Horizons in STEM Higher Education Conference: Making Connections, Innovating and Sharing Pedagogy

Online event

1 July – 2 July 2020, University of Nottingham, UK

Due to current social distancing guidelines, we are not be able to host a physical conference at the University of Nottingham this year as planned. However, we are committed to keeping the learning dialogue open with our STEM community, so please find a warm welcome and the programme for our alternative online conference.

Abstracts in the programme are those originally submitted for the conference and thus for a variety of formats such as posters and workshops. As the event is changed to online delivery, please take this into account when reviewing the details.

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Programme and Table of Contents

For each of the four Breakout Sessions there are either three or four channels or 'rooms' for you to choose to attend, which are found when you select the channel e.g. Day 1 13:45 - 14:45

DAY 1 – Wednesday 1st July

Arrival time: prior to 13:00

Welcome (13:00 – 13:05)

Katharine Reid (University of Nottingham)

Plenary (13:05 – 13:40)

Breakout Session - Day 1 13:45 - 14:45

Equality, Diversity and Inclusion (EDI)

Laboratory Work

TEL

DAY 2 – Thursday 2nd July

Breakout session - Day 2 09:30 - 10:30*

Student Support

TEL *(*extra time in channel to 10:50)*

Equality, Diversity and Inclusion (EDI)

BREAK (10:30/10:50 – 11:05)

Breakout session – Day 2 11:05-12:05

Assessment and TEL

Plenary Speakers

Plenary Wednesday (13:05 – 13:40)

Digital Exams: Transforming Assessment

Marianne Rand-Weaver (Brunel University London)

In her role as Vice-Provost (Education), Mariann provides academic leadership and strategic guidance to enhance the University's educational provision, and is responsible for external regulatory compliance. Mariann is a Principal Fellow of the Higher Education Academy and an experienced academic who is championing sector-leading initiatives such as digital examinations and integrated programme assessment. For this work, Brunel has received two CATE (Collaborative Award for Teaching Excellence) awards, in 2016 and 2019. Mariann has held a range of senior roles at Brunel, including Head of Biosciences; Deputy Head of School of Health Sciences and Social Care; and for the past nine years as Pro-Vice Chancellor/Vice-Provost. Mariann has published widely in comparative endocrinology and ecotoxicology, and served on editorial boards and acted as expert reviewer for international research councils. She is committed to integrated academic practice, and continues to teach, supervise PhD students and peer review. Mariann has served on the Curriculum Committee for the Royal Society for Biology; she is a Governor of HCUC further education college; and is a member of the AQA Board of Trustees.

Plenary Wednesday (16:05 – 16:40)

Exploring the attainment gap and black student leadership

Myles Smith-Thompson (Open University Students Association) and

Afua Acheampong (Nottingham Trent Students' Union)

Plenary Thursday (12:25 – 13:00)

Transitioning into HE: Remote, Inclusive & Accessible?

Rachel Bolton-King (Staffordshire University)

Dr Rachel Bolton-King is a National Teaching Fellow, CATE Award winner, Churchill Fellow and Associate Professor of Forensic Science at Staffordshire University. She leads Research4Justice (www.research4justice.ac.uk), an innovative project to openly share criminal justice related research to professionals and researchers across the world. Rachel primarily works with large cohorts of undergraduate students, although teaches and supervises research in firearm investigation, firearm identification and forensic ballistics at Masters and PhD level. Her passion to develop academia-industry relationships, support knowledge exchange within higher education and the criminal justice system, and enhance the student journey through technology-facilitated practices all led to her being shortlisted for a THE Award in 2019.

Abstracts

Day 1 – Wednesday Afternoon

Breakout Session – Day 1 13:45 - 14:45

Equality, Diversity and Inclusion (EDI)

Surviving the Viva Voce Experience: the Positive Impact of Learning Support for Physics Project Assessment

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Abstract

Assessment of physics project work via oral exams or presentations provides a valuable opportunity for students to develop key employability skills related to communication, and to gain experience of an interview environment related to their degree content. The viva voce exam format also provides an authentic opportunity to assess student understanding, and is particularly valuable when assessing individual contributions to small-group projects.
However, students with autism spectrum conditions, anxiety, social communication disorders and other specific learning difficulties may be significantly disadvantaged by this assessment format, with the risk of it diminishing their overall attainment.

I describe an intervention aimed at supporting students with additional learning needs through their viva voce assessment. This intervention took the form of a web resource which provided students (and staff) with information on the purpose and scope of the physics project viva, preparation guidance, signposting to various pre-existing support structures, and specific advice for certain conditions and/or difficulties. The resource was shared with the full cohort. I monitored student attainment in the viva, overall attainment in project modules, and attainment in prior vs. final year of study. Students were surveyed as to their opinions on the efficacy of the resource, and their attitudes towards oral exam assessments.

In 2018/19, following this intervention, students with learning support plans covering specific additional needs related to anxiety and social communication performed to a far higher standard in oral assessments than had previously been observed, bringing their attainment more in line with that of other forms of assessment. They also had a greatly improved experience in terms of their self-reported expectations, preparation, and stress/anxiety levels.

Examination of the oral assessment performance of the full cohort revealed a statistically significant increase in the ratio of oral assessment attainment vs. other assessment attainment relative to that of previous years - in addition to benefiting the students it was designed for, the resource raised the performance of the cohort as a whole. Students report less anxiety towards subsequent oral assessments or interviews, and have more confidence in their preparation. In the case of four-year integrated masters degrees, the impact of the resource on 4th year project viva performance pre- and post-intervention was markedly less- these students had already experienced (and had academically survived) a project viva in the preceding academic year.

In this contribution, I will highlight [i] different strategies for supporting students with specific needs, [ii] appropriate signposting to existing resources [iii] how clear guidance and equitable support is beneficial to all students. I will discuss how centering accessibility within the curriculum, even through relatively simple interventions such as this, can promote the production of high quality learning resources for all students.

Enabling inclusive groupwork

Anne-Marie Gallen and Elaine McPherson

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Abstract

The ability to work effectively in a group or team is a key employability skill as well as a requirement of many accreditation bodies. However, managing the group dynamics and expectations, along with assessing group and individual contributions is challenging. Approaches to group work are more likely to lead to successful group interactions when they consider diversity and inclusion and promote equitable participation by all students.

This presentation will focus on the development of guidance around inclusive teaching and learning for university lecturers and students involved in group work.

The guidance was developed through the gathering of good practice and the inclusion of the student voice; by involving a range of stakeholders across our institution and taking an iterative collaborative approach. Based on initial discussions with students with disabilities from a range of disciplines, a set of issues and some recommendations were recorded. For example, students identified the benefits of having information around group work in advance to help reduce anxiety and allow them to plan. They commented that how a group begins affects the extent to which they feel included throughout the activities. It follows that academic leads have a specific role in setting the tone and expectations for the group (i.e. the need to be considerate and respectful of each student) and then modelling this behaviour.

Following the initial student consultation, interviews were conducted with interested and experienced staff who corroborated and extended these ideas, leading to the creation of development resources for professional staff who lead group work activities. These resources were then trialled and refined, based on feedback within this group. By then revisiting notes from the student consultation and staff interviews, we were able to refocus on issues relevant to the design of group work activities. This provided a basis for critically reviewing the group work activities with the stakeholders within a recently developed module and making recommendations for the designers creating group work activities for a new module. The endpoint was the creation of a document containing recommendations for group work designers.

Overall, engaging key stakeholders in the development of guidance for inclusive group work has revealed issues but also offered solutions. The outcomes of this iterative review and development process suggest that those aspects of module design determined as being essential for inclusive group work included: the communication tools chosen; adequate reading and thinking time scheduled; agreeing tasks within the group as well as establishing a range of appropriate roles (e.g. data gatherer). Setting an appropriate context for group work is also essential, ensuring that students understand what skills are being developed and how they relate to the discipline. Finally, designing contingencies that minimise the impact of delays or inconsistent contributions can help mitigate issues during group work.

Personal Tutor Vs Personal Tutees Expectations: Are We Reading off The Same Page?

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A Sutton Trust report, in 2018 identified that due to an increasing number of commuter students studying at universities, the universities should be providing students with more support. This support is often provided through the use of a personal tutoring system (PTS), where tutors are the first contact point for assisting students who are experiencing difficulty in their academic journey through university. In reality, tutors are now being faced with a number of challenging situations that they are not able to deal with based upon their own experiences and training e.g. 75% of the personal tutors that were interviewed in McFarlane's research stated that the personal tutor's role lacked clarity and often left tutors confused about their boundaries (McFarlane, 2016).

The overall aim of this study is to investigate whether personal tutors and personal tutees have clarity over their roles. Furthermore, the study will look into the diversity of tutees and establishing the effects, if any, individual differences have on the support they require. Along with this, identifying postgraduate students' views on being assigned a personal tutor; with them only being within an HE institution most often for just a year and whether or not they believe they may benefit from this scheme and what might be done in terms of the postgraduate experience to help the population.

Laboratory Work

The use of video tutorial vs laboratory simulation in preparation for Biosciences practicals – a comparison of student learning and preference.

