



ESTEEM
THE OU CENTRE FOR
STEM PEDAGOGY



The Open
University



The 10th eSTEE M Annual Conference 2021

**STEM Scholarship for a Changing World –
Disruption, Innovation and Impact**

Conference Booklet

30th June – 1st July

Via MS Teams

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PROGRAMME – DAY 1

Wednesday 30th June 2021

Time	Session		Online Room
14.15-14.30	Registration and Coffee Grab a cuppa and have a chat with colleagues before the conference gets underway		Medlar and Juniper
14.30-14.45	Welcome and Introduction Trevor Collins and Mark Jones, eSTeEM Directors		Hub Lecture Theatre
14.45-15.45	Day One Opening Panel Discussion Mark Jones, Diane Butler, Victoria Nicholas and Carlton Wood How has COVID affected Assessment, Tuition and Student Support? The global pandemic has had wide-ranging impact on universities across the world. While The Open University, with our distance learning approach, may have been well-placed to respond to some of the challenges posed by COVID, it is still the case that many aspects of our teaching and student support had to change. In this panel discussion, we will be joined by three of our Associate Deans – Diane Butler (Academic Excellence), Victoria Nicholas (Four Nations and Tuition Delivery) and Carlton Wood (Student Experience) – to reflect on the changes in practice due to the pandemic and the opportunity this provides to question our processes. The panel will discuss how the experiences of the last 18 months are shaping our longer term thinking about assessment, tuition and student support, and the implications this has for Scholarship and Innovation in STEM Higher Education.		Hub Lecture Theatre
15.45-16.00	Break and Posters		Medlar and Juniper
16.00-17.00	Parallel Session A: Short Oral Presentations – Supporting Students		Room A
Chair: Andrew Potter	Anne-Marie Gallen, Mark Jones and Anne Campbell	“...it’s just added to the happiness of the whole experience, just to be able to link up with other people ...”: Do student perceptions and expectations of tuition in groups overlap with those of their tutors?	
	Chris Thomson, Andy Hollyhead and Alexis Lansbury	Perceptions and Plans of the Practice Tutor role in computing apprenticeships	
	Abi Kirk	Encouraging verbal communication in online small-group Maths problem-solving sessions; taking inspiration from individual sessions	
16.00-17.00	Parallel Session B: Short Oral Presentations – Supporting Students		Room B
Chair: Ann Walshe	Cath Brown and Catherine Halliwell	Extensions – how are students using them, and what is their impact?	

	Victoria Murphy, Jo Buxton and Natalie Tegama	Student support during lockdown	
	Katja Rietdorf, Jane Loughlin, Diane Butler, Kate Fox and Lorraine Waters	Two Years of the Early Start Opportunity in S294 – what have they achieved?	
16.00-17.00	Parallel Session C: Workshop/Demonstration – Online/Onscreen STEM Practice		Room C
Session C	David Conway, Janet Hughes and Christine Gardner	Are live virtual visits an effective way of engaging distance learners?	
17.00-17.30	Wine Down Colleagues are invited to bring along their drink of choice and reflect on day one.		Medlar and Juniper
17.30	Close of Day One		

PROGRAMME – DAY 2

Thursday 1st July 2021

Time	Session		Online Room
9.15-9.30	Registration and Coffee Grab a cuppa and have a chat with colleagues before day two of the conference commences		Medlar and Juniper
9.30-10.30	Parallel Session D: Short Orals Presentations – Supporting Students & Equality, Diversity and Inclusion		Room A
Chair: Trevor Collins	Lorraine Waters and Sarah Daniell	Students' perceptions of online tutorials and forums in S294 and/or SK299	
	Laura Dean	Learning and Development Needs of Autistic Adults Studying STEM Subjects via Distance Learning	
	Muriel Sippel and Nicole Lotz	Understanding the mental health attainment gap in Design modules	
9.30-10.30	Parallel Session E: Short Oral Presentations – Supporting Students & Equality, Diversity and Inclusion		Room B
Chair: Nigel Gibson	Hayley Ryder and Toby O'Neil	Through a glass darkly: challenges of making tutorials accessible	
	Helen Jefferis, Frances Chetwynd and Chris Gardner	Cluster tutorials - what do the students think?	
	Andrew Potter, Delyth Tomos and Chris Hughes	Welsh-medium tuition in Level 1 Mathematics/Addysgu Mathemateg Lefel 1 trwy gyfrwng y Gymraeg	
9.30-10.30	Parallel Session F: Workshop/Demonstration – Online/Onscreen STEM Practice		Room C
	Janet Hughes, Ann Walshe, Brendan Murphy and Bobby Law	Remote pair programming	
10.30-10.40	Break and Posters		Medlar and Juniper
10.40-11.40	Parallel Session G: Short Oral Presentations – Supporting Students & Technologies for STEM Learning		Room A
Chair: Sarah Davies	Richard Walker, Sarah Mattingly and Chris Gardner	Remote sighted helper support for visually impaired students: exploring good practice	
	Chris Thomson, Marina Carter and Dave McIntyre	Supporting Apprentice Learners by Evaluating their Study Needs	
	Helen Lockett, Kay Bromley, Kevin Gowans, Claire Richardson and James Smith	A classification scheme for OpenSTEM Labs experiments	
10.40-11.40	Parallel Session H: Short Oral Presentations - Equality, Diversity and Inclusion, Learning Design and Delivery & Technologies for		Room B

