedded in the research community.

Post-docs are a highly skilled and motivated community in the school, with limited time to engage with students, but often willing to expand their teaching and mentoring experience.

As Acting Deputy head of the new MSc Bioinformatics of the Faculty of Life Sciences, Celine Petitjean was particularly interested in supporting our PGT students in building their self-confidence, professional networking skills, and engage with their local community, i.e., school of Biological Sciences.

During the first year of the new taught MSc in Bioinformatics of the Faculty of Life Sciences, a mentoring scheme trial was started, pairing MSc Bioinformatics students with a post-doc of the school. The scheme has some good feedback although no impact study was implemented. Since then, Manisha Koneru, PGR in the School of Biology has been conducting a literature review on the topic of mentoring in academia, with a focus on post-graduate communities and the impact evaluation of mentoring. Her work is funded on a pedagogical grant from the School of Biological Sciences.

In the near future, the goal will be to use the results of the literature review to evaluate the impact of a revived mentoring scheme between MSc Bioinformatics students and post-docs.

A long-time goal of this project will be to expand this mentoring scheme to other post-graduate programs.

The aims for such a project are, for the mentees, to learn from their mentors, expand their network, improve their self-advocacy and self-confidence, for the mentors, the opportunity for teaching and mentoring experience, training on the University’s support structure and mentoring. For all, to create and increase a sense of community between them and in the school and improve self-advocacy and well-being. This project fits particularly well in the theme of Building communities inside and between both students and post-docs communities, as well as nurturing the feeling of belonging with their direct professional environment.

This presentation will cover the original idea and mentoring scheme, the key findings of the literature review conducted, and the plans for a new mentoring scheme, including its formal impact study.

Key words

Mentoring, Postgraduates, Postdoc, Community, Self-confidence
An Open University (OU), third year, interdisciplinary sensory neuroscience module (called SD329 Signals and Perceptions) is a compulsory module in the OU Health Sciences qualification and an option for other OU qualifications. 300-400 students study the module each year. The module is worth 30 credits (of 360 for an OU degree) and requires around 300 hours' worth of study hours. It is conceptually complex and the assessment strategy in the past focused heavily on assessing acquisition of, and application of knowledge. In earlier presentations of the module, there were three formative assessment points and a final module exam. The module result depended entirely on the exam performance.

With this assessment strategy, retention and pass rates were poor (62% and 50% respectively in 2017). In order to address this, the assessment strategy was revamped from 2020 onwards. The two main changes were that all assessment results now count towards the final grade. In addition, the end of module exam was replaced with a synoptic assignment which students had 6 weeks to complete. These changes resulted in a completion rate of 80% and a module pass rate of 78% for the 2020-2021 academic year, and this has largely been maintained in subsequent presentations. Data was evaluated across different demographics using sector and government norms. The completion and pass rates for students with a declared disability increased. A similar improvement in completion and pass rates was seen in students with a declared mental health condition. The completion and pass rates for Black students also increased, reaching similar levels to White students. A similar trend was seen when comparing White with Black, Asian and Ethnic minority students.

Changing an assessment strategy that allows all assessed work to count towards the final module grade and replacing the exam, improved student retention and pass rate on this third year module. These improvements were also seen when different demographic categories were evaluated.

Assessment, exam, pass rate, retention
Education based capstone projects in Bioscience degree programmes: Creating accessible STEM activities using the UDL framework for those that require additional support for learning.

Background: The Scottish education system has an inclusive ethos which recognizes diversity and allows for all learners to appreciate and recognize differences which will result in a more inclusive society (Scottish Universities Inclusion Group, 2022). The Universal Design for Learning (UDL) framework is an inclusive learning approach used to reduce barriers faced by those that require additional support for learning (ASL) in the classroom. The framework has been argued to attract those requiring ASL to science, technology, engineering, and mathematics (STEM) and ensure their success in these subjects (Griffiths, 2021). The aim of the current study was to create an inclusive STEM lesson with accessible activities for those that require ASL using the UDL framework.

Methods: Critical appraisal of current literature was completed using a PRISMA search to design a UDL-based STEM lesson and to identify data to analyze the effectiveness of these lessons for those requiring ASL. The lesson was delivered to students from the Queen Margaret Academy Supported Learning Centre. The study included a cohort of 5 groups with an average of 6 people from S1-S4 year groups, all with varying ASNs. The students were supported through a series of activities which were developed based on the three UDL principles - providing multiple means of engagement, action and expression and representation.

Results: Critical analysis of the investigations carried out by Knight et al. (2013), King-sears et al. (2015) and Root et al. (2019) also showed that UDL-based STEM lessons are effective for those that require ASL as they found a clear increase in student academic performance using the UDL framework. No formal assessment used to measure the efficacy of the framework in the current study however, student engagement was self-monitored and closely observed. Overall, the UDL-based lesson positively influenced engagement. A feedback survey completed by teachers also suggested the UDL-based STEM lesson was accessible and inclusive to the cohort.

Conclusions and implications: Overall, the current investigation at QMA demonstrated that the UDL-based lesson provided accessibility and positively influenced the cohort's engagement, however, it would be useful to gain quantitative empirical data to analyze the impact of the UDL framework on their academic performance. This will form the basis of future work.

References:

Key words

Inclusive STEM Education, Universal Design for Learning (UDL), Additional support for learning (ASL)
Can Globalising Higher Education Curriculum Promote Inclusion?

Habiba Akter
Queen Mary University of London

This poster reflects the globalisation of the curriculum that helps promote Equality, Diversity and Inclusion in higher education in UK universities. According to HESA (Universities UK-International Facts and Figures, 2022), 22% of the total students in 2020-2021 were international which is even growing higher in the post-pandemic era. The globalisation of teaching materials can make the learning experience better for the students while promoting inclusivity. To do so, starting with doing detailed background research on international curricula, we will require a true picture of the education systems of different countries to be considered. The main obstacle would be the difficulty to come up with a “best” approach that would potentially allow us to offer a global curriculum specially in Science, Technology, Engineering and Maths (STEM) since the knowledge and implementation of STEM can be manifold, with even the possible impact of culture. However, finding an optimal solution is not impossible provided that we can evaluate the importance of the factors that we will consider while making the curriculum of any course a global one. Moreover, a close look at global job opportunities can also play an important role here. A dataset can be collected from different courses in STEM that will give us an idea about how any proposed change impacts teaching and assessment and most importantly if that is giving the students the assurance of feeling “included”.

Key words

Global Curriculum, Inclusion, Teaching and Assessment
Gendered information landscapes and their impact on routes into and through apprenticeships

Maria Cecil
Edinburgh Napier University

This poster outlines a recent research study which examined the information landscapes of young people (age 15 – 24) in Scotland in the context of gender, vocational choice, and career development. The research context is Skills Development Scotland (SDS) who are Scotland’s national skills agency. This study involved an exploration of extant literature on the subject of gender imbalance in STEM careers and a critique of a myriad of relevant theories on information landscapes (Lievrouw 2001: Lloyd & Wilkinson, 2019: Chen, 2021), gender identity and stereotyping (Brown & Stone, 2016: Siyanova-Chanturia, et al., 2015), and self-efficacy and possible selves (Bandura, 1997: Markus & Nurius, 1986).

The primary purpose of the research as outlined in the poster was to understand how gendered information landscapes may impact on the decision-making process of various groups of young people in relation to their career choices, particularly relating to apprenticeships and work-based learning, and how they may impact on gender balance in crucial sectors within STEM. The aims were to understand how information landscapes are formed, to identify different sources of information, and to explore how these information sources may embody and reinforce gender stereotypes.

Qualitative research methods used for data collection in the form of two focus groups and two interviews with a total of 12 careers guidance practitioners employed by SDS. These were carried out to ascertain the expert views of careers professionals on the topic. These focus groups/interviews were carried out over a 2-week period in February 2022, and were conducted, recorded, and transcribed via Microsoft Teams.

The main finding of this study was that whilst young people obtain information from a myriad of different sources, careers practitioners thought that people were the most influential source in regard to career decision making, and that stakeholders such as parents, teachers, and peers had a significant impact on the development of young people’s gendered information landscapes.