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Abstract

Across all levels of education, pedagogues are continuously looking to develop and improve teaching methods in order to provide fully inclusive learning environments for students. The development of online e-learning platforms has provided a flexible modern teaching tool that can be incorporated into many different teaching models to help increase inclusivity. Interactive methods, such as laboratory simulations, have been shown to be diversely adaptable amongst learning models and support student understanding.

Here, the use of a combination of traditional video tutorial and online simulations to teach the process of micropipetting to first year Biosciences students at Aston University was assessed through a bespoke online quiz. Both the simulations and the quiz were created by Learning Science. The results were statistically analysed to identify any significant difference in learning between the use of the video alone, simulation alone, and of the combination of both resources. The results did not show any significant differences in understanding and both teaching tools were praised within student feedback. However, there was variation amongst the students' individual preferred choice. Most students preferred the combination of the two resources over using one or the other, suggesting that the resources complimented each other and catered to various learning styles.

These findings show that both teaching tools had a positive impact on student learning, but that different learners may prefer different educational methods. Therefore, both tools should be offered to provide a fully inclusive way of teaching, whereby students can tailor their own learning and educators can be confident that either method will be equally effective to teach vital laboratory competences.

Enhancing student's lab-based learning experience through extensive training of demonstrators

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Well-constructed science lab activities are powerful learning tools in STEM fields which allow undergraduate students to experience research-connected learning by employing scientific principles and experimental methods to solve discrete problems1. With over 400 students joining the School of Life Sciences every year with varied proficiency in laboratory-based skills, promoting and supporting active student learning poses a huge challenge. Postgraduate students (demonstrators) are recruited to lead the lab sessions. They often come with minimal instructional training and as such, their teaching has been found inconsistent over the years, with students finding it difficult to learn from inexperienced teachers.

This study assessed the impact of extensive training of demonstrators in practical courses on their teaching effectiveness. Demonstrators were trained in three key areas: Subject-specific knowledge; inquiry-based learning and group management. Demonstrators were provided with 2-5 hours of hands-on training prior to the actual practical session as well as inquiry-based work sheets outside the formal training. The training also focused on managing the student's expectations by discussing different scenarios and ways to deal with them.
Demonstrator's teaching effectiveness was evaluated using 1) modified 11-factor student and demonstrator evaluation of educational quality2 2) end-of year module evaluation. Ratings from undergraduates taught by demonstrators with and without training indicated the impact on teaching effectiveness.

Undergraduates rated demonstrators who completed the extensive training higher than those who completed the minimal training. A significant increase in student's satisfaction was observed for each of the 11 factors evaluated. Open comments allowed to gain more insight into students' views and expectations. Students valued the demonstrator's subject knowledge and confidence but emphasized the need to include training on inclusivity and understanding student's individual needs. This study suggests that in order to manage students' expectations we need to train demonstrators with high order teaching skills.

1. Rissing, S. W., & Cogan, J. G. (2009). Can an inquiry approach improve college student learning in a teaching laboratory?. *CBE life sciences education*, *8*(1), 55–61. https://doi.org/10.1187/cbe.08-05-0023

2. Hughes, P. W., and Ellefson, M. R. (2013) Inquiry-based training improves teaching effectiveness of biology teaching assistants. *PloS one* 8, e78540

OpenSTEM Labs: enhancing collaboration between HE and FE in SE Wales; enriching the FE STEM curriculum

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Introduction: OpenSTEM Labs (OSL) is a remote access laboratory hosted by the Open University (OU), which challenges traditional STEM teaching models of students and tutors collocated in a laboratory. OSL is web-based and students remotely access and control laboratory equipment. Equipment includes scanning electron microscopes, telescopes, auto-titrators, Multisim Live (electronics) and mechanical devices. Interactive real-time laboratory classes for students can be run.

This study operates within the Partnership for Progression and Prosperity (PPP), a collaboration of higher education (HE) and further education (FE) colleges in South East Wales.

Objective: This study performs a qualitative analysis of the observed contribution of workshops showcasing the OSL. Furthermore, it will highlight the potential for application of the OSL to enhance FE teaching and learning.

Methodology: OSL was showcased to strand leaders from the four FE partner colleges. The favourable response led to the strand leaders facilitating a workshop for their STEM staff. In the workshop, teachers utilised and evaluated the applicability of the resource to their classroom. The objective being to introduce aspects of OSL to FE teaching and learning.

Results: Strand leaders were impressed with the capabilities and potential of the OSL to their institutions. The STEM staff were able to identify which areas of the OSL would be suitable for their teaching and learning and were motivated to utilise the resource. Although the small sample size has precluded any statistical analysis, the positive reception of this innovative technology may be representative of similar FE institutions.

Conclusions: The OSL has enhanced collaboration with FE Colleges in South East Wales. The next stage is to integrate OSL into teaching and learning within FE. Further testing is required to assess wider applications of OSL, however, the results of this pilot study are promising.
With continued success of this collaboration, embedding OSL into FE teaching and learning will raise the awareness of the Open University as a HE provider for post-FE students and could enhance recruitment.

TEL

Employing videos in teaching laboratory skills and the associated student experience

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Abstract
Current educational systems support the notion that, students who have studied in the 21st century, are more inclined to favour a visually orientated approach to learning. In this study, the authors created ten educational videos to be shared with students prior to attending their laboratory sessions.
A questionnaire was used as data collection tool to assess the engagement of students' with the laboratory videos, measure the impact of the videos on students' learning and identify if there are factors that can influence a student's level of participation with videos as a method of learning. The questionnaire consisted of: Likert-type scale, multiple response, open and closed ended questions. Ethical approval was obtained from the Faculty Research Ethics Committee (FREC). Around 140 MPharm students at level 5 were invited to take part in the study and a response rate of 60% (n=84/140) was achieved. The completed questionnaires were coded and analysed using the IBM SPSS Statistics Data Editor. Over a third of students identified themselves as visual learners as, this gave an encouraging insight as to how beneficial the students might perceive the educational videos. 75% of the students have watched the videos with 64% of them have watched the videos at their own time. Students have rated videos that demonstrate complicated techniques such as granulation techniques as very useful while simple techniques such as sample dilutions and use of pipettes scored a lower rate (Figure 1). Over 80% of the students have felt that the laboratory videos motivated them, increased their engagement and boosted their confidence.

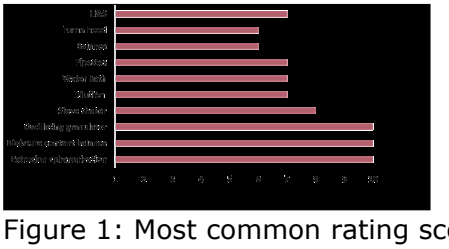

Figure 1: Most common rating score on the usefulness of the lab videos

Keywords: Pharmacy student, instructional video, engagement, laboratory learning, blended learning.

Investigating the benefits of cross reality (XR) technology in Inquiry Based Science Education (IBSE) in Scottish Secondary Schools

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Abstract

Inquiry based science education (IBSE) is an active form of teaching which allows student to be hands-on and engaged in their learning. Effective implementation of IBSE in the teaching and learning space has been met with its own challenges for teachers as they move away from traditional pedagogies and look towards technologies to support more interactive learning methods. This has led to the rise of technology-supported inquiry learning in science. The aim of this project was to use cross reality (XR) technology to assist IBSE and assess the outcome of its implementation upon the students learning experience in science.

In this study, participants from two secondary schools were separated into control (n=18) and experimental (n=35) groups with lessons designed to align with S1 to National 4 biology curriculum. The control group followed a regular lesson plan, whilst augmented reality was incorporated into the IBSE lesson plan of the experimental group. Pre- and post-testing was carried out using multiple choice questions to account for variances in baseline knowledge across the student cohorts on the chosen topic. A 4-point Likert-scale questionnaire was used to assess initial science interest, lesson enjoyment and knowledge advancement. Statistics was carried out using ANCOVA, paired t-test and unpaired t-tests. Pre-test analysis confirmed no changes in the groups baseline knowledge of the topic (Control 46.3%±16.4 vs Experimental 59.4%±24.48), however post-test analysis revealed that the experimental group (90.8%±8.9) statistically outperformed ($p=0.043$) the control group (64.2%±21.7). An overall increase in both enjoyment and knowledge was observed in the experimental group (3.45±0.6, 3.43±0.7) compared to control (1.79±0.63, 2.8±0.95), respectively.

Overall, integrating IBSE and XR technology was shown to improve knowledge and enhance the learning experience for students in the classroom. The present study highlights that students taught using the IBSE structure in addition to XR technology score higher in tests when compared to those who followed conventional lesson plans. Further investigation is planned to increase student cohort size across more schools with additional assessment of student learning achievements with consideration of surface versus deep approaches to learning.

Using remote laboratory experiments to develop learning outcomes in engineering practice.

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Abstract

Remote laboratories allow students to undertake experiments using remotely controlled equipment over the internet (de Jong, 2018; Nedic et al., 2015) and have gained a great deal of interest in recent years as a means to deliver hands-on laboratory teaching to distance learning students. Brinson's (2015) review paper shows that remote and virtual laboratories are being used to develop a wide range of learning outcomes, most commonly developing 'knowledge and understanding' but less frequently developing 'practical skills'. This presentation will present our experience of developing a remote experiment to deliver learning outcomes in both knowledge and understanding and practical skills.