STEM Learning			
Chair: Mark Jones	Vaclav Bayer, Martin Hlosta, Miriam Fernandez	Learning Analytics and Fairness: Do Existing Algorithms Serve Everyone Equally?	
	Lesley Boyd	Update on the search for collaborative improvements: using learning networks and learning analytics to drive module improvements in STEM at The Open University	
	Ade Adeliyi, Michel Wermelinger, Karen Kear and Jon Rosewell	Improving the Learning of Programming at a Distance Through Collaborative Coding	
10.40-11.40	Parallel Session I: Workshop/demonstration – Supporting Students		Room C
	Georgy Holden and Rachel Hilliam	Supporting students through their study journey: the use of qualification wide subject websites	
11.40-11.50	Break and Posters		Medlar and Juniper
11.50-12.50	Celebrating the Impact of Scholarship		Hub Lecture Theatre
	<p>Shailey Minocha and Trevor Collins</p> <p>The Scholarship of Teaching and Learning (SoTL) challenges us to critically engage with educational research, systematically investigate our teaching and learning practices, and share our findings for others to review and build upon. In this closing workshop, we will encourage you to consider how scholarship has impacted your teaching and learning and reflect on the processes you instigated to enrich your practice. We will introduce an impact evaluation framework that we developed for SoTL and share a selection of inspiring impact stories to demonstrate how eSTEEeM scholarship projects have enhanced the student experience, improved retention and progression, influenced discipline-based teaching, and facilitated the professional development of project team members. Reflecting on these examples, we will identify some of the environmental and cultural factors that can be barriers and enablers for impact. Through celebrating the ways that scholarship has informed teaching and learning in STEM, we hope this workshop will help identify potential pathways to impact for your scholarship.</p>		
12.50-13.00	eSTEEeM Scholarship Projects of the Year and Best Interactive Poster Presentation Prizes followed by Closing Remarks		Hub Lecture Theatre
13.00	Close		

WELCOME AND INTRODUCTION



Trevor Collins

Welcome to the 10th eSTEEeM Annual Conference: STEM Scholarship for a Changing World – Disruption, Innovation and Impact. The aim of this conference is to bring together the OU STEM scholarship community to disseminate and discuss findings from recent scholarship projects and consider how these can be applied across the curriculum. Our purpose for scholarship is to maximise the success of our students in achieving their objectives and aspirations. This year eSTEEeM is delighted to host the Horizons in STEM Higher Education Conference along with the eSTEEeM Conference. We hope that by aligning these events, colleagues will engage with the national scholarship community and identify synergies across institutions that can inform our teaching and foster further collaboration.

The eSTEEeM Conference programme is an exciting mix of panel discussions, presentations, workshops and posters – showcasing scholarship from colleagues in the STEM Faculty and wider University. Change is one of the few constants in higher education and is the theme for this year’s conference, where we will reflect on the disruption, innovation and impact related to the pandemic and the challenges and opportunities this has brought for our scholarship. We will open the Conference with a panel discussion, where three of our Associate Deans – Diane Butler (Academic Excellence), Victoria Nicholas (Four Nations and Tuition Delivery) and Carlton Wood (Student Experience) – will discuss changes in assessment, tuition and student support, and consider what lessons we can take from them.

We are increasingly being asked to evidence the impact of our scholarship within the University and across the higher education sector. For this reason, we have been working with Shailey Minocha (Scholarship Lead for the School of Computing and Communications) to develop an Impact Evaluation Framework for scholarship. This framework provides us with a set of criteria that can be used to plan for and review the impact of a scholarship project. In the closing Keynote, we will consider how scholarship has informed teaching and discuss examples from eSTEEeM projects using the framework. As well as celebrating the impact of scholarship in STEM, reflecting on the process of developing the framework has enabled us to identify potential barriers to impact and strategies that can facilitate impact.