Although most participants alluded to the belief that parents, teachers, training providers and employers all had an impact on career choice and gender segregation, the extent of this impact was unclear. I believe it would benefit future research to include these stakeholder groups in the data collection process, to gain a more robust understanding of their role in the context of young people's gendered information landscapes. Perhaps using a more quantitative method such as a survey would be a good way to facilitate this.

Key words
Apprenticeships, Work Based Learning, STEM, Gender balance, Occupational segregation, Equality
Imersifi is a virtual reality software studio, specialising in embedded learning in VR integrated with physics-based interactions and simulations.

The talk will cover the latest XR trends, best practices for VR in higher education and an introduction to research in the field. The talk will also dive into an application ‘Aerospace Spatial Awareness’ which is deployed at Swansea University and used for formal assessment.

Joe:
Placing importance on user-centric instructional design and leveraging my passion for cutting-edge technology, I am skilled at creating engaging, immersive learning experiences that improve employee/student skills and productivity. With experience working with cross-functional teams and stakeholders to align VR initiatives with business goals and objectives, I am bring my skills and experience to new opportunities and continue driving the use of VR for learning and development in forward-thinking organisations.

Jack:
I believe that VR offers limitless potential for enhancing the way we learn and develop new skills. Whether you’re a student, professional, or just looking to explore the new reality, I can help you tap into this exciting technology and take your training to the next level. Working with clients to design and deliver customized VR training scenarios tailored to their specific needs, the programmes boast high levels of engagement and knowledge transfer. My expertise covers a range of VR platforms and development, from interactive multiplayer simulations and linear scenario training to immersive environments and experiential learning.
Active Learning (Thursday 29th, 10.00)

Making workshops work

I evaluate and compare the relative merits of different approaches to workshop teaching in STEM subjects, drawing in particular on the experience of teaching introductory mathematics for physics students, and coordinating workshop activity in other physics modules. Workshops have been an integral feature of the Level 1 undergraduate physics programme at Swansea University since their introduction in 2017. Many different approaches to this type of teaching have been tried and tested, partly in response to constraints imposed by the Covid-19 pandemic, but also in response to student feedback, academic outcomes, student engagement, and pressures on staff workload. As we embark on a wider curriculum review which (inter alia) may include the provision of workshop teaching at higher levels, and as we also respond to updated requirements for accreditation from the Institute of Physics, it is timely to reflect on the most effective approaches to workshop teaching.

Timothy Burns
Swansea University
t.burns@swansea.ac.uk

Key words

Workshops, Active Learning, Technology-enhanced learning
The Gamification of Learning in a Medical Science curriculum

Dylan Jones

Bangor University
dylan.jones@bangor.ac.uk

Gamification is the process of using game mechanics and design elements in non-game contexts to engage and motivate learners. In a medical science curriculum, gamification can be a powerful tool to enhance student engagement, motivation, and retention of complex information. By transforming learning into an enjoyable and interactive experience, students can experience a greater sense of accomplishment, develop problem-solving skills, and increase their level of participation. Gamification in scientific education can also foster a spirit of healthy competition, allow for immediate feedback, and increase student autonomy. The use of game elements in the classroom has the potential to improve student outcomes and provide an immersive and effective learning experience.

As part of this discussion, I will reflect on the impact of incorporating game-elements into student assessment for second year medical science undergraduate students and the positive impact that these elements have had on student engagement and attainment. Second-year medical science undergraduate students are often faced with complex and challenging coursework that can be difficult to grasp and require the drawing together of concepts taught across different modules and years of study.

The coursework in question involves students attempting to diagnose a patient by role-playing as members of the clinical multidisciplinary team and engaging with a role-played patient. As part of this assessment they are expected to carry out a clinical history, request diagnostic interventions and suggest treatment plans which they then present to the class. Whilst this practice is long established in medical programmes it’s use in non-clinical medical science/biomedical science degrees is not as common and poorly described within the literature. The impact of the assessment style on students demonstrates a significant positive impact with students on average attaining high first class marks compared to other module assessment averages of 2:2 as well as being a constant source of positive student feedback.

Gamification, Group work, Assessment, Positive engagement, Transferable skills, Active learning

Key words
Assisting Transition and Promoting Active Learning: A Case Study of a First-year Engineering Module

Yue Chen
Queen Mary University London

yue.chen@qmul.ac.uk

Technical modules, especially those with engineering elements are often challenging for first-year undergraduate students as these modules cover complex concepts, theories and require students to be able to apply the knowledge and skills to solve real-world engineering problems. This case study presents an effective curriculum, pedagogy, and assessment design of a first-year engineering module. The approach aims to promote active learning while assisting the transition to university. Key elements of this approach include pre-lecture tasks, in-class activities, group and individual lab assignments, and peer assessment. The pre-lecture tasks are carefully designed light-weighted activities that students can attempt before attending lectures. The tasks typically require students to observe some engineering phenomenon or conduct a small experiment with readily available tools, in order to arise their curiosity on ‘why is this happening?’. The content of the lecture then reveals the underpinning theories/principles of the relevant engineering problem. This frees students from a list of pre-reading text which could be overwhelming for first-years and links the complex concepts/theories with real-word engineering applications.

The in-class activities are designed for ‘learning by doing’. They make the learning fun and student-centred as students can test their understanding and see the feedback straight away. By dividing long lecture sessions into smaller chunks through this active learning technique has also helped to enhance engagement and focus among students.

Conventional individual labs which are often seen in this type of engineering module have been redesigned to include both group and individual assignments. The group assignment adopts inquiry-based learning, which promotes active learning and allows students to ask questions, explore topics and develop their understanding through investigation and research. The collaborative nature of the group assignment helps to alleviate the anxiety that individuals may feel when tackling challenging technical subjects on their own. Learning in a team helps to build up first-year students’ confidence, providing a solid foundation for subsequent individual lab work.

Peer assessment is adopted to encourage students to take an active role in their learning. The process of applying given marking criteria to assess peer students’ work promotes self-reflection and critical thinking, which are essential skills for effective learning.

This approach, with a mix of the above elements, has been well received by a first-year class of 60 students. The case study also presents reflections based on module evaluation, student attainment statistics and feedback from students on what has worked well and what could be further improved.

Active learning, Transition, Inquiry-based learning, Peer assessment
Equality, Diversity and Inclusion (Thursday 29th, 10.00)

**Women into Tech:**
understanding barriers, making connections

Computing and technology need a better gender balance. BCS report that, in 2021, only 22% of all IT specialists in the UK were women and their median hourly pay was 13% less than male employees. Further, according to HESA data, only 21% of students in UK universities’ computing departments were female in 2020-21. As the digital technology sector underpins a huge amount of our lives, it is vital that women are well-represented throughout, both to design appropriate products and systems and to empower women, socially and economically. This project aimed to support women apprentices and students in tech subjects, along with women professionals in digital technology roles, to encourage them to progress their careers in tech.

A scoping study, involving women students and apprentices via an online survey and focus groups, plus “influencers” via webinars, identified barriers to women and girls choosing to study computing and pursue careers in technology. The main barriers were lack of awareness of digital jobs; predominantly male environments; and lack of access and support in some schools. The project addressed these via collecting and publishing case studies of women in tech, illustrating the diversity of roles and routes in; skills workshops; and events to bring women together, supporting awareness-raising and peer-mentoring (Connect-Ups); plus, a CPD course to support women’s leadership skills.

The project was based in two local partnerships, each centring on a university, to compare outcomes across contexts. However, as the implementation took place online (mostly due to covid restrictions), geographical differences were minimised. Meanwhile, partnerships with two established non-profit organisations working in the same area enabled the project to include skills workshops for students and also to benefit from relevant networks to recruit participants and disseminate outputs.

Over a hundred women were involved across the project and evaluation was largely positive. For example, through the Connect-Ups, women (especially students) gained confidence and enthusiasm from meeting both their peers and women who were establishing and enjoying technology careers; they specifically valued discussions around inclusion and sustainability in the digital sector as part of these events. A final evaluation survey asked about the impact of the project and also what actions women felt would help them to thrive in the tech sector in the near future. Respondents valued meeting other women in the sector in this context; they identified that mentoring, networking, and targeted skills training would help them to thrive.