The Engineering Council AHEP framework (Engineering Council, 2014) requires that engineering graduates achieve output standards in engineering practice as one of six key areas of learning. The AHEP definition of engineering practice includes the understanding of relevant materials, tools and equipment and a practical knowledge of workshop and laboratory practice. In face to face settings, these learning outcomes are developed through hands-on laboratory sessions supported by a lecturer or demonstrator.

Remote laboratories at the Open University are delivered through the OpenSTEM Labs, a major initiative used across the STEM Faculty. Engineering undergraduates use the OpenSTEM Labs throughout their qualification, starting at FHEQ level 4 with observational experiments viewed through a live video stream, and building up to fully interactive experiments from FHEQ level 5. This presentation focuses on a level 5 remote experiment to investigate the strain in a pressure vessel wall, that was developed as part of a course on stress analysis. The experiment develops knowledge and understanding of stress and strain and also practical skills related to the use of engineering equipment, taking measurements and error analysis. The presentation will describe the experiment design and how the student activities were designed to meet the learning outcomes. A key challenge was to design a web interface for the remote experiment that would allow students to develop the required practical learning outcomes, replicating the student experience in a face-to-face setting as closely as possible.

The pressure vessel remote experiment was used for the first time in 2019 with a cohort 418 students in the T272 Core Engineering B module. The submission rate for the coursework task associated with the remote experiment was 96 % and the pass rate for the coursework was 80 %. There was a high level of engagement with the experiment and student feedback was generally positive, but further research is required to assess how effectively the learning outcomes were achieved compared to a conventional face-to-face laboratory.

References

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Active Learning

Designing a flipped learning model in a computing course to facilitate students' self-regulation

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Abstract

Traditionally in higher education, transmission of knowledge takes place in lecture theaters (in-class time) and assimilation occurs outside-of class in the form of example sheets. Based on Bloom's taxonomy, it has been showed that the phase of assimilation requires much more complex cognitive tasks and paradoxically, this is when students are working independently with less support and guidance available. A well-known alternative is the flipped classroom. In this student-centered approach, the knowledge transfer is done by students during their independent study time at their own pace with adequate teaching material such as lecture notes and short video tutorials. Students are then required to apply their knowledge in class with the support of the lecturer and teaching assistants. It is hypothesised that a flipped classroom encourages self-regulation. Important components of self-regulation are motivation, resilience and cognitive engagement.

This study presents how a flipped classroom has been implemented for an introductory programming unit for a large cohort of 1st year engineering undergraduates (around 220). Computing skills are essential for engineers but most of the students have no previous experience in writing and understanding computer programs. A scaffolded approach is necessary to support students. A first lecture is given to the whole cohort to clearly explain the intended learning outcomes of this course and why a flipped classroom model has been adopted. Students are not used to this type of teaching, so to clarify expectations, they need to be made aware of how it is organized and the potential benefits. Each week, students must watch short tutorial videos and complete quizzes available on the virtual learning environment. The online quizzes enable them to assess their own level of understanding and build their confidence. Completion of this preliminary work is essential before attending the computer-based sessions. During the computer laboratories, students apply their knowledge to a specific topic and can get direct feedback from the teaching team. To complete this cycle, students must submit 2 formative assignments. This offers students a safe environment where they can try without fearing failure, and an opportunity to receive constructive feedback and improve their computing skills. At the end of the unit, students must work independently on an open-ended summative project.

Student feedback for the unit has been compared before and after the classroom was flipped (two years ago), highlighting the benefits and limitations of the flipped classroom. This approach is particularly well-adapted to teaching a programming language. Indeed, whereas it is rather easy to understand the principles of programming, it is much more difficult to implement them. In this model, students learn by doing and learn from their mistakes through the feedback on the formative assessments. They are encouraged to be active and to adopt a resilient and positive attitude. Results showed that most students did engage and completed all formative

assessments. Students mentioned that they appreciated working independently at their own pace and getting support when they needed it. Overall, self-regulated learning enhances students' motivation and self-confidence.

Evaluating the effectiveness of flipped learning in an introductory mathematics module for chemists

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[2] University of Nottingham, School of Chemistry

The use of flipped learning has become increasingly common within Higher Education, both nationally and globally. A large advantage of such an approach is that it offloads a large portion of the content delivery to be done asynchronously by students. This enables students to learn at their own pace and frees up time for educators in face-to-face sessions to facilitate more active learning activities.

Although success within STEM subjects has been previously shown1, there has been a lack of focus on its potential as a teaching technique towards cohorts of students with diverse educational backgrounds. A common issue in traditional lecturing is deciding at which academic level content should be delivered, which is exacerbated when the cohort of students has a large degree of variability in ability. This is an issue prevalent in many introductory mathematics modules in chemistry degrees, as most institutions do not require an A level (or equivalent) in mathematics leading to a mixed cohort where some students do and others do not have this background.

The work presented here follows the implementation of a flipped approach to the delivery of such an introductory mathematics module aimed at first year undergraduate chemists. All content delivery materials and formative assessments were made available online, and face-to-face sessions were adapted to incorporate a greater element of active learning. These changes were evaluated through a series of surveys and focus groups with students, as well as comparisons to previous years' assessment performance.

Initial data shows that there has been a 4% increase in the attainment of the lower quartile of students (n=116), and that students find the flipped nature of the delivery allows them to identify gaps in their knowledge prior to the active learning sessions.

1 J. O'Flaherty and C. Phillips, The use of flipped classrooms in higher education: A scoping review, *Internet High. Educ.*, 2015, **25**, 85–95.

Explorative Research into Learning Team Health and Performance

Steve Cayzer and Conall Sharkey

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This student-led research project is an exploration into learning analytics within a Team-Based Learning taught postgraduate unit at University of Bath - 'Engineering Project Management'. It aims to identify characteristics of learning teams that are indicative of team health and team dynamics, and to determine their consequential influence on team performance. Throughout the unit different types of data have been collected and analysed to determine what aspects are relevant to teaching staff in improving effectiveness of teaching using teams. Team health issues are identified through categorical and qualitative data analysis, collected through observations, questionnaires, and student feedback. Team performance was measured through in-class assessments, with both absolute and relative performance considered.

Some of the research hypotheses are:
1. Can team health/balance issues be identified through analysis of the collected data?
2. To what extent does team health influence team performance?

During the session results will be shown and discussed, including implications and actionable outcomes thereof. The results are suggestive rather than statistically sound, but still provide useful insight to teachers transitioning to using teams in teaching programs. This is also especially relevant to students transitioning from independent academic work to employment, where many will work within teams

Breakout Session - Day 1 15:00 - 16:00

Transitions and Student Support

Developing communication and presentation skills in a key level 1 introductory mathematics module in the Open University

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Abstract
MU123 *Discovering mathematics* is a key introductory Level 1 mathematics module in the Open University (OU), which provides a vital grounding in mathematical concepts and techniques for a wide variety of qualification pathways across the university; including Computing, Economics, Business and our multidisciplinary Open Degree. The notion of "Good Mathematical Communication" (GMC) was coined during production of MU123 in order to allow students to demonstrate communication skills in mathematics. An integral component of the module assessment for MU123, and now some other modules in the School of Mathematics & Statistics, is demonstrating GMC skills. Students are awarded marks for the clarity of their communication and presentation and adherence to mathematical orthographic and symbolic conventions.

Feedback from students, tutors and academic colleagues across the university has shown that our strong emphasis on the acquisition of GMC is seen as one of the most important skills developed by MU123 students. The ability to present a logical argument is widely acknowledged as a key transferable and employability skill.

A concern for MU123 is that since the majority (over 80%) of our students are not studying towards a qualification in mathematics or statistics they may not feel that GMC necessarily applies to them. As a result, and to acknowledge the impact of these skills beyond the mathematical sciences, we have chosen to present GMC under the broader umbrella of "Communication and Presentation" while maintaining a strict "when in Rome…" policy: That is we aim to provide motivation for students for observing GMC when studying mathematics and stress the importance of context in communicating and presenting work beyond MU123.

In this session, we will present an initiative which involves the design and development of a learning tool to support students in their development of "Communication and Presentation" skills within a mathematical environment. This tool will also support tutors in their teaching and assessment of GMC as a Communication and Presentation skill. The design of the learning tool is an interactive grid which decomposes various aspects of GMC into categories providing exemplars of "excellent", "needs developing", and "poorly developed", practice in each of those areas.

The grid has been developed and has undergone some initial evaluation over three short cycles in collaboration with tutors and students using online forums and focus groups and initial findings will be presented in this talk.

Further evaluation of the effectiveness of this learning resource will take place during the next presentations of the module, through student and tutor focus groups with an action research methodology. Once developed, we plan to make this learning resource available to all access and level one students who study mathematics. We hope that participants at this session will gain a better understanding of the issues surrounding the communication and presentation of work in STEM subjects and will be encouraged to consider the implementation of similar approaches in their own discipline areas.

Supporting inclusion and encouraging diversity in Chemistry-where do you see yourself?

Dr Baljit Thatti, Dr Nicholas Freestone, Maheesh Magoo, Abigail Miller

Kingston University, School of Life Sciences, Pharmacy & Chemistry

RSC Inclusion and Diversity Grant Funded

The Royal Society of Chemistry report "Diversity Landscape of The Chemical Sciences" has highlighted that intersectionality in the diversity landscape means that the inequality experienced by individuals who identify themselves with multiple underrepresented groups may be further exacerbated. There are a number of multifaceted reasons as to why BME students underachieve and previous research suggests that a lack of appropriate role models is one of the possible causes of poor attainment (Dhanda 2010, Singh 2011).