Mark Jones

The programme includes a rich collection of scholarship focusing on: Supporting Students; Equality, Diversity and Inclusion; Online/Onscreen STEM Practice; Technologies for STEM Learning; and Learning Design and Delivery. To make full use of the online medium, this year we have asked colleagues to record a short voice over to accompany their posters, and all of the conference delegates will be invited to vote for the best poster. We will be announcing the winners of the eSTEEeM Scholarship Project Awards, where prizes will be awarded in two categories, namely: Innovative Approach to

Teaching and Enhancing the Student Experience. The prize winners will be announced at the end of the Conference on the 1st July, following the closing Keynote.

Throughout the parallel sessions, the workshops, poster sessions and breaks, there will be plenty of opportunities for you to join the STEM scholarship discussion and we very much look forward to your contributions. We hope you have an informative, stimulating and enjoyable conference.

Trevor Collins and Mark Jones, eSTEE M Directors

CONFERENCE INFORMATION

Conference Programme

To join the online conference which will take place in Microsoft Teams, please visit the eSTeEM & Co VLE website at the following link – <https://bit.ly/esteem-and-co>. It may be useful to bookmark this page as this is the link you will need throughout the conference. If you become disconnected from a MS Teams call at any time, make your way back to the eSTeEM & Co website to find all the links you need. Please click on the conference programme for the relevant day and select the link for the ‘Medlar and Juniper’ to register.

If you do not already have the Teams app installed on your computer, upon clicking the link you will be asked whether you wish to ‘Download the Windows app’ or ‘Join on the web instead’, we would recommend that you install and use the app version which will allow you access to all of the features within Teams.

Registration and Coffee

Between 14.15-14.30 on Wednesday 30th June and between 9.15 and 9.30 on Thursday 1st July, conference delegates are welcome to grab a cuppa of their choice and meet with other colleagues and have a chat before the conference gets underway.

Session etiquette and networking

We respectfully ask all delegates to mute their microphones and switch off their cameras during the sessions when you are not speaking. You may also wish to set any mobile phones/devices to silent.

Please note: Do not forget to set your status to ‘Do Not Disturb’ in Skype for Business and Teams, especially if you are presenting.

Social Media

You can also get involved with the discussions throughout the conference via Twitter [@OU_eSTeEM](#) using [#eSTeEMConf21](#) [#eSTeEMFringe21](#)

Helpdesk

eSTeEM conference staff will be available throughout the conference to help you with any queries that you may have. There will be a member of staff based in the Medlar and Juniper online room, but they can also be reached by emailing esteem@open.ac.uk.

Conference breaks and wine down

Please feel free to use the Medlar and Juniper room during the coffee/tea breaks as a social space between sessions throughout the conference and don’t forget to join our much-loved wine down session at the end of day one between 17.00 and 17.30, but of course BYOB!

Recording and publicity

Please note that the conference sessions will be recorded and made available as replays via the eSTEEeM Conference website to OU staff shortly after the event. Conference staff may also capture images from the sessions for further dissemination via the eSTEEeM website and social media channels. Audience members are participants in this process. If you have any concerns, please contact esteem@open.ac.uk.

Interactive poster presentations

This year we invited presenters to pre-record an interactive poster presentation up to a maximum of 2 minutes. Recordings are available to watch via the eSTEEeM & Co VLE website <https://bit.ly/esteem-and-co> allowing conference delegates to watch and vote at their leisure.

Voting will close at 11.50 on Thursday 1st July. The winning poster will then be announced at the end of the conference on Thursday 1st July between 12.50-13.00.

eSTEEeM Scholarship Projects of the Year Awards

We will be announcing the 4th eSTEEeM Scholarship Project of the Year Awards which celebrate excellence in eSTEEeM projects. There are two categories that the judging panel were asked to consider – ‘Innovative Approach to Teaching’ and ‘Enhancing the Student Experience’. The winners will be announced at the end of the conference between 12.50-13.00 on Thursday 1st July.

Session changes

We will try to keep any session changes to a minimum but inevitably there may be some last-minute changes or cancellations. Any information about changed or cancelled sessions will be added to the programme on the eSTEEeM & Co VLE website <https://bit.ly/esteem-and-co>.

Feedback

We welcome your feedback. If you have any issues or concerns, please contact a member of the eSTEEeM conference staff. We hope you enjoy the conference.

BOOK OF ABSTRACTS

Day One Opening Panel Discussion

How has COVID affected Assessment, Tuition and Student Support?