We’re keen to encourage further take-up of the project activities and resource and have established the Women into Tech blog. This currently hosts the case study profiles and the materials needed for groups to organise and facilitate three Connect-Ups, plus news and events to support our growing network of students, apprentices, and women working in tech.

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Ella Taylor-Smith
Sally Smith
Carron Shankland
Mario Kolberg

Edinburgh Napier University
University of Stirling

e.taylor-smith@napier.ac.uk
Day 2

Women into Tech blog: https://blogs.napier.ac.uk/womenintotech/

Key words

Gender, mentoring, women
How much do we really know about what our students enjoy in their learning? Do students feel they should enjoy education? Positive and negative emotions are known to impact learning and also play a role in the choices that students make before, during and after their degrees. Enjoyment has a big, but often overlooked, role in Education.

In this research, we explore the role and impact of enjoyment in Life Sciences, including whether enjoyment of a subject influences students’ academic decision making (for example module choices), how enjoyment impacts learning, and what barriers to enjoyment exist. Through a series of interviews with staff and final year students in the Department of Life Sciences at Imperial College London, we explore some of these questions from both and staff and student perspective.

Initial findings identify some mismatch between staff and student perspectives and highlight the role of societal pressures in inhibiting student enjoyment of their degree and education. Findings also indicate a key role for pedagogical relationships, for both teaching staff and students. The presence of and space to develop such relationships can enhance enjoyment, while barriers to developing pedagogical relationships seemed to reduce enjoyment. The research also highlights the role and importance of staff enjoyment of teaching which is often overlooked and supports the existence of feedback loops between staff and student enjoyment.

This research and particular focus on enjoyment allows us to better understand the whole student experience, and has implications for better supporting students through teaching, pastoral support and other areas. Whilst conducted in a Life Sciences context at Imperial College London, this research suggests that a focus on enjoyment could enhance the staff and student experience in other contexts.

Enjoyment, Pedagogical relationships, Biosciences Education
As educators, we are aware of the multiple transition periods that our students experience throughout their time here with us. Although all transitions can impact students it is clear that a successful transition into higher education can be fundamental to a student’s ultimate success at university. Moving from secondary education to university can be a stressful time where students experience multiple stressors including the need to meet and make new friendship groups. During this first transition, developing a sense of belonging with peers, staff and the institution is crucial and, if successful, can provide academic benefits, increased retention, the development of learning communities and wellbeing benefits. In October 2022 we introduced a new residential field course into our degree programme, this not only included key biological skills training but a strong focus on community building. Since the field course, we have been following our current year 1 cohort to understand and explore exploring whether attending a residential field trip at the start of a degree programme influences their sense of belonging at university. Preliminary analysis of our survey, focus groups and one-to-one interviews data has identified four themes where students found the field course to be impactful, these include 1) the importance of building social relationships and connections between students; 2) the removal of barriers in education; 3) creating a meaningful study environment and 4) a perceived level of care and respect by the School. Within this talk, I will outline how we developed the trip to focus on creating a strong sense of belonging, summarise the first emerging thoughts of our students and outline how we will continue to assess the experience of students in the future.

Emily Bell
Celine Petitjean
Rose Murray

University of Bristol

emilly.bell@bristol.ac.uk

Key words

Transitions, Wellbeing, Sense of belonging, Skills training, Field trip
Laboratory, field and practical work (Thursday 29th, 10.00)

Do students still want overseas field courses?

The importance of field courses to embed learning, motivate students and develop key employability skills is well established. Field courses taking place overseas and in novel environments can be an important recruitment tool and may have the benefit of introducing students to a range of field techniques not available in the UK. Students may also experience greater learning gains following an overseas field course, and this experience may also enthuse and inspire them in their learning. International field courses tend to be optional but, as they often require a financial contribution from the student, may be considered less inclusive. Overseas field courses may also fail to equip students for working in the UK, leaving gaps in species identification and habitat recognition that may be key for future employment in the geography, biology and ecology sector.

For educators, challenges in running UK-based field courses, such as staff time, health and safety policy and ensuring inclusivity, are increased for overseas field courses. Additionally, in the few years during which field courses have been suspended due to Covid, awareness of the environmental costs of overseas field courses is more apparent among both staff and students. These factors raise a number of questions for us. Do students still want overseas field courses? Should we as educators still be promoting overseas travel? Do UK and overseas field courses offer equitable academic and transferable skills? Is there value in promoting overseas field courses or should we be looking closer to home?

Wendy Harris
Swansea University
w.e.harris@swansea.ac.uk

Key words
Overseas field course, Climate and environment, Employability
Live fieldwork broadcast - a student co-production partnership

Janine Maddison
Newcastle University

j.l.maddison2@newcastle.ac.uk

Key words

Fieldwork, Virtual fieldwork, Student placements, Students as partners, Technology enhanced learning

Broadcasting live from a fieldwork location is something that previously would have been limited to TV shows such as Springwatch and Blue Planet Live. With the recent transformation in digital education, this delivery method has been adopted by institutions and organisations to diversify delivery channels for their fieldwork teaching within the Biosciences and Geography, Earth and Environmental Science disciplines e.g. FieldCasts from Open University and #FieldworkLive from the Field Studies Council. Whilst these broadcasts have valued student contributions via Q&A and synchronous communication tools, these fieldwork delivery methods have been facilitator led, with little known of how student voice can inform this digital fieldwork approach and the extent to which students can play a more active role in their development and delivery.

This presentation will reflect upon the journey of working with students to actively and meaningfully negotiate this technology enhanced digital delivery method via three undergraduate student placements. Students worked in partnership with a PhD researcher to co-design and co-develop the content of the broadcast and deliver the final live broadcast to its intended audience, Stage 1 students. It will present initial evaluations on the impact of learners participating in a co-production partnership and consider future possibilities of student-centred live broadcast within fieldwork education in higher education.
Practical teaching is central in science education, students are expected to graduate with competence and confidence in a breadth of procedures. We aim to support the development of independent critical thinking and problem solving in students, however whilst we provide hands on teaching for scientific skills the approach can sometimes understandably rely on quite didactic methods. In recent years students seem more reliant on approaching staff members to ask simple questions before attempting to work through the task. They seem preoccupied with failure and less confident in applying skills, often not understanding the ‘why’ underpinning the skill. This study investigated a novel approach to developing practical skills, providing an opportunity to use techniques already taught and learn new skills in response to a challenge. Central to the design was creating a supportive safe space to fail, where students could puzzle through and apply knowledge. The hypothesis was that by introducing a level of uncertainty students would engage more with problem solving and critical thinking approaches, building their confidence and competence.

The session was run with first year medical students working in groups of 3/4. They were provided with a brief background and the equipment needed to test two samples. To complete the task, they had to apply practical skills already taught - blood smear, drug dilution and microscopy and new skills not previously taught – using a micropipette, urinalysis, using a colorimeter. Before starting, the students were asked to rate their confidence in practical skills and their competence in each of the specific skills. At the end they were again asked to rate their confidence and competence and given free text questions. 225 students completed all components and are included in the analysis.

Before the session self-reported confidence was mixed, 68% - unconfident. This increased significantly with all students expressing at least some confidence and 79% quite or very confident. Self-reported competence in all skills increased, e.g. pipetting 58% to 94%, urinalysis 36% to 90%, colorimeter 56% to 92%. Analysis of comments indicated that students found the practical an overwhelmingly positive learning experience enabling them to utilize problem solving skills, think independently and identify their own weaknesses. Some expressed feelings of unease and that the sessions challenged them, however, these groups also noted that they learnt more, enjoyed being challenged and benefitted from the trial-and-error approach, finding it a safe space to attempt the tasks and in doing so increasing in their confidence. In this study our cohort was medical students, however we believe that this approach could apply to any subject teaching practical skills. Being given the opportunity to apply and learn skills independently allowed students to self-identify weaknesses and enhanced their understanding of the ‘why’. Providing students with a challenge in a safe space allows them to feel more confident to be independent thinkers and approach skills learning with an inquiring and inquisitive mind.

Sarah Aynsley
Nazim Ali
Rebecca Mackenzie

Keele University

s.aynsley@keele.ac.uk
Day 2

Key words

Problem solving, Independence, Enhancing confidence, Practical skills
Engineering subjects are dominated by theories, equations and formulae; the origins of which are not usually made clear. How, Why and Under what circumstances those theories, equations and formulae were produced and by whom is rarely discussed. Moreover, the few discussions that do take place are based on how the West sees engineering and education. We do not include other practices that are used around the world.