The Department of Pharmaceutical Sciences and Chemistry has collected surveys of students who graduated within the last 10 years from chemistry-related disciplines. From the 101 responses received 20% of graduates went onto laboratory- based jobs within the science sector whilst 54% of graduates, although obtaining employment within the science sector, were working in non-laboratory-based environments. This data will help identify skill sets associated with specific, relevant job profiles and will encourage the development of these embedded within curriculums. These skills will be cross-referenced back to the RSC-accredited Chemistry degree, and the Academy of Pharmaceutical Science-accredited Pharmaceutical Science degree at KU. The end goal of this research project is to provide KU students who may come from non-traditional backgrounds unused to the unwritten rules and contexts of UK HE the chance to get an idea as to where their KU degree can lead them in terms of employment. Currently many students are unsure as what to do once their degree is completed so this database has been created to give those students some guidance as well as potential networking opportunities with culturally appropriate and relevant role models.

Developing teaching approaches to support students in higher education

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The research focus of this study is enable students achieve good skills, featuring the importance of critical thinking for effective learning and take responsibility for their own learning from their prior experience. At the end of the module the students achieve a good learning experience. The particular focus here is to help the weaker students to:

- clarify surface learner's doubts in the lecture theatre (by offering reservation)
- invest time in special clinics
- give more examples and analogies
- encourage by emotional praise despite his/her little contribution

In this regard, the first cycle is developing classroom material and use of VLE resources for outside classroom learning

Figure 1 shows the logistic use of the learning material. The class notes is an ideal way of learning things in a short time. The study material is a supplement and support class learning. It has various advantages, a) acts as impetus for active learning process for a considerable period of classroom time, b) it also enhances their writing skills ([1]; page137) and c) there is evidence the original learning contributes towards long-term retention [2]. However, on the other side, jotting down notes during delivery of lecture, the student will not concentrate on *receptive listening* to the lecture.

Yet, the students are advised to pen down important/unclear points, for future reference and lineate with e-learning material (Fig.1). This means that the students' ability to comprehend will be high and through self-reflection enable them to acquire skills essential for maintaining logbooks, a chronology of working notes for future navigation (Fig.2).

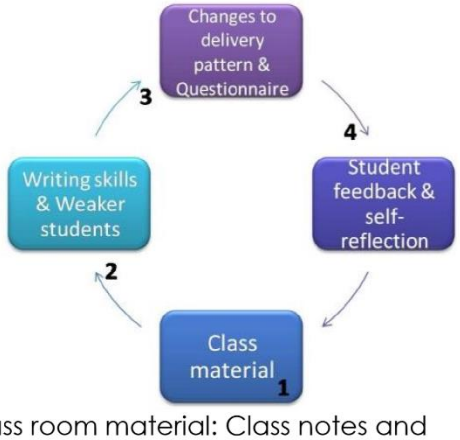

Fig. 1.
Delivering class room material: Class notes and textbooks

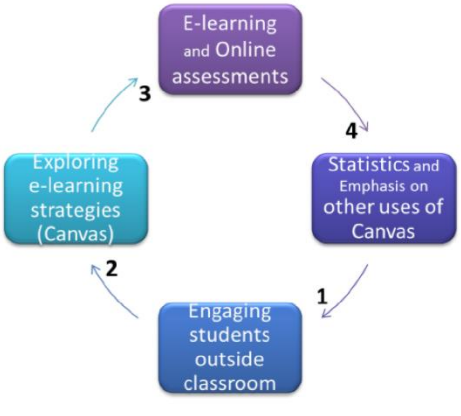

Fig. 2. Cycle-2: Canvas and e-learning

e-learning

It is necessary to know–really–where students can get involved. It is through partnerships. E-learning[1]/[2]Canvas helps with 1. listening and 2. creating space to collaborate, share and make learning more meaningful. In other words, students are leading change through independent

learning. It helps to supplement face-to-face teaching to achieve the learning objectives of the module. It is known also helps engage all students to think, improve their writing skills and work on their e-portfolio. The latter is useful for their employability. Online tutoring benefits those that are shy, international/BME students to raise questions especially if they are lagging behind the more able students [3, 4]. The present authors at AdvanceHE 2018 [5] say that e-learning encourages collaborative learning, and helps synthesize and evaluate ideas. This may be especially true with international students that are used to traditional learning approach. We think that Canvas would not only be a material transfer and interactive tool, but can also be used for professional and innovative activities.

Summarize: with incorporation of this e-learning approach, the students albeit slowly will become more responsible for their own learning.

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[1] This will help students to access updated module information 24x7 and to learn at their own pace.

[2] Canvas is a learning management system, also known as e-learning tool. The positives of this approach:

> *1. It helps manage assessment calendar, all dates from submission of course work to feedback, to access updated module information 24x7 and to learn at their own pace*
>
> *2. Lab ROTA could be managed; schedule appointments with students; can be alerted re non-submission of reports*
>
> *3. Deleted contents can be restored, 2 to 3 months old*
>
> *4. It can help create simple activities. For example, drag and drop of the YouTube URLs into what is called Watch box, although copyright issues has to be addressed.*
>
> *5. Feedback to the students in Rubric is actually a communication with the students*

TEL

Assessing Data Analysis using Screencasting Software

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Abstract

Bioscience students learning about light microscopy at Aston University are asked to **design** and implement **data analysis methods** and **screencast** their process, choices and observations. In this assessment students create an analysis protocol to quantify image data, implement it using software taught in class and process their raw numerical data and create a figure, for interpretation. They then reflect on the process and critique their own method. Students record their voice and computer screen (screencasting) to describe and explain their methodology. This method of assessment delivery is aligned to the assessment type. It teaches students problem solving and design skills, prevents collusion, introduces variety and prepares students for future research projects. Students find this assessment challenging, different to anything they have done previously, and value the problem solving learning experience.

PeerWise: an online platform for high quality peer-learning in a geographically dispersed cohort

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Abstract

To support our students during their study and exam preparation we have developed a novel synoptic revision exercise using the online PeerWise system. Academic staff involvement was passive after introducing the assignment to the cohort via scaffolding activities, thus generating an entirely student-led peer-learning environment for the task. Student engagement exceeded all expectations with high levels of activity and peer-learning occurring over a wide range of topics. We report on a detailed investigation of the quality of the student-generated content, involving two years of data with separate cohorts. The analysis includes classification of the student question type (revised Bloom's taxonomy), investigation of the utility of the feedback/model answers, along with time-resolved analysis of activity during the coursework window. The research seeks to reveal the nature of student behaviour in a peer-review environment and alleviate some of the common concerns held by academics considering moving to this type of activity.

PeerWise registration/access and guidance resources can be found at: http://peerwise.cs.auckland.ac.nz/

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Evaluating the accessibility of an alternative format of module materials in Maths & Stats

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Abstract

The community of Open University disabled students includes those that are blind or visually impaired and rely upon assistive technology, such as screen readers, to access their materials. It is these students for whom this project was primarily developed; in particular, students in this community wishing to study mathematics and statistics modules.

The project was designed to evaluate an alternative format for module materials in Maths & Stats, designed to be used with assistive technology. At the heart of the evaluation was a consultation with the Royal National Institute of Blind People (RNIB).

The consultation took place over two phases: phase 1 was an 'expert assessment', and phase 2 was 'user testing', in which 8 blind users of assistive technology and mathematical qualifications tested the alternative format. The feedback from the users was collected and collated systematically by the RNIB, who took each user through a dedicated 'training' section, followed by a 'task-based' section in which they were asked to explore and interrogate the mathematical content.

The session will cover the motivation for the project, the issues and feedback raised by the two phases, and a demonstration of the output. We will reference our moral, social and legal obligations to our students, including the accessibility requirements for public sector bodies which detail that material should be perceivable, operable, understandable and robust. We will unpack this description in terms of the prototype that we developed and tested, particularly in relation to mathematical content. We will give summaries of the feedback from the participants, and, if appropriate, hint at some of the technicalities of the implementation.

Sustainability

Sustainability: chemistry in context

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Since a Theo Murphy meeting of the Royal Society in 2010,1 development of context-set chemical education in sustainable chemistry has been pursued in two ways.

1. A module for graduating classes in 'Sustainable Chemistry' was introduced in 2011/12. Available teaching resources were limited at that time. A key aspect to encourage context ownership was the inclusion of summative assessment in the form of a team project. The outcomes were a joint report and a team presentation. Peer assessment was included.

2. A new teaching resource has been developed since 2017, aimed at providing the roles of chemical elements.3 The text builds on a base of year 1 chemistry and can provide material for a one-semester. The context is organised in terms of the four spheres of the ancient world: Earth, Air, Fire, and Water; all 118 chemical elements are considered. Two emphases are been maintained.

a. Quantitative aspects are stressed so that understanding, application and assessment of the material can be faithful to physical sciences.
b. The characteristics of elements, and materials, are expanded by context-relevant parameters such as embodied energy, embodied carbon and virtual water. These provide the basis of evaluating chemical aspects of the 'Prospects for planet Earth'.