Mark Jones, Diane Butler, Victoria Nicholas and Carlton Wood
STEM Faculty

The global pandemic has had wide-ranging impact on universities across the world. While The Open University, with our distance learning approach, may have been well-placed to respond to some of the challenges posed by COVID, it is still the case that many aspects of our teaching and student support had to change. In this panel discussion, we will be joined by three of our Associate Deans – Diane Butler (Academic Excellence), Victoria Nicholas (Four Nations and Tuition Delivery) and Carlton Wood (Student Experience) – to reflect on the changes in practice due to the pandemic and the opportunity this provides to question our processes. The panel will discuss how the experiences of the last 18 months are shaping our longer term thinking about assessment, tuition and student support, and the implications this has for Scholarship and Innovation in STEM Higher Education.

Parallel Session A: Short Oral Presentations – *Supporting Students*

“...it’s just added to the happiness of the whole experience, just to be able to link up with other people ...”: Do student perceptions and expectations of tuition in groups overlap with those of their tutors?

*Anne-Marie Gallen¹, Mark Jones¹ and Anne Campbell²
STEM Faculty¹, Academic Services²*

Five years ago, we asked STEM ALs to talk about their perceptions and expectations around tuition in groups as part of an initial phase of our project investigating Perceptions, Expectations and Experience of Group Tuition.

That work revealed that the tutors shared the following perceptions about group tuition: they saw their role as facilitators not teachers; that they were building student confidence and maintaining motivation within groups; that social interaction/sharing formed the basis of group tuition and was essential to its success; that teaching threshold concepts and developing skills are reasons for students attending tutorials and that collaboration/group work help students develop their skills through peer interaction.

Tutors also shared perceptions that assessment is a key driver for student engagement with tuition within the OU, although they typically prefer tutorials to focus on more on learning. Many ALs saw this disparity as one of the factors leading to lower attendance at tutorials both face to face and online.

But do students’ perceptions and expectations of tuition coincide with those of their tutors? In 2019, having carried out a survey and a set of semi-structured interviews with level 1 STEM students, we started to get a picture of the variety of tuition as experienced by these students. Using textual analysis of the interviews to identify common themes among the transcripts of the interviews we began to see patterns around shared experience and social interactions. Emergent categorisation also reinforced differences identified between students new to study and those continuing their pathways; especially around online versus face to face tuition.

In this presentation we use interview and survey data to better understand the student expectations and experience of tuition. In particular, we are interested in the overlaps and tensions between the ways in which tutors and students perceive tutorials. These areas include student preconceptions of the tutorial experience, the value of a variety of teaching approaches in the context of diverse learning styles, the social function of tutorials and the relationship between assessment and tutorial content.

Perceptions and Plans of the Practice Tutor role in computing apprenticeships

*Chris Thomson, Andy Hollyhead and Alexis Lansbury
STEM Faculty*

Apprentices are a new addition to the OU family of learners. As part of their support we provide a dedicated practice tutor throughout their learning journey whose role includes pastoral and learning support. With our first apprentices in their final and 4th year of study in computing we have explored the perception of their role by the apprentices. 25 apprentices responded to our survey from across the four year-groups. Just under 50% were living with their parents, and the remainder were living with their own families or on their own with just under 30% having a young family themselves. The vast majority reported enjoying their studies, finding assessments interesting and receiving high quality support from their practice tutor and employer. They perceived their practice tutor's role to be focused on regular discussion and problem solving, whereas for the OU they provide an important role in managing progression and retention.

Practice tutors chair a regular progress review meeting with the apprentice and their employer. Apprentices recognised that this was to track and check on progress, but also raised that problem solving and planning next steps were important benefits. This resonates with their goals for study which focus on career benefits and the acquisition of knowledge that can be applied in work. The apprentices also highlighted some challenges in understanding the requirements of the university, settling into university study and managing their time effectively.

We are exploring the perceptions of apprentices further in a series of interviews which were carried out in February 2021 and are using this to inform our future plans following the creation of a number of narrative case records and transcribing the interviews for subsequent coding. Our challenge is to take what is working well as a support mechanism for apprentices and introduce a consistent level of progress review and enhancement that will increase retention and learner success, against a background of external reviews by quality assurance bodies, including Ofsted in England, and HEFCW in Wales.

Encouraging verbal communication in online small-group Maths problem-solving sessions; taking inspiration from individual sessions

*Abi Kirk
STEM Faculty*

There is evidence that few students speak in online tutorials. A sequence of studies of OU STEM online tutorials from 2008 to 2016 contributes to this evidence. Though speech did occur in the small-group tutorials at the start of this period, the later studies suggest that by the end of the period the emphasis had moved away from speech, with text chat predominating.