This session will introduce the need for decolonising the engineering curriculum and identify the challenges faced in decolonising engineering topics. It will also provide some key points on how to navigate those challenges, interrogate our subject areas and deliver practical actions that can be implemented in our teaching styles and content. The simple steps provided here will enable educators to start their journey in decolonising their programmes and address the inequalities in our education system.

Tosha Nembhard
University of Leicester

tn125@le.ac.uk

Key words
Engineering, Decolonising, Higher Education
Day 2

Engineering Capital: The Development and Adoption of a Domain-Specific Perspective on Engineering Inequities in the United Kingdom

Issues of diversity and inclusion are long recognised within the domains of Science, Technology, Engineering and Mathematics (STEM). In the United Kingdom these patterns of inequity are particularly severe for engineering: only 16.5% of professional engineering roles were occupied by women and only 11.4% by those from non-White ethnic groups (EngineeringUK, 2018; EngineeringUK, 2022). These inequities of participation and representation must be recognised as systemic, present within educational, career, and societal contexts, and resistant to intervention despite significant attention and economic investment (Department for Education, 2021; Hutchinson & Bentley, 2011; National Audit Office, 2018). It is therefore argued that a more sophisticated approach to understanding engineering inequities is necessary to support more effective intervention with these entrenched patterns of inequity.

In this paper a novel theoretical and empirical model of engineering inequity is outlined. This model of ‘Engineering Capital’ considers cultural and social resources, or ‘capital’, that underpin patterns of inequity within the engineering domain. Drawing from sociological thinking tools of Bourdieuan cultural capital and Archer et al.’s (2015) innovative ‘science capital’ perspective this model offers a sophisticated lens on how young learners are supported to access the engineering domain. This perspective considers the distribution of supportive engineering resources as a more comprehensive and intersectional understanding of the ‘mechanics’ of engineering inequity.

First, the engineering context of the United Kingdom is outlined to delineate the problematic inequities present within this domain. This exploration reflects on the interconnectivity of STEM domains and the need to approach inequities in a domain-specific manner. Next, the theoretical model of engineering capital is outlined. This model critically unifies past literature within a contemporary structure of Bourdieuan capital to explore inequities present within engineering literacy, attitudes, social networks, in-school and out-of-school learning and more. Empirical data collected from over 900 secondary school-aged learners in England and Scotland is then analysed to validate the engineering capital perspective. This investigation reveals distinct insights into engineering inequities between gender, social class and academic ability groups. Those with higher levels of engineering capital are found to hold more positive views and identities towards future engineering. The ability of this empirical structure to predict inequities in aspiration for future engineering education or careers is statistically investigated and found to support the validity of an engineering capital lens. Finally, the insights of this model are reflected on in relation to teaching and learning practices in the United Kingdom. The need to develop sophisticated and culturally-rooted understandings of social injustice is considered in relation to STEM teaching and policy-making. Recommendations for use of the engineering capital perspective within educational contexts and future avenues of research are also explored.

Rory McDonald
University of Central Lancashire

RAMCDONALDS@ucln.ac.uk
Day 2

**Key words**

STEM Inequity, Engineering Inequity, Engineering Capital, Equality Diversity and Inclusion
Gaining deeper understanding of the female decision making process for the selection of Mechanical Engineering at degree level in the UK, to counteract its low uptake

This research highlights work undertaken to better understand the motivating factors for females in selecting Mechanical Engineering (ME) as a degree subject in Higher Education (HE). Through improved understanding of this, suggestions can be made with regards to interventions that will encourage more females to pursue ME as a career. The work aligns with the theme of Equality, Diversity and Inclusion.

In 2016, IMechE (IMechE, 2016) reported that only 8% of girls felt they knew a great deal about engineering as a concept. This consequently leads to misconceptions, surmised as the collision of the “engineering and gender-stereotype” (Starovoytova, et al. 2016). The impact of these misconceptions is poor representation of females studying and working in engineering. In Swansea University (SU), only ~18% of engineering undergraduate students were reported as female; with ME having a distinctly smaller representation at only 8.5% (Swansea University, 2018). Lower than the 11.2% National Average for ME at HE institutions (HEDI, 20/21). As a consequence of the pervasive under-representation of females in the field of engineering, the HE environment for female engineers tends to present a climate of “dominant masculinity” (Madara, et al. 2016). With a pronounced inequality in “power” relations between men and women, creating a distinct patriarchal bias (HØrby et al. 2016). This non-nurturing, male-dominant learning environment can contribute to the leaky pipeline effect (Linnenbrink-Garcia et al. 2018), deterring females from pursuing their career in ME.

Consequently, to better understand the motivating factors around the selection of ME at degree-level, the SU undergraduate cohort currently studying ME in the academic year 2022/23, have undertaken an extensive online survey; with 243 respondents (just under half the cohort), of which 44 identified as female. A key objective of this survey was to identify internal versus external motivating factors for the selection of ME as a future career; and, in establishing prior experience and impact of outreach activities on the female decision-making process.

Based on the initial quantitative statistical review of the survey questions using Numeric Rating Scaling, a more “internalised” decision making process was evidenced for the females. In order to gain a deeper understanding of this, female-only Focus Group sessions have been undertaken to establish what particularly appeals to females about the subject of ME? And, the importance, or not, of Role Models and Mentoring; in addition, feedback has been sought regarding effective outreach approaches.

The initial findings following quantitative and qualitative analysis of this data will be presented; along with next steps on how findings will be used in developing appropriate interventions to encourage females into ME.

Jennifer Thopson
Chloe Morgan
Andrew Rees
Katie Hebborn

Swansea University

jennifer.thompson@swansea.ac.uk


Swansea University, CoE Athena Swan 2018 application

HESA data from HEDI plus for 20/21


Hørby et al. (2009). Engineering education-out of the Male Reserve! In European Society for Engineering Education (SEFI) Annual Conference (pp. 1-4).


**Key words**

Mechanical-Engineering, female, underrepresentation, ED&I
New Office for Students metrics on progression and completion (OfS, 2022) have added further pressure to higher education (HE) institutions. Concerns about inequitable achievement among different student groups were already apparent and work to reduce differential awarding gaps has been ongoing (Berry & Loke, 2011; Woodfield, 2014). New targets, priorities and requirements have added pressure to staff, already burdened with a myriad of responsibilities (Binns, 2017). Stress levels among HE staff are high (Kinman & Wray, 2013; Morrish, 2019), contributed to by multiple simultaneous expectations and priorities from management and students, and a relentless pace of work. Additionally, change is difficult (Kanter, 2012), and not always effective in HE (Timperley & Parr, 2005; Burner, 2018).

In an urban widening participation university, concerns about progression within large (350+) first year biosciences modules were identified. To address long-standing problems about engaging large classes and personalising student experience sustainably, a proactive problem-solving approach based on design thinking (Brown, 2008), was used to engage staff in a collaborative, empathetic process of re-imagining first year biosciences provision. Design thinking is founded upon five principles – empathise, define, ideate, prototype and test - to encourage creativity and collaborative concept development, and has been applied to a wide range of scenarios including HE (Morris & Warman, 2015; Wise, 2021). This ongoing project began with two bespoke full day workshops. Within the workshops, activities were structured to allow staff to voice their concerns and frustrations in a non-judgemental environment, which encouraged movement beyond frustration and into creativity. The workshops, activities and current progress will be described in this presentation along with potential approaches delegates could adopt at their own institutions.