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3'Elements of a sustainable world', J. Evans, Oxford University Press, 2020.

Interdisciplinary Science and Sustainability

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Abstract
This talk will look at the science of sustainability as a vehicle for introducing interdisciplinarity into HE STEM curricula. The presentation will provide a framework in which this can be achieved. We shall show that looking at sustainability from the perspective of fundamental science necessarily leads to the integration of physical, chemical and biological aspects. Thus, we contend that science from an interdisciplinary perspective is an essential aspect of Education for Sustainable Development (ESD) and hence the need to expose undergraduates to working across disciplines. This can take the form a module to introduce interdisciplinary thinking for students in single discipline programmes or involve students from different programmes interacting across the disciplines.

Biology in the Blender, and other ways of democratising computer generated learning materials.

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Abstract

Free open source software running on standard PCs can produce high quality animations, apps and games to deliver and support STEM and healthcare education. The current emphasis on remote delivery as a response to COVID-19 has highlighted the necessity for effective and engaging electronic teaching/learning materials. Barriers to more widespread adoption are training, motivation and (relatively small) infrastructure costs. We are currently in a golden age of freely available, open source software which matches commercially available alternatives where it matters – in the effectiveness of outputs. With appropriate training, support and access to standard computing facilities anyone in the world can produce innovative and effective educational materials for deployment to the web or to mobile devices. An important consideration for our own collaborative projects is that there should be minimal financial or licensing restrictions, and robust consideration of privacy and data protection; we are interested in developing workflows that can be universally reproducible, including in low income contexts among vulnerable populations (in the UK and globally).

In multidisciplinary degree programmes such as pharmacy there are barriers to engagement relating to the specific subject aptitudes and interests of students: some students will have limited interest in, for example, my area of molecular biology.

We have run pilot projects to co-create materials with undergraduate students to explore whether engagement with complex molecular and cellular biology material can be improved by use of computer generated animations and game-like materials.

With input from representatives of target learner groups we have created and tested a variety of electronic teaching/learning materials including 2D, 3D and 360 animations, 360 video and interactive game-like objects, using only freely available software running on standard computers and deployed to mobile devices, VR headsets and the web. Quantitative and qualitative evaluation of student engagement and retention is ongoing and suggests that there is a clear appetite for this type of material among undergraduate pharmacy students.

We will discuss the advantages and disadvantages of several platforms for use in UK HE and for healthcare education and training in low and middle income countries. The problems we have encountered in producing these materials will be highlighted, and our successful workflows shared.

Day 2 - Thursday 2nd July

Breakout Session - Day 2 (9:30 - 10:30*)

Student Support

Personal Tutor Scheme: students' expectations and perception

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Abstract

Due to the more recent move to massification in the Higher Education (HE) sector, there has been an emerging necessity for supporting all students, especially those non-traditional students who are increasingly part of the student body. (Mairead, 2002) In the majority of the universities in the UK, this support is offered to students via the Personal Tutor Scheme (PTS), in which many institutions have invested time and resources. The personal tutor is a key point of reference for students during their time at University. In the HE sector, PTS are essentially considered an integral part of students' services, which provide support to students in relation to study planning and bureaucratic issues, as well as academic writing and referencing, or CV preparation. Yet, the PTS is delivered by academics, who often concentrate on teaching, to the bad of spending time thinking about their roles as personal tutors and of adopting a more desirable holistic approach to the student.

In an attempt to answer the question: 'Why do students need personal tutors?', Wheeler and Birtle (1993: 3) suggest aspects of the personal tutor system: "the purpose is primarily to provide an anchor on which the support system of the university rests. The personal tutor is needed by all students, including those who enjoy a relatively straightforward passage through university. The existence of this system in itself may reduce student anxiety. Personal tutors also provide assistance for students in need. There is also a welfare component and students may seek advice on a wide range of matters including housing, finance, emotional and relationship problems."

This project aims at seeking the students' view and perceptions of the PTS. Questionnaires will be used as the data collection tool. Over 800 questionnaires are expected to be distributed with an expect response rate of 50%. This project is expect to provide a quantitative evaluation of students' perception and expectations on the PTS. The research outcomes will inform HE providers across the UK about the best approach for PTS scheme that can optimize students' engagement and benefit from the scheme.

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Supporting mathematics and statistics students at a distance from beginning to end

R. Hilliam[1], G. Arrowsmith[2], A. Siddons[2], D. Goldrei[2] and C.Brown[2]

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[2] The Open University

Abstract

The School of Mathematics and Statistics (M&S) at The Open University (OU) is constantly exploring new ways of supporting students outside the 'classroom' environment. Students learn with the OU at a distance and have limited face-to-face opportunities to interact with their peers or their M&S community more generally. This means that embarking on OU study and transitioning between study levels can be particularly challenging for these students.

In order to foster a community and support network, in 2017, the School of Mathematics and Statistics launched a website, the M&S Study Site. This website provides interactive resources which enable student to self-serve module choice advice, revise and refresh content prior to starting study on their chosen module, and make a head start, in a variety of ways, thus supporting the transition both onto their first module and between modules. The support extends to the entire student journey and is based on the Student Experience Practitioner Model (Morgan, 2011). In order to support the transition to further post-graduate study or employment there is a dedicated M&S careers and employability section, jointly produced by the School and the OU careers service, with external support from the Institute of Mathematics and its Application (IMA) and the Royal Statistics Society (RSS).

The resources are backed up by an online forum with the intention of providing wrap around support. Students, academics and student support staff all contribute to the forum, creating a bounded learning community (Wilson et al, 2004). In the forum contributors discuss future study plans, how different modules may help with future careers and what it is like to study the variety of modules on offer. In addition, students provide first-hand feedback on all aspects of the student experience in terms of both current and future curriculum and student support in all its forms.

Analytics have been collected and analysed on how and when students use the different areas of the website. The analysis has provided useful information regarding the points in the year where students most need support. Different methods of directing students to the website are used by the School, including embedded links in student support messages, links from each module website, distributed postcards outlining the site contents, the creation of an M&S newsletter. The analytics show that each of these result in an increase in student usage of the site.

Both students and staff, including the large number of staff who provide support for M&S students, have been surveyed on how they use the site and their opinions of the different resources which will inform future plans for enhancing the website and its promotion.

How Do Mathematics Students Get Motivated to Learn Computer Programming?

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Abstract

Many undergraduate mathematics courses can be supported and enhanced by using computer programming to solve challenging numerical problems that are difficult to do by hand. Mathematics students may learn computer programming as a core part at an early stage of their degree programme of study. However, mathematics student motivations towards learning computer programming have not been paid enough attention to in research.

To evaluate the students' motivations of learning computer programming, a semi-structured interview was conducted with a number of second-year mathematics students who studied computer programming in year two after they had learnt introductory computer programming in year one. The interpretative phenomenological analysis research method was employed to analyse the collected qualitative data.

This presentation reports some findings of students' motivations showing some implications of computer programming on enhancing student learning experience. It will be of interest to those who teach mathematics courses with computational elements, as well as those who are keen users of ICT in their classes.

TEL (*session extended to 10:50)

Technology for Tutorials: Using Digital Learning to Recreate the Conventional Tutorial For Distance Learners

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Abstract
Degree Apprenticeships are a new route to vocational training and higher education which are rapidly growing in popularity.[1] However, despite the numerous advantages that the programme offers to students (developing on-the-job skills whilst working towards a recognised, bachelor or Master's degree without being responsible for universities fees), employers (developing a highly-trained workforce with academic support and expertise) and universities (developing strong networks with industry and expanding its portfolio of teaching programmes to suit a diverse range of learners) there are challenges in aligning the teaching delivery and learning outcomes of distance learners with that of students studying *via* the conventional, full-time route.

One such challenge surrounds academic tutorials. These are an invaluable source of contact time, active learning and formative feedback, which are highly valued by students[2-4] and have a positive impact on academic performance.[2, 5, 6] These learning activities are particularly important in assuring an equal baseline comprehension of year 1 students due to the increased diversity of the student population due to widening participation schemes[7] and the continually growing numbers of international students from all over the globe.[8, 9] They also help students develop a sense of collegiality and a range of transferable skills, such as critical thinking and communication skills. As Degree Apprentices receive an equivalent level qualification as students on conventional degree programmes, it is imperative that they achieve the same learning outcomes and also that they do not lack the community and support that is inherent to on-campus study.

This talk will detail the use of digital technology at the University of Nottingham to ensure that Chemistry Degree Apprentices receive the same high standard of tutorial support as the campus students. It will cover the rationale of approaches taken to overcome differences and challenges of distance learning teaching, the technology used and report experiences of the online tutorials from the perspectives of both teachers and learners. Initial responses have been positive, with students providing constructive feedback to aid in the continued development of the video/digital tutorials. With the correct technology and software, the traditional face-to-face tutorial session can be authentically recreated online, offering the same benefits in terms of community, learning and development.

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Spaced Testing: using software to enhance long-term recall.

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Abstract

Students have a habit of leaving their revision for the week before the exam. While this approach is often successful in the exam, it does not build the lasting memory or deep understanding needed for advanced study in higher education (Kornell and Bjork 2007). There is a large body of evidence to show that spacing practice—self-testing in particular—throughout the term is effective in remedying this situation (Dempster 1989).