Hilda Mulrooney
Gemma Shearman
Nigel Page

Kingston University

hilda.mulrooney@kingston.ac.uk

Key words
Design thinking, attainment, problem-solving, collaboration
In the Core Engineering B T272 module at The Open University, students continue to develop a reflective engineering practice. To help students apply the many theoretical principles to real-world conditions, the course introduces them to two distinct activities: an introduction to the industry-standard finite element analysis software ANSYS, and the completely remote Open Engineering Laboratory. Despite that the course is given completely online (within a virtual learning environment), students are encouraged to learn through praxis — wherein they continually refer to pieces of fundamental knowledge through pragmatic experimentation. Through praxis, students are said to gain a more meaningful understanding of theory and develop their independence through experimenting and testing first-hand. This research is interested in learning more from students about their experiences with the ANSYS software and remote laboratory to determine whether students are developing an increasingly reflective practice. To do so, a mixed method approach was used to collect data across two cohorts (2021 and 2022) and analyse their answers using Higher Order Thinking Skills (HOTS). A link is sensed between the depth of understanding and increasingly higher order thinking skills. HOTS presumes different levels of comprehension. Roughly, (by order of increased comprehension) students can (i) remember, (ii) understand, (iii) apply, (iv) analyse, (v) evaluate, or (vi) create knowledge. This paper will triangulate and analyse findings from student-completed questionnaires, semi-structured interviews with a select number of representative students, and their assessment results. Results are used to determine which order of thinking students are achieving, and whether the proposed practical activities affect these outcomes. The paper will also identify any significant barriers to the development of HOTS and conclude with a reflection on next steps to improve module content.
We present the results of an investigation of the development of the attitudes to science of students in an undergraduate interdisciplinary science programme. The programme features interdisciplinary modules involving biology, chemistry and physics delivered by a form of problem-based learning across a three-year degree. The question we address is the extent to which students develop expert attitudes in the individual disciplines in the course of their degree programme. From our longitudinal study over a period of six years we find positive results in the formation of expert-like attitudes in biology and chemistry and for higher performing students in physics (Semsar et al. 2011, Adams et al. 2008, and Adams et al. 2006). We note that the nature of science, that is the beliefs of experts about science with which our students’ responses are compared, are not taught explicitly in this programme, but acquired through experience of the pedagogy (Brewe et al. 2009, and Reddy 2019). Our conclusion is that students generally develop more expert-like attitudes in the separate disciplines, and hence a greater understanding of the sciences, over the first years of a degree. It is the developing maturity of students over an extended time frame rather than the intensity of study of individual disciplines that is key. We believe this is an important contribution to the argument for greater interdisciplinarity at all levels in STEM education.

References

Key words
Attitudes to Science, Interdisciplinary, Problem-Based Learning
Although the value of experiential learning within the field-based disciplines has been well evidenced (Pyle, 2009; Mogk & Goodwin, 2012), there is increasing concern over the lack of diversity, equity and inclusion within these disciplines (Bobbette et al., 2021; NERC, 2021), which has been perpetuated through traditional approaches to fieldwork education (Atchison & Libarkin, 2016; Mol & Atchison, 2019). Blending opportunities for students to actively participate in-person or online has been proposed as a flexible learning approach that helps address the challenges of accessibility and sustainability facing fieldwork education (Marshall et al., 2022).

In this presentation we will share the findings from a blended field course where we explored the use of video calls (i.e., Zoom), file sharing (i.e., Google Drive), messaging (i.e., Discord), and web streaming (i.e., YouTube Live) to facilitate collaboration between 17 geology students during a ten-day residential field course in the San Francisco Volcanic Field, Arizona. Fourteen of the students visited the field sites in-person and three participated online, over half the group (9/17) had declared a disability and some of the online students (2/3) had work or family obligations that made travel to the field impossible. The students spent the first six days visiting sites on the Holey Tour (Greeley, 2011) where they developed their field inquiry and group work skills. The final few days were spent on a set of group projects applying those skills to describe and interpret a new field site.

Overall, we found that communication was facilitated by the use of the Discord messaging platform. The students introduced themselves and interacted on Discord before the field course, enabling relationships to grow organically. This eased anxieties when collaborating and allowed the students to interact with one another at a comfortable level (i.e., using the emoji reactions and built-in video chat options). There were multiple ways to engage with the course materials and each other, and as a result, the students did not feel pressured to overexert themselves. Zoom meetings allowed flexibility with meeting times and locations, so students could join from their rooms or take a rest day and catch up later with the recordings. The web broadcasts enabled the students to feel physically present at a distant field site, whether they were in their rooms or in another time zone.

However, although the engagement options and apps worked favourably for everyone, some of the students reported that there was still a disconnect between the online and in-person students. The online students could not participate in group meals or share downtime with the in-person students, so these bonding and mentoring moments did not bridge the physical separation between the groups. Therefore, further planning is required to facilitate mixed-mode community building. From this study, we conclude that incorporating options for in-person students to complete an activity online could foster more connections between the groups, and designing activities requiring both in-person and online
Day 2

components may be the best option for inclusive mixed-mode field courses.

Key words

Fieldwork, Blended Learning, Collaborative Learning, Equality Diversity and Inclusion
Development of an At-Home Practical to Overcome a Control Theory Threshold Concept

Haziqah Shahari
Becky Selwyn
Joel Ross

University of Bristol

The aim of this paper was to investigate the effectiveness of practical learning through a home lab kit on students' understanding of core taught concepts. The topic of Proportional Integral Derivative (PID) control in a second year 'Dynamics and Control' unit was identified as a possible threshold concept for engineering students, and hence was the focus of the intervention. A new at-home practical activity was designed and implemented, and student engagement with the activity and learning gains were monitored. Many students engaged well with this task and found the application of theory to be beneficial to their understanding.

At the University of Bristol, home laboratory kits are provided to first-year Civil, Aerospace and Mechanical Engineering (CAME) students. With the CAME home lab kits in mind, an electrical practical was developed and integrated into a second-year Mechanical Engineering unit, 'Dynamics and Control'. This practical allowed students to visualise the effect of electrical damping, varied using resistors, on the response of a system. This task also built upon their first-year coding knowledge.

To encourage student participation, two tests were introduced into this task using the virtual learning environment (Blackboard). A pre-lab quiz was used to direct students to the relevant content required by identifying key skills and equations. It allowed students to reflect on and gauge their current understanding of the topic before engaging with the new lab. Following this, a post lab test was used to assess the application of theory. This test also collected qualitative data on student experience with practical application, preference between theoretical problem sheets and practicals and future suggestions and improvements. Over a hundred students have since participated in this study. Whilst it was found that many students prefer theoretical problem sheets as they are more suited to our current assessment format, many students considered the pre-lab test to be useful as it encouraged them to revise the required content prior to completing the experiment. Furthermore, many students enjoyed the practical element of this task by applying the taught knowledge and visualising the damping responses.

Threshold Concepts, Engineering Education, Control Theory, Home Laboratory Kits
Graduates joining our MSc Molecular Biosciences programme come from diverse educational backgrounds. They often have limited laboratory experience, where the opportunity to develop hands-on molecular biology research skills is a major factor driving them to pursue postgraduate study. Here we report on the implementation of a level 7 practical unit that incorporates student-led hypothesis design and a collaborative experimental approach to answer authentic research questions.

Research Project 1A is an all-year, taught stage unit in which students use molecular biology to develop distinct CRISPR-Cas9 approaches to turn a green fungus yellow, and evaluate which approach is the most efficient. The unit is structured to provide practical scaffolding to enable students to build confidence in i) basic laboratory and higher-level molecular biology skills, ii) applying knowledge to data interpretation, and iii) verbal and written science communication.

Students consistently give the unit top marks in their evaluations, supported by positive feedback regarding their experience, the opportunity to learn cutting-edge techniques, and the support they receive. This structured authentic molecular biology experience provides students with a window into research and builds confidence which is vital for their individual research project undertaken at a later stage in the course. The principles and design of the unit (hands-on practical skills/data interpretation/written skills/group collaboration etc.) can be easily adapted to fit with other level 7 laboratory practicals.

Zoë Burke
Neil Brown
University of Bath

Data Interpretation, Authentic, Research, Collaboration, Molecular biology
**Employability work-based learning and apprenticeships (Thursday 29th, 11.50)**

**Enrichment workshops to encourage awareness of employability skills**

A previous research project on practical skills progression and employability (Haresnape, 2022) revealed that few students realise the employability benefits of engaging with practical investigations or appreciate the skills they are developing by engaging in practical work. This led us to pilot a programme of informal employability-focussed workshops for biology and health sciences students at the Open University (OU) during June and July 2022 when most students are taking a break from their studies. The workshops were intended to help students to understand the skills required in different biology and health science-related fields of work and to appreciate how engaging with the practical elements of their modules are helping them to develop these skills. In addition, the programme provided a continuation of learning opportunities over the summer months between one October start module and the next, so it was hoped that it would help to build a sense of community among our biology students – something which is often difficult to achieve in the distance learning environment.

The workshop facilitators shared first-hand experiences of working in biology and health science-related jobs, including working in a research laboratory, undertaking field work in exotic places, and working in bioinformatics. They focused on what it is like to work as a scientist, and on particular the skills required for different jobs, and included plenty of opportunities for participants to ask questions. Most of facilitators were OU tutors. The sessions were informal with plenty of opportunity for participants to ask questions and took place in an online tutorial room on the Open University Science Study site.

Students who had participated in the programme were invited to complete a feedback questionnaire which explored to what extent the workshops had been successful in helping them to understand the skills required in different biology and health science-related jobs, and also to feel part of a community of OU students. There was also the option to give additional free text comments on the opportunities and insights the workshops had provided.

This oral presentation will give an overview of what was included in the programme, and a brief analysis of the comments from participating students, most of which were very positive. It was clear that they found the workshops not only interesting but also useful in learning what professional biologists and health scientists think about and work on, how learning is applied to real world situations, and moreover it opened students’ eyes to possible employment opportunities which they were previously unaware of.

Delegates will be invited to share experiences of any similar programmes of employability-focussed workshops which they have organised and be invited to suggest ideas for future workshops in the programme.

Following the success of the 2022 programme, we are running more extensive programme of similar workshops in 2023, starting earlier and

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**Janet Haresnape**
**Ruth Gilbert**

**The Open University**

[janet.haresnape@open.ac.uk](mailto:janet.haresnape@open.ac.uk)
running over a longer period. The programme will be underway by June 2023 so there should be an opportunity to present some initial feedback from the first workshops in the current programme.

**Key words**

Employability, Skills development, Community-building, Practical skills, Laboratory skills, Enrichment of learning, Active learning through participation
Swansea University department of Chemistry is new, having reopened in 2017. Part of the reopening was the renovation of laboratory space to provide a teaching resource that is fit for the 21st century, with 40 stations, each with computer and large fume hood. We have used this space to host regional schools to allow them to perform practicals otherwise unattainable at their schools.

As a new department, we have a very small graduate programme. As a result, our chemistry undergraduate students have been the main source for supervising this outreach. This is unusual at best and the extent to which we do this is unique. To date, over 200 undergraduate students have helped to supervise over 6000 school pupils in the labs.

This paper will describe the overall programme and report reflections and surveys from the undergraduates. There will also be the opportunity to see the activity "in action".

Outreach, chemistry, undergraduates
Integrating an e-portfolio into the curriculum to allow students to track skills development

Becky Thomas
Rebecca Lewis
Siobhan Swindells

Royal Holloway University of London

rebecca.thommas@rhul.ac.uk

Key words

Employability, E-portfolio, Skills

The regular reflection and recording of skills gained within and beyond the core curriculum is important for students to maximise their development while at university and to be ready for the graduate job market. Often though, institutions do not have a purpose-built tool for tracking this skills development, nor the resources to purchase one.

As a small team, we designed and built a bespoke e-portfolio system using our university’s existing Microsoft 365 toolkit and were able to tailor the design to support our first year Biological Sciences students. The e-portfolio allowed them to record both their skills development along with supporting evidence and to begin building their personal profiles to encourage them to track this development from their first year of study. The students can export their whole portfolio including the skills lists at any time.

We integrated the e-portfolio into a first term module as well as the personal tutoring system. Personal tutors were able to view and comment on their students e-portfolio and students can endorse the skills of other students (especially relevant for group working tasks). We produced training videos and guides for both staff and students as well as providing training to students within a module teaching session.

We carried out a student questionnaire before and after the introduction of the e-portfolio. 68% of the students surveyed found the e-portfolio easy to use. We also found a significant increase in their understanding of terms such as ‘transferable skills’. We found excellent engagement within the first academic term with 58% students editing and/or adding at least one skill to their portfolio.

This system is customisable to different disciplines/institutions and our approach of embedding it within the curriculum has led to a significantly positive level of engagement considering that the students are very early in their academic career, many will not yet be that career focused and that the activities are not linked to any assessment. The tool is also new to staff, and we'll present some reflections of how we trained and supported academic staff.
Cengage Parallel Session (Thursday 29th, 11.50)

Digital Focused Pedagogy

The future of education materials has always been digital. From affordability to enhancing the learning experience for students and instructors, adapting to a digitally focused pedagogy for STEM must be explored.

Cengage is one of the largest education technology companies in the world. Serving the higher education market, we provide quality digital products and services to make learning accessible to all.

Two Cengage Faculty Partners will discuss how a digitally focused pedagogy has impacted their institutions:

1. Dr Dimitrios Christou is an Assistant Professor of Applied Mathematics at Deree - The American College of Greece
2. Tjerk Sminia teaches Organic Chemistry at Wageningen University and Research in The Netherlands.

Join us to discover how educational technology solutions build confidence by equipping students with the skills and competencies needed to advance their careers in STEM.

Key words

Digital, learning experience, education technology
Workshops (Thursday 29th, 13.30)

Room: Wallace 218

Questions, Stories, Pictures, Decisions: A streamlined framework for embedding work-readiness curriculum into STEM teaching

Graham Cole
Newcastle University
graham.cole@newcastle.ac.uk

Whilst the technical competency of STEM students graduating from UK Higher Education institutions is well respected, employers recognise a gap in skills relating to work-readiness; the means by which technical capabilities can be harnessed to bring value in an organisational setting. The complexity, breadth and depth of knowledge and skills which must be included in STEM curricula in the Higher Education setting leaves little time and space in which to focus on delivering these work-readiness skills and competencies. Aligned to this is a self-perceived skills deficit in many academics with respect to work-readiness skills, either through lack of personal experience and suitable training and support. It is apparent, however, that many work-readiness skills are intrinsic to STEM teaching without explicit relationships drawn to their application in the workplace.

This session will explore the relationship between skills delivered in domain-focussed STEM curricula and their counterparts in a vocational setting, drawing out similarities and building towards a mapping of skills in four key areas: asking questions, telling stories, drawing picture and promoting decisions.

It is hoped that by highlighting the skills overlap in these seemingly disparate settings that skills taught in existing STEM curricula could better related to industry requirements, strengthening student skillsets, and promoting successful graduate outcomes.

Key words

Work-readiness, Skills mapping, Successful graduate outcomes
Using computer tools to support molecular biology labs

Cloud-based molecular biology software and digital notebooks are exciting new tools I use to engage students in critically evaluating their laboratory protocols, making predictions, or creating new experiments. I use these tools in group work sessions, but they also allow for self-directed and self-paced distance learning. They are very accessible and free to use on any internet-connected device. I use the free online software Benchling and have developed a range of worksheets for students. Using these resources, students can understand complex methods before arriving in the lab; the digital notebooks embed pre-lab study with practical sessions creating student buy-in for these activities. Making a more enjoyable experience focused on learning and thinking and supplementing valuable practical time.

Attendees will learn how to use a wide range of molecular design tools and integrate these analyses in digital notebooks. I will demonstrate how instructors can rapidly review these tools to support their students and maximise student buy-in when studying challenging molecular biology techniques.

Philip Leftwich
University of East Anglia
p.leftwich@uea.ac.uk

Key words
Molecular Biology, Cloud software, Benchling, Lab notebooks
In recent years there has been considerable progress in placing Decolonisation at the top of the Higher Education agenda (Grange, 2020). However, while decolonisation is central to current theoretical debates, embedding this theoretical framework in practice is at its infancy (Morreira et al., 2020). Previous work has shown that one of the barriers of decolonisation in practice is lack of knowledge and expertise from the educators’ perspective (Hall et al. 2021; Shahjahan et al., 2022). The workshop aims to provide a practical framework for diversifying teaching practice using an active learning approach. In this workshop we will share key practices and tools from a project we have developed and run at the University of Nottingham to assist colleagues in Higher Education in diversifying their teaching practice and provide a space for attendees to discuss and work on developing an aspect of their curriculum. We would like to encourage colleagues who wish to attend the workshop to bring an example of content they would like to work on during the workshop. Examples include but are not limited to: lecture slides, assessment plan, workshop outline, seminar plan.