This poster showcases the use of a custom-built web app to facilitate students self-testing throughout term time. The app supplies students with a bank of questions for a module and—as each student completes them—it schedules those questions for later review. Questions that the student repeatedly gets right are scheduled for increasingly delayed reviews, while questions that the student struggles with are flagged for practice and immediate review.

The app was made available to 429 physics students on a first-year thermodynamics module across a period of three years (Voice and Stirton 2020). Students were informed about the app through a lecture and use was voluntary—no credits were offered for using the software.

Students' use of the app was compared with their end-of-module exam score. To control for baseline ability and exam technique, an ANCOVA analysis was used to adjust the scores based on previous exam performance. Students who used the app to space questions scored 70% on average, compared to 61% for non-users ($p < 0.0001$); essentially a full classification grade enhancement.

Long-term recall was assessed in an impromptu delayed test after the summer vacation for the final cohort. Students that had engaged in spacing had an adjusted mean score of 45%, while non-users scored 34% ($p = 0.02$). While less material was retained over the summer, this demonstrates the power of spaced testing for improving long-term retention.

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"Blended Tutorials" – Blended Synchronous Learning in Mathematics

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Abstract

"Blended synchronous learning" – singular learning events which take place simultaneously in both the face-to-face and online medium – has attracted some attention in recent years. Bower et al. (2015) point to the potential benefits of such an approach: students who live at a distance, who have caring responsibilities, or who are ill can still participate in face-to-face classes by joining remotely online. However, Bower et al. (2015) also highlight the potential challenges of blended synchronous learning, not least of which the need to design active learning approaches carefully, and the "heightened cognitive load" on the teaching practitioner(s).

In the context of mathematics learning, and in similar symbol-rich disciplines, there are additional technological challenges when it comes to technology-enhanced learning. Representing symbolic calculations in synchronous online conferencing environments can be difficult without the use of specialist software and hardware. As such, there are few examples in the literature of experiments with blended synchronous learning in STEM subjects.

The Open University (OU), an institution with over 50 years of experience of teaching distance learners, typically offers synchronous tuition in the form of either face-to-face tutorials or online tutorials. On modules with low populations of students (especially specialist honours-level modules), teaching time is at a premium. As a result, face-to-face tutorial provision is often patchy and dependent on where tutors are based. Despite this, opportunities for "blended tutorials" are rare and those that do exist lack an evidence-based approach to evaluation.

We present initial findings from a scholarship of teaching and learning project, funded by eSTEeM, the OU centre for STEM pedagogy. Our study involves a pilot of two blended tutorials on the undergraduate honours-level pure mathematics module *M337 Complex Analysis* during the course of its 2019/2020 presentation. Our evaluation strategy uses a mixture of qualitative data – including reflective journals, peer observations, and student interviews. We discuss the effectiveness of a blended synchronous tuition approach, and explore the themes that have emerged from staff and student feedback. Initial results indicate rich points for further discussion: technological, pedagogical, and institutional issues, as well as mathematics- and STEM-specific challenges.

In this session, participants will learn of the barriers and opportunities of using a blended synchronous approach to tuition, with the opportunity to discuss emergent themes. We hope this will inspire participants to engage critically with the issues raised, and reflect on the benefits and challenges of using a similar approach in their own teaching practice.

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The Role of Web Broadcasts to develop Online Learning Communities in STEM Modules: a multiple case study

Venetia Brown, Trevor Collins and Nicholas Braithwaite

Practical science teaching and learning in an online and distance environment can be a challenge due to not being co-located on-site and with the scientific equipment. While interactive screen experiments and remote laboratories can provide practical activities at a distance, there is a need to bring spatially separated students and lecturers together to relate to each other (Lowenthal & Dennen, 2017) and experience science in action (Lambourne, 2007).

To provide this opportunity, the Open University uses interactive web broadcasts to allow students to observe and engage in laboratory and field-based science while promoting a sense of community, interest and engagement. In these live broadcasts, large cohorts of students use synchronous or real-time text-chat and question-and-answer widgets to interact with their lecturer during practical science experiments and demonstrations. Students ask and answer questions through the text-chat, and the collated responses to the widgets are used by the lecturer to check the students' understanding and make decisions regarding the experiments.

This research is adopting a mixed-methods research approach to evaluate how web broadcasts are being used to enhance community building across the STEM disciplines. A pilot study investigated the extent to which the web broadcasts supported learning and influenced students' sense of community. Student questionnaires were administered, and two staff members for two modules interviewed. Findings show most students perceived the web broadcasts as useful to their learning and that the synchronous tools provided an opportunity for student engagement. Open-ended survey responses revealed students found the broadcasts enhanced a sense of community and removed the remoteness of solitary study. Staff interviews revealed lecturers used the broadcasts for different pedagogical purposes; to involve students in an experimental process or to support formative assessments.

Multiple case-studies are being conducted for several STEM modules and will further explore the motivations, online interactions and perspectives of audio-visual production teams, lecturers and students. Descriptions of the planning and production phases will draw upon observational notes and comments from the production team and lecturers. Interaction analysis of the broadcasts and text-chat transcripts will be used to classify lecturer and student behaviours. A thematic analysis of the text-chat will identify the ways students and lecturers interact with each other. Interaction data (i.e. the widgets, system data logs and text-chat transcripts) will be collected to examine student participation. Students' perceptions of the broadcasts and perceived sense of community will be collected through questionnaires. Data will be triangulated with the findings from staff and student focus groups.

The intended outcomes will be to compare results on the effectiveness of interactive broadcasting and develop guidelines and recommendations on the pedagogical and social features supported by web interaction and broadcasting technologies.

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Equality, Diversity and Inclusion (EDI)

Inspiration Leads to Aspiration: Improving Chemistry Literacy for Learners with a low Socio economic status

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Background: Learners from socially deprived backgrounds often experience specific barriers to engagement within an educational context and thus, it is widely recognised that these learners are underrepresented in Higher Education (Gorard & See, 2009). Further research indicates that for these learners there may be multiple barriers to success including low self-esteem and self-efficacy, and there can be a high proportion of 'hard to reach, difficult to influence' students (Gorard, 2010). This carries a social cost for individuals, who have limited earning potential, and a societal cost for an economy that requires a technically skilled workforce. Programmes such as the Royal Society of Chemistry's (RSC) *Chemistry for All* (Chemistry for All, 2019) and the UK Office for Students *National Collaborative Outreach Project* (Office for Students, 2019) are working to understand the barriers to HE for these learners and to provide a strong evidence base of what works to increase confidence and ability to progress into HE.

Objectives: Working with the above programmes, a cross-university team with expertise in Chemistry, Education and Outreach, has developed and delivered a longitudinal suite of enrichment. High-energy, UK curriculum based sessions that engage learners in student centred, hands on activities to enhance their scientific literacy and improve independence and confidence in Chemistry. Through partnerships with local schools, an intensive set of interventions have accompanied students through their educational journey from ages 12 - 16. This talk will illustrate how the interventions were tailored for these learners, aiming to address their particular needs and taking a holistic approach to support the development of essential skills whilst building Chemistry knowledge. Immersive experience days at the University gave opportunities to meet with student advocates to dissolve the mystique of University Life and address social barriers. Using a mixed methods approach, evaluation data demonstrates improved chemical literacy, and has gathered teachers' and pupils' views of the impact on attitudes and choices for study and careers.

Discussion and Conclusions: The data shows that student engagement and enjoyment in the interventions was high. The students benefitted from a student-centred ethos where they were empowered to take charge of their own learning. The pedagogical approach was to be inclusive, with learners of all abilities having the opportunity to undertake all tasks, and be supported to do so. The higher attaining learners could work independently, and the less confident students could access support to attempt higher-level challenges. The exposure to student advocates and professionals in their workplace, and the experience of contextualised science which related to careers, improved their understanding of where Chemistry study can lead (Vennix, den Brok, & Taconis, 2018). The longitudinal and intensive nature of the interventions has enhanced direct impact and also contributed to other factors that may support positive social change in the community. In this study, sustained and progressive outreach interventions are more effective than ad hoc single events and could lead to a review of university outreach provision in the future.

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An Investigation into Science Students' Views on Decolonising the Curriculum

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The "decolonising the curriculum" agenda has gained momentum in the UK, led by the National Union of Students' "Why is my curriculum white?" campaign (Hussain, 2015). There are diverse views of what "decolonising the curriculum" means, but most agree it involves a reconsideration of the subject content, who is teaching it, and how it's being taught. To date much of the focus of this initiative has been on disciplines in the Arts and Humanities. One view is that STEM students have been less animated about the agenda and therefore less attention has been paid to it when reviewing the STEM curricula. Nonetheless, if we only teach the work of white men in STEM we marginalise the contributions of others. This can lead to BME students feeling excluded, possibly contributing to the BME attainment gap.

The aim of this project was to explore Science students understanding and views of the decolonising the curriculum agenda. A questionnaire was used to ask the students about whether they had heard of the initiative and whether they thought it is relevant to their science education. Students were then be asked to rate their level of agreement on ten potential actions for decolonising the curriculum based on Schwartz's "theses" (Schwartz, 2018). Students (n >300) on Chemistry, Pharmaceutical Science, Pharmacy, Biomedical Science, Pharmacology, Nutrition and Biological science were surveyed. The presentation will highlight which actions students thought would be the best way to decolonise the curriculum. The results will be analysed for any trends in the responses of students from different ethnic and subject backgrounds. It is hoped that the results will inform the work of curriculum developers.