Deionisation, active learning, workshop, diversification, curriculum development

Angie Makri
Stephanie McDonald

University of Nottingham

angie.makri@nottingham.ac.uk

Key words

Decolonising the curriculum through an active learning approach
Identifying and developing good practice in the Scholarship of Teaching and Learning (SoTL) within STEM HE

The Scholarship of Teaching and Learning enables practitioners to contribute to and learn from the body of pedagogical research informing teaching and learning practices within HE. It promotes systematic, ethical and reflexive enquiry by practitioners to inform professional practice. Principles of good practice in SoTL have been proposed indicating that it should be (i) inquiry focused on student learning; (ii) grounded in context; (iii) methodologically sound; (iv) conducted in partnership with students and (v) made public (Felten, 2013).

The aims of this workshop are to consider the variety of institutional practices that support (or discourage) practitioners to engage in the Scholarship of Teaching and Learning within their roles, and to identify and share effective approaches across institutions and disciplines. The workshop facilitators bring a breadth of experience of academic leadership and scholarship and are involved in coordinating scholarship within their institutions. One of the driving forces for the facilitators helping establish the Horizons in STEM Conference series in 2016 was to promote SoTL within the STEM disciplines. By discussing and identifying effective practices for scholarship across institutions, our aim is to raise awareness and engagement with the variety of approaches and invite delegates to reflect on and review these. For many, time for scholarship was limited during the pandemic, therefore, this workshop offers a timely opportunity for delegates to come together as a community to reflect on and review institutional support for scholarship and renew their commitment to scholarly teaching.

The facilitators will welcome the delegates, introduce themselves and give an overview of the workshop (5 minutes). Three approaches to embed scholarship at our institutions, relating to the topics of student partnership, academic reward and recognition, and structural support for scholarship will be presented (15 minutes). Delegates will then be divided into groups to have facilitated discussions on the three topics, drawing on the practice at delegates’ institutions. We will then move to a plenary session to collate examples of effective practices and discuss what further role the Horizons in STEM Conference community can contribute to the support and promotion of SoTL.


Key words

Scholarship of Teaching and Learning, SoTL, Pedagogic Research
Embedding employability through a framework of authentic assessment and training support in the undergraduate research project

The undergraduate research project forms a key requirement in the psychology curriculum and contributes considerably to degree classification. In this talk we present insights from a project looking at the development of a new framework of assessment and training support for undergraduate students. Key objectives in this project include providing students with opportunities to develop and gain experience in articulating key professional competencies, to develop as independent researchers, as well as to support staff in the supervision process. We present key findings from an impact evaluation study we conducted, in the form of staff and student surveys and focus groups with students, on changes introduced in the delivery, assessment, and student engagement within the context of the undergraduate research project on the student learning experience, learning outcomes, and impact on supervisors. We will discuss these findings within the context of curriculum design to enhance the student learning experience, key outcomes, and employability.

Stephanie McDonald
Lee Perkin

University of Nottingham

stephanie.mcdonald@nottingham.ac.uk

Authentic assessment, undergraduate research project, employability
Developing Transferable Skills with Final Year Biosciences Students using Design Sprints and Assessment Co-Creation

The School of Biosciences at Aston University places a strong emphasis on employability and focuses on developing student skills and experiences from the first year onwards. As many students come from disadvantaged backgrounds, increasing employment opportunities is crucial. However, some students do not fully realise the significance of transferable skills until after they graduate and can quickly lose interest in activities centred around developing skills if they think they already have the necessary abilities or do not see their immediate value.

To ensure personalised and authentic learning, the main assessments in our final year Professional Development modules on the BSc Biological Sciences and BSc Biochemistry programmes were co-created with students using a ‘design sprint’ approach. By allowing students to choose relevant skills and determine how they are assessed, there has been a notable increase in their enthusiasm for personal development.

The Professional Development modules include a set of interconnected assessments. Students begin with a mock video interview that focuses on their current skills. After identifying a skills gap with their personal tutor, they write a reflective piece outlining their previous attempts to develop the skill and a plan to improve it in the future. Next, students collaborate with the academic team to choose skills they all want to develop. Initial ideas are generated during a structured, time-bound design sprint process that encourages collaboration, creativity, and rapid user-focused solutions. Students then learn about assessment design and co-create an assessment to develop and reflect on their selected skills, including designing the mark scheme. This highly collaborative approach showcases the power of co-creation, with the assessments being both authentic and innovative. Feedback from the modules indicates high levels of satisfaction with co-creation, and students value the opportunity to develop their personal skills. The results from the co-created assessment show a typical bell-shaped distribution with the majority of grades being in the 65-75% range with fewer grades at the extreme ends.

In this session, we will share our personal experiences in creating and delivering the module and offer a flexible framework for colleagues to adopt similar approaches. By collaborating with students, we have observed that skills development becomes a higher priority on their personal agendas and more fun for all involved.

Joanne Gough
Alan Goddard
Aston University
j.r.gough@aston.ac.uk

Key words
Co-creation, Employability, Skills development
Transitions, Student Support and Academic Mentoring (Thursday 29th, 14.30)

Postcard Project: an investigation into engagement and retention on a level one module

Design Thinking in the 21st Century is a large Level 1 module within the School of Engineering and Innovation (E&I) at the Open University recruiting over 1000 students per year. The course leaders for this module launched a project at the start of the 2022 presentation with the aim of improving engagement, retention, and achievement on the module. Student retention has been lower than other comparable Level 1 modules in E&I but has differing challenges in that it recruits from a potentially wider range of qualification pathways. It therefore has to work harder to meet the needs of a diverse student cohort who have chosen the module for a variety of reasons that are often extrinsic to their chosen career or study path.

Students are placed in a tutor group of 20 students with one Associate Lecturer delivering module content and assessing their work. The project aims to improve engagement and retention by ensuring students have contact with their Associate Lecturer at least once per week through the delivery of a digital postcard with bite-sized, highly visual information that highlights key learning points on the module planner for that week.

The project is being run as a pilot study to allow for an analysis of the impact of this regular contact, targeting 13 tutor groups spread across the UK. The postcards have all been created by the course leaders to ensure all of the students are receiving the same content. These postcards are sent out by the Associate Lecturer to their tutor group to encourage further interaction and develop a stronger relationship and sense of belonging within their group. No new module information is provided to the pilot groups to ensure they do not have an academic advantage over their peers in the control groups.

We will use a predictive data tool developed by the Open University, ‘OU Analyse’, to look at weekly student engagement with the module VLE and submission of assignments within the pilot groups and the control groups to see if, and how, the project is having an impact.

We believe this research is important as we are keen to understand why so many students drop out of this module, and to develop strategies to ensure students feel optimally supported. This is important for the success and well-being of the students, and also for the financial security of the University particularly considering that we are a distance learning provider where students are more likely to feel isolated. By seeking to encourage more regular interaction between students and their Associate Lecturer, we would hope to understand how students are responding to the content and delivery of the module, and to address their concerns before they made the choice to withdraw.

Elouise Huxor
Theodora Philcox

Open University

elouise.huxor@open.ac.uk

Key words

Retention, engagement, interaction, motivation
A strong sense of community amongst learners has been shown to contribute to development of resilience (Barber et al. 2019), attainment (Cançado et al. 2018) and retention (Foster et al. 2012). However, formal university-based communities are harder to establish amongst distance learners, but their social media activity indicates significant numbers of such students value communities.

In the first phase of our project, we aimed to create a sense of community amongst students on a single first year module. This had both the direct aim of enhancing the student experience, and also the indirect aim of improving retention and success, not just within that module but in their studies going forward.

Our approach was to run activities that were inclusive and accessible to all, and not dependent on academic knowledge or attainment. We achieved this by ensuring that all activities are of a purely social nature, such as quizzes, games, and talks, and involved students interacting synchronously in small groups. Having activities to carry out provides a purpose for the social interaction, which helped even the least outgoing students to participate.

Students were surveyed on their feelings about, and experience of, community at the end of the module. Participants varied in how much it was valued, but two thirds considered it important to be part of a community within their module and degree, whilst far fewer felt a need for this within a wider academic group. However, it was noticeable that whilst immediate community was valued, far fewer (just over 40%) felt part of these communities.