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'It's our campus': exploring student perceptions of physical space on campus

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Abstract

Feeling that they belong at university impacts on student engagement, retention and participation (Thomas, 2012; Strayhorn, 2012). Belonging is multifaceted, and includes both personal and geographical dimensions (Antonsich, 2010). Being physically present on campus facilitates the development of strong relationships with peers and academic staff. Both have been shown to be important in helping students feel that they belong (Goldring et al, 2018; Kelly & Mulrooney, 2019). The development of strong positive relationships with academic staff is also considered a marker of a high quality education by students (Dicker et al, 2017, 2018). Conversely, given the diversity of student populations in many higher education institutions, it is possible that the nature of the campus space may inadvertently disadvantage or disengage some student groups, by not meeting their needs.

This project explored the student perception of physical space on campus, using a questionnaire and optional workshop, among a diverse student population. Full ethics approval was granted by the Faculty Research Ethics committee. We wanted to explore the extent to which the campus space aligned with students' needs, identify the functions of the campus from their perspective and ascertain what the ideal campus would look like to them. Qualitative and quantitative data was collected, in addition to relevant demographic information. The project is ongoing, but to date responses from over 600 undergraduate students have been collected. Data collation and analysis is ongoing. This workshop will explore the findings of this work, using some of the interactive methodologies used within the focus groups to illustrate how data was gathered.

Intended learning outcomes

At the end of the session, participants will:

- Consider the nature of physical space on campus and how this may facilitate student perceptions of belonging
- Contribute to group-based activities to develop the ideal campus space
- Explore the findings & implications of this project

Layout of workshop

Activity	**Who?**
Brief introduction & background to the project	Presenters
Exploring perceptions about physical space on campus	All; small group activity
What did we find?	Feedback from small groups; presenters will discuss research findings
Building the ideal physical space on campus	All; small group activity
Our findings	Feedback from small groups; presenters will discuss research findings
Pulling it together:: what next?	Presenters

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Breakout Session – Day 2 11:05-12:05

Assessment and Technology Enhanced Learning

Assignment Extensions: How are they used and what is their impact on student success?

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Non-traditional students, such as part-time, mature, distance-learning, commuter or those with disabilities or from a widening participation background typically have substantial other calls on their time in addition to their studies. The implementation of a more flexible approach to deadlines than typically used could be key to enhancing the retention and success of such students, and studies have confirmed the importance of such accommodations to students (Stone, 2019), an increasing degree of expectation that these be provided (Masinter, 2019) and reported positive impacts on student success (Meyers *et* al, 2019; Patton, 2000). At the Open University, it has long been the practice to readily grant short extensions to students, when a suitable reason is given for the request. However, there is a perception that extension use is growing. It has been suggested this could be linked to the OU's changing student demographic and increasing numbers of students studying at full time intensity. Such growth is a concern since the overall impact of extensions on student success is unclear; whilst in some cases extensions are vital to retain students, in others they can impact adversely the student's ability to cope with the remainder of their course.

This project considers students studying the five OU modules available in Life and Health Sciences at Level 2 (second year equivalent). The qualitative component examines how extensions are used; this is being conducted using student-facilitated student focus groups and tutor-facilitated tutor focus groups. The quantitative part involves a statistical analysis of data on extensions and performance for the last two years; this will entail:-

- establishing any relationships between study intensity and extension use and between extension use and success
- identifying problematic clashing demands between modules
- potentially creating a predictive model for student outcomes on these modules based on early scores and extensions.

The intended impacts of the project include informing the university's future policy on extensions, enabling module assessment timings to be modified to reduce clashes, and supporting discussion with students about their choices.

In this short talk we will outline our findings to date and their potential implications, both within the OU and more broadly for the sector.

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Patton M A (2000) The importance of being flexible with assignment deadlines, *Higher Education in Europe* Vol 25 (3) pp 417-423

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Getting real about learning analytics

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Abstract The promotion of educational technology has a tendency to focus on the 'next big thing', often before we have a decent sense of whether or not the last thing delivered as claimed. The pace of scholarship does not always match the pace of technological or organisational innovation. The related approaches of critical realism (e.g. Archer, 1995) and realist evaluation (Pawson & Tilley, 1998, 2005) have emerged as increasingly influential approaches in the study of information systems (e.g. Mingers, 2014) and more recently, educational technology (e.g. Wong et al, 2010). These approaches claim to offer a basis for enabling the identification of underlying mechanisms which lead to particular outcomes in particular contexts. Mechanisms are typically hidden, sensitive to variations between contexts and generate outcomes which might be seen at multiple levels. Identifying such mechanisms may help us transfer learning from our individual projects to a shared body of knowledge, which may be applicable in other situations.

This presentation illustrates the way in which the evaluation of some learning analytics implementations in the Open University STEM Faculty has taken a realist approach (Walker et al, 2019; Olney et al in preparation). We interviewed over 40 tutors and 6 STEM module teams/chairs.

The learning analytics pilots did not demonstrate clear benefits to student retention, generally the primary objective. Tutors had mixed views about the effectiveness of the analytics dashboard, with many reporting inter alia that it did not add significantly to what they already knew about their students, that the interface was clumsy and that the predictive element of the data was opaque and unreliable.

We analysed the interview transcripts from a realist perspective, looking to answer the questions 'what works, for whom, in what context, and why'. We are particularly interested in which mechanisms worked top-down (conditioned by either/both technological and social constraints and opportunities), bottom-up (in which individual actions contribute to wider change or stasis) and at the level of individual's decisions about their own practice. We identified some candidate mechanisms which may explain at least some of the observed outcomes. For example, where dashboard predictions that an individual student was unlikely to submit an assessment repeatedly differed from the tutors' expectations, and the latter were subsequently confirmed, tutors would see decreasing value in routinely checking the dashboard, contributing to a wider pattern of dashboard non-use. Some of the mechanisms we identified may be quite specific to learning analytics but others may have a wider relevance (for example, to other technologies or pedagogic innovations).

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Developing an effective blended learning Interprofessional learning environment for Pharmacy and Dietetic students

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Interprofessional education (IPE) occurs when two or more professions learn with, from and about each other to improve collaboration and the quality of care (CAIPE, 2016). Pharmacy (MPharm) and Dietetic (MNutr) curricula present many IPE opportunities and module commonalities, but face challenges with a significant disproportion in student numbers on different campuses and limited resources.

To inform the learning design, the modules learning outcomes and students prior knowledge were considered to ensure that they were constructively aligned to the learning activities (Biggs, 1996; 1999; 2011). The 7Cs of learning design framework (Conole, 2012) and conversational framework for learning (Laurillard, 1993) considered the diverse learning styles and needs of our students and our course design.

This diverse digital blended learning IPE experience, incorporates an taught lecture with either a nutritional or pharmacology focus on each campus, small group workshops which incorporate one interactive IPE online case study to consolidate students' knowledge and learning by identifying their key management points through peer group discussion. These are shared through the production and upload of a short video clip onto a dietetic/pharmacy VLE.

The group video clips from the other profession are viewed, with students using and developing their reflective practice skills to share their IPE learning, their role and those of other health care professionals in the management of diabetes using a discussion forum and online evaluation to review our effectiveness.

Student feedback has been very positive, with 91.7% agreeing that watching the video clips enabled them to consider other roles, with 60.7% reporting that there were learning points that they hadn't considered.

'As we are trainee dietitian, the pharmacy students brought a new perspective and more information on the medication'

'I think the exercise was very beneficial as I learnt about the Dietetics role. Their input was very helpful to develop my understanding of my role and how the team provides a patient with the best quality care'

This blended learning environment design could be used by others to share knowledge and skills of colleagues, supporting collaborative teaching and learning on common subject areas, which may have traditionally faced barriers and different ways of working.

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Student Support

Comparing belonging across institutions

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Abstract

Sense of belonging is of critical importance for outcomes at all stages of education. Scholars such as Vincent Tinto have shown that belonging is related to engagement and self-confidence, and in turn to achievement and retention of university students. Sadly, belonging can be hard to come by, especially for students from some demographic groups. Ethnic and socioeconomic background, disability, and access to campus have all been shown to interact with sense of belonging.

As part of the national "What Works? student retention and success" programme, Mantz Yorke developed a survey with questions addressing belonging, engagement, and self-confidence. We have used these questions to look at the experience of life sciences students in two different higher education institutions: a Russell Group university in the North of England, and a post-92 university in London. We will use non-parametric statistical tools to analysis the survey data. We will then compare and contrast the results from the two institutions, considering relevant aspects of institutional demographics and culture and their impact on sense of belonging.

(We have been unable to do our analysis yet due to the industrial action and coronavirus, but we will be able to add something to the abstract summarizing our findings for the published abstract book)

The effect of scheduling on optional tutorials

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Abstract

Optional tutorials play a key role in student success. However, with the additional pressures of external commitments on students are the "traditional times" of offering study support the optimal times?

Historically, tutorial support for part time distance learning students has been focussed around geographic location to facilitate face-to-face tutorials. The students would be split into groups based on their physical location and given access to tutorials locally. These tutorials would generally take place during the evening or at weekends to enable students to attend outside of standard working hours. In more recent years the Open University has seen an increase in full time students and a migration in the method of tutorial support to where it is now predominantly given on-line. However, the arrangement of tutorials generally still follow the constraints put in place when location was the determining factor.

Data collected at our institution through student questionnaires and discussions with Associate Lecturers have shown that to effectively provide the tutorial provision required by students, tutorials need to be more closely focused on their academic and pastoral needs and easily accessible. In particular, there is a demand for:

- tutorials during the daytime, in the evenings and weekends;
- tutorials at slower and, to a lesser extent, faster paces;
- tutorials that help students catch up when they have fallen behind and that help when they are ahead;
- tutorials based on specific combinations of concurrent modules.
- tutorials on academic study skills such as typesetting or tackling assessments;
- tutorials on tricky topics;
- tutorials that are recorded.

Following on from the trends in increased availability of mathematical support (Grove et al., 2019) and as a result of our internal data collection, we have piloted a model that focusses on providing different tutorial streams based on, time of day, study speed and study programme, along with some specialist tutorials.

This presentation will focus on the rational for the different tutorial streams and the data collected on tutorial attendance during the programme.

Michael Grove, Tony Croft, Duncan Lawson, The extent and uptake of mathematics support in higher education: results from the 2018 survey, Teaching Mathematics and its

Applications: An International Journal of the IMA, Volume 38,Issue 4, 2019.

Developing Peer advice to Associate lecturers to aid the effective use of indicators to help support students

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Background

Associate Lecturers (ALs) at the Open University look after a group of around twenty students on a course and are responsible for the academic learning and support to those students on that course. The University has always supplied information to the ALs to help them support their students and more recently the University released, electronically, a set of "Early Alert Indicators" about the students to their Als. The Early Alerts Indicators (EAI) are designed to identify students who may be "at risk" of dropping out of their course. The indicators are intended as an information tool for an AL and include predicted probabilities of completing/ passing the module and, also, of the student submitting their next assignment. The EAIs were developed by a technical team who arranged a series of voluntary Adobe Connect sessions to advise ALs what the indicators showed. This project picked up after that point.

Outline

The primary intention was to supplement the formal rather technical approach of the EAI team with the views of a range of ALs and the views of students. Twenty ALs were recruited to use the EAI information in a structure way over a period of three months and then provide advice to their peers. The advice was collated and presented by one of the ALs and it was hoped this would carry a practical credibility to other ALs.

Als were asked to review the EAI data two weeks before an assignment was due and record whether it influenced their decision on whether to contact a student about the up coming assignment or not. The timing of the project enabled us to involve ALs on both October and February presentations of two different courses. This mean that we could consider potential contact before all four assignments on each course.

A concern of ALs is how students would react to a "cold call" from them and so we collected both the subjective views of the ALs in the pilot and requested views from a set of students on one of the courses.

The secondary intention of the project was to provide feedback tot eh technical team for future development.

Evaluation

The qualitative analysis proved to be somewhat easier than expected because of the uniformity of the ALs views. A series of suggestions have been shared with ALs across a range of STEM courses and principal amongst these have been how to use the EAIs's alongside other information and the limited time relevance. Sharing the ALs experience is an ongoing process at AL staff development sessions.

Similarly a number of suggestions have been fed back to the technical team that may help wider adoption of the EAIs. The principal suggestion here is a way to make the process more transparent to the ALs without losing much accuracy.

Active Learning

Can an asynchronous student conference in OpenStudio develop students' critical evaluation skills?

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Abstract

The final year Open University undergraduate module 'Evaluating Contemporary Science' helps students learn, develop and apply important key skills such as evaluation of current science research and communication of these findings to different audiences, along with professional skills such as giving constructive feedback to peers and reflecting on learning practices.

Students take part in an asynchronous online conference using OpenStudio, an online platform for sharing and commenting on content. For the conference they create a poster presentation, using accumulated knowledge to evaluate a contemporary topic in science. This work is developed further for the final module assessment, so participation in the conference can have a significant impact on a student's module grade.

Whilst many students enjoy the conference, it is not clear to what extent they develop (and recognize) deeper critical evaluation skills that focus on the science presented. It is also important to understand how students approach learning through peer-to-peer feedback in an online environment so that student experience and success can be enhanced and best practice in the assessment of such activities can be shared.

Previous studies by Thomas *et al*. (2016) and Kear *et al*. (2016) noted that students enjoyed the visual and social aspects of OpenStudio but lacked confidence giving feedback to peers and were reluctant to critically evaluate each other's work. This reluctance to critique peer work is concerning for educators wishing to promote the known values of active learning (Freeman *et al*., 2014).

Quantitative and qualitative data on the student conference has been collected and analysed. One hundred student posters, randomly selected from 2019's student conference, were evaluated and scored against a Likert scale for evidence of understanding of scientific methodology, comparisons of results and the limitations and benefits of recent research in a contemporary science topic, ie, critical evaluation of the research presented in their posters.

This was complemented by the findings of tutor-led focus groups which discussed perceptions of student engagement and satisfaction with the conference.

From these a number of 'quick fixes' have been identified to help promote student engagement in deeper learning.

In this presentation we will share our findings to date and discuss their potential implications for online synchronous and asynchronous student conferences.

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Social complexities and student agency in engineering design: towards real world problems?

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Abstract
The concept of student 'agency' is important in exploring how learning in higher education prepares students for employment and the wider challenges of their future lives. Agency in the learning context means the degree of control or direction a student has over their learning: for example, can a student decide which strategy to follow to solve a problem, or even which features of a complex, perhaps not entirely solvable problem are the 'best' ones to focus on? Preparing students to cope with scenarios in which they have agency is important, because 'real world problems' do not come packaged with clear instructions, marks breakdowns and learning objectives.

The chemical engineering design project is an example of a learning task where students have a high degree of agency, compared to lecture-based classes where content is relatively constrained by the curriculum. A core part of accreditation requirements (and therefore a major feature in UK chemical engineering degrees), the project involves a complex, open-ended process design, typically contributing a substantial fraction to degree assessment in BEng/MEng degrees.

We study directly how students respond to this high agency learning situation. Using a grounded theory approach to analyse data gathered from extensive student interviews with two recent cohorts at the University of Strathclyde, we identify some key characteristic phenomena which dominate how students cope with the demands of the project. We consider some behavioural factors and even 'moral' beliefs that may drive these responses.

In the Strathclyde design project, students work in groups, over a complete semester, starting with a minimal design brief. Students therefore potentially have substantial agency as to decision-making, problem-solving, group interactions, and so on. We find that students respond to this increased agency with a strong drive toward *constraining* the open-endedness of the scenario. The most simple and direct responses include attempting to source basic constraints from the design brief itself (even to the point of some creative 'reading between the lines') and from the comments of their group's academic supervisor.

More complex constraint searching involves a highly *socially comparative* approach: students constantly share and 'trade' information, look for differences and similarities in approaches to problems, and spontaneously form dynamic groupings, outside their 'official' project groups, around specific technical challenges. Interestingly, students *strategise* sharing and comparing: they sometimes *withhold* information or judge carefully at what stage and in what form to *partially* share.

One notable observed consequence of the comparing approach is that creative ideas are often 'worn down' by students' reluctance to differ from the 'norm': innovation is seen as risky (arguably an intriguing parallel to the oft-bemoaned low-innovation, risk-averse situation of some industry sectors). Intriguingly, a small number of students were observed to isolate themselves from comparison to try to preserve their differences, rather than see their ideas eroded by 'the norm'.

What emerges is a surprisingly socially complex picture of how students cope with a high-agency, high-stakes task. Better understanding of how such projects are really experienced by students should ultimately lead to students better prepared for the challenges of the 'real world'.

Student-led curriculum innovation: Developing graduate attributes whilst supporting student learning

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The MSc programmes in Chemistry and Chemistry with Medicinal Chemistry at the University of Glasgow are one-year programmes comprising of two semesters of lectures and a formal exam followed by a summer research project. PGT students come to the University of Glasgow from very varied backgrounds and with a diverse range of practical knowledge and skills. In preparation for the project work, it is essential that all students have an equitable and balanced level of training.

In this presentation we will describe a student-led project : "Bridging the gap between student and researcher: the development of the Research Skills MSc project module". This project, led by final year undergraduate students, investigated examples of good practice and used this information to create new practical projects that combine aspects of inquiry-based learning and practical skills.

We intend to illustrate how student-led projects can support students' learning and integration, as well as providing the student researchers with an opportunity to develop positive graduate attributes such as work-related learning; problem-solving, collaboration, organisation and communication (e.g sparqs 2019 conference).

This Research Skills module was implemented for the first time in academic year 2018/19. To evaluate its effectiveness, the undergraduate researchers gave the PGT students pre and post module questionnaires and held a focus group to learn about their experiences and needs. The outcomes from this evaluation, which provided valuable feedback for supporting international students in the future, will be discussed.

This project describes a model for student-led curriculum development which is beneficial to those developing as well as those receiving the training. In addition to creating valuable material for supporting PGT students it has given undergraduate researchers exposure to a wide range of transferable skills which will be beneficial in their future careers.

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