In the second phase, we have extended the scholarship to look at the larger community of students within the School of Mathematics and Statistics. This has included the creation of a community website located within the School’s main student-facing resources site. One of the advantages of hosting community events on this site is that it nurtures vertical connections amongst students, enabling informal mentoring relationships to develop.

Further investigations of student perceptions will be carried out using focus groups during early 2023 and preliminary findings will be explored during this presentation.

Cath Brown  
Susan Pawley  
Open University  
cath.brown@open.ac.uk

Key words
Student support, Academic Community, Retention, Resilience
Within higher education institutes in the UK, the bioscience honours dissertation is traditionally a lengthy document submitted at the culmination of the undergraduate degree. While it provides an excellent apprenticeship for students wishing to undertake research programmes it does not necessarily develop the skills considered desirable for a career in industry nor does it develop transferable skills, for students seeking non-scientific employment. In the context of existing literature, which identifies neo-liberal managerialism in conjunction with increased student recruitment as contributing factors to excessive workload and work-related stress. There is much need to abandon archaic teaching practices and innovate final-year projects in a bid to foster academic equity, whilst easing the teaching burden.

This presentation highlights the transformation of institutional practice and assessment strategies through creative solutions for reconstructing the final year projects within the Bioscience department at Aston University. Diverging from a conventional thesis to the submission of three considerably shorter submissions, consisting of a research proposal, a research paper and a conference-style poster presentation. The research will also showcase associated marking rubrics for each assessed component, provide insights into adopting a team approach to project supervision and exhibit an array of student support sessions. Quantitative feedback highlights stark improvements in student satisfaction and engagement, whilst qualitative data have been accumulated on the success of the transformation of the project module originating from the student body, academic members, and external examiners. Furthermore, the data presented herein identify the successful implementation of non-traditional final-year research projects, i.e., scientific writing, sustainability in science and the co-creation of learning resources. Of these novel approaches to final-year dissertations within the Aston Bioscience department, this presentation will showcase one particular example, a student-led pedagogic project in the field of equality and diversity, which utilised a combination of qualitative and quantitative techniques to determine the academic barriers experienced by BAME students, studying in west midlands-based universities. This work has been published in a peer-reviewed journal and is a testimony to this new approach towards final-year projects.

The objective of the session is to provide a student-centric stimulus, stemming from academic experiences to help recognise the necessity of diversifying the variety of final-year projects and inspire delegates into inculcating a novel approach into their respective final-year project module. Consequently, reducing their workload, whilst simultaneously developing alternative honours projects to meet the needs of students from different backgrounds, with different learning styles and different career goals. This research hinges on the conference’s core values and correlates strongly to the thematic area of assessment design, pedagogic research, equality diversity and inclusion.
Day 2

Key words

Dissertations, Final-Year Projects, Assessment, Inclusive, Pedagogy
Identifying students’ misconceptions and finding effective ways of addressing them has been of the major concerns in chemistry education. There are many advantages for lecturers and students to know about misconceptions. The aims of this research to describe misconceptions in general chemistry courses, especially intermolecular forces (IMFs) topic. The two-tier multiple-choice tests have played an important role in helping researchers determining students’ level of understanding and in identifying specific misconceptions. A two-tier test consisting of 20 items has been developed and has a reliability index of 0.878 alpha Cronbach. The project involving 88 students (76 female and 12 male) of chemistry education study program of Universitas Tanjungpura, Indonesia who already studied IMFs as participants. Students’ misconceptions were identified from the second-tier test, which is students’ reason for the chosen answer. Surprisingly, 29 misconceptions were acquired from the test of IMFs concepts. Misconceptions receiving the highest percentage were associated with dipole-dipole interaction and hydrogen bonding. These findings were then confirmed by interview. In-depth interviews were conducted with 6 students and it was found that students could not write the examples of intermolecular interactions. Even though they can state the definition of dipole-dipole definitions or hydrogen bonds, but they could not explain the interaction process of the intermolecular forces. The findings of the interviews show that students’ understanding of the concept of intermolecular forces is still lacking and did not understand the topic. Those findings imply that lecturers need to teach chemistry as a whole and supported with multiple representations. The lacking understanding and misconceptions will impact on students’ understanding of further chemistry concepts. To overcome those problems, lecturers need to carry out a diagnostic test prior the teaching. In addition to that, lecturers should explain the concepts by using a multi-representational approach and providing a comprehensive evaluation after the learning process. By doing so, the instructors could understand the extent to which the concepts can be understood by students.

Misconceptions, intermolecular forces, understanding, diagnostic test
Elements of work-based learning are necessary in degree apprenticeship provisions because they allow learners to develop awareness of the contextual circumstances in which declarative knowledge and procedural skills, usually taught in University programmes, can be appropriately applied. Indeed, although the goal of mainstream degree programmes is a set of graduate attributes (competencies) that would subsequently be moulded into an occupational role following graduate employment, the end goal of an apprenticeship programme is full occupational competence at the point of graduation. Work-based learning also offers the opportunity to an apprentice’s employer to flexibly contextualise the curriculum of the provider to match their own business needs and ensure an influx of new knowledge and skills into the organisation. Designing and delivering work-based learning, however, comes with certain challenges, most notably, balancing academic requirements with employers’ needs and interests and supporting learners to achieve ambitious targets related to both.

We share innovative work-based assessment practices introduced in the context of a Digital and Technology Solutions Specialist (DTSS) (data analytics specialism) Master’s degree apprenticeship programme at a London-based HEI. These leverage the synoptic assessment structure of the pre-existing MSc. in Data Science and Analytics and evolve it in the context of bespoke work-based assessments mapped to the Knowledge, Skills and Behaviours of the Level 7 DTSS apprenticeship standard. As the two programmes run in parallel, teaching sessions are shared between them, however, apprentices complete separate work-based assessments utilising employer resources and context. The teaching sessions and their respective study blocks constructively align with assessments for the MSc. programme and the DTSS.

Challenges for the programme delivery team include: a) balancing similarities and differences of the two programmes while at the same time complying with apprenticeships-relevant regulations (e.g. Ofsted); b) supporting apprentices to make meaningful connections between teaching and learning sessions and workplace contexts, thus integrating off-the-job learning with on-the-job impact; c) supporting employers to flexibly customise the curriculum to their own business needs through work-based assessments.

Practical lessons on curriculum design, delivery and management of degree apprenticeship programmes will be drawn for providers.

Key words

Work-based assessments, degree apprenticeships, data analytics, digital, postgraduate
The Pizza Model: Working at the Academic and Industry Interface to Improve Graduate Employability

Lee Higham
Newcastle University
lee.higham@ncl.ac.uk

Universities target increased graduate employability via a range of initiatives including promoting industrial placements, supporting international student mobility, enhancing their digital and information literacy and encouraging entrepreneurship. Yet a key difficulty arises because these areas are traditionally unconnected and can result in siloed activity, meaning students are sometimes not reached and innovative staff can become isolated and frustrated.

A coherent approach to develop critical mass at the university/industry interface is needed and here I argue that a collaborative working approach (the ‘pizza model’), delivered by our cross-campus School of Natural and Environmental Sciences Employability and Enterprise Working Group (EEWG) constitutes a relatively simple model that can be used by other schools and universities to readily coordinate, harmonise and invigorate common objectives which otherwise would be left to ad hoc initiatives. I will discuss how the Working Group members were identified and recruited as champions for their sector in our School, articulate why I believe our shared responsibility model works so well and then provide evidence of the impact that the group has had on our goal of raising student employability, together with addressing some of the challenges that working in this area brings.

Key words
Collaboration, Employability, Sustainability, Active Learning
Final Plenary (Thursday 29th, 15.40am)

How do we learn? Why do we learn? How don’t we learn? How can we all use the science of learning to support our students?

Phil Newton

Swansea University

Bio

P.Newton@Swansea.ac.uk

This interactive session will share some principles from the fundamental neuroscience of learning, and then cover some simple ways in which we can all apply that science within our teaching and assessment, supporting our students to engage in deep, meaningful learning.

Professor Phil Newton is the Director of Learning and Teaching for the Swansea University Medical School. Phil is a neuroscientist whose research focuses on evidence-based approaches to Learning, Teaching and Assessment in Higher Education.