The question of whether students can be encouraged to speak in online tutorials seems particularly pertinent during the current pandemic, when teaching has been transferred online. Many Mathematics lecturers have been providing recorded video lectures, followed by synchronous online sessions of some sort. There is anecdotal evidence that students do speak in online individual support sessions (ISS). This project aims to learn lessons from these and to use them to encourage speech in small-group sessions.

Data has been gathered from Level 2-3 Pure Maths tutors on speech in their ISS. In a survey run in December 2020 tutors were asked for examples of actions taken that had encouraged speech

in ISS, and for suggestions on encouraging speech in group sessions. There were only six responses, but these provide a range of useful suggestions. Additionally, six descriptive logs of ISS were gathered from tutors. They document a range of aspects of the ISS, including any relating to speech by the student.

The free-text responses from the survey have been analysed thematically. This has suggested a number of features to incorporate into the design of future problem-solving sessions. A key theme that emerged was that students would speak when there was a clear benefit to them from this. The intention is to reflect this in the session design. Other elements emerging are small groups and the use of an ice-breaker, possibly involving identifying existing errors in a solution. The latter is an attempt to translate into a mathematical setting the structured spoken activities evident in language tutorials. A number of questions about features of the group session design arise from consideration of sources on language tutorials and also on innovative Mathematics teaching during the pandemic.

The ISS logs by tutors are now being analysed thematically. A number of factors are emerging which appear to influence the interaction, including speech, in the ISS. These include the way the tutor ascertains the student's needs, the way mathematical content is shared visually, and the way the tutor leaves gaps for the student to think or interject. These factors will be used to suggest further elements of the group session design and to attempt to answer the questions mentioned just previously.

Once the session design is complete, a pilot series of group sessions will be run with students on M337 Complex Analysis. These will be evaluated in a range of ways. Feedback will be taken from students and an observer, and the amount and type of speech will be analysed.

Parallel Session B: Short Oral Presentations – Supporting Students

Extensions – how are students using them, and what is their impact?

Cath Brown and Catherine Halliwell
STEM Faculty

Even before the pandemic, there was a perception of a growth in the number of extensions being requested by OU students. In parallel, there have been increasing numbers of students studying at high intensity. This approach was not encouraged historically at the OU, and so the curriculum was not designed to facilitate it; it therefore creates the potential for significant assessment clashes.

This project sought to answer the question “How are students using extensions, and what is the impact on their success”. We used quantitative methods to tackle research questions on the potential link between study intensity and use of extensions and whether significant extension use could legitimately be regarded as a warning of students struggling, whilst a qualitative approach was needed to understand how students are using extensions.

We focused on students taking one or more of five level two, 30 credit Biology and Health Science modules towards their degree in Natural Sciences or Health Sciences. These students would typically take more than one module concurrently, so impacts of assessment clashes seemed likely to be apparent.

We used focus groups to explore both AL and student perceptions of extensions and their use; the facilitators were respectively ALs and students, to promote uninhibited discussion. The views and experiences amongst students were particularly varied; we will present these with an outline of points for consideration for ongoing policy.

The statistical analysis to date has revealed a complex picture. The relationship between study intensity and extension use is far from clear. The impact of extension use on success varies considerably by module; what does this tell us about our module and assessment design? The data also raises the question of whether our approach is serving our disabled students well.

Student support during lockdown

Victoria Murphy, Jo Buxton and Natalie Tegama
WELS Faculty

The COVID-19 related lockdown caused students in higher education across the UK to experience an unprecedented amount of emotional and academic stress as universities closed and moved online. The Open University, while better prepared for non-face-to-face learning than most UK universities, was forced to quickly update its policies and support provisions. This eSTEEeM project explores how OU students used their networks for emotional and academic support during this time, focusing on what role the OU played in those networks.

The project uses mixed-methods social network analysis to compare the experiences of students. In total 16 students will have participated in the study. Initially, students were asked to complete a network map of both their academic and emotional support during lockdown. The students were then interviewed, using their network map as a prompt to discuss their experiences. Network analysis was used to visualise the networks of students and calculate descriptive statistics. Thematic analysis was used to highlight themes that spanned multiple students' experiences. In addition to gathering data on the student perspective, the project held focus groups with STEM ALs and OUSA.

Early results show that students drew on OU contacts for academic support in several ways during lockdown. While the way that lockdown affected students varied greatly, ALs were mentioned by many participants as key forms of support. The student support team and discussion forums were also mentioned as ways in which students reached out when they had questions. During the focus group, OUSA members noted how proactive they had needed to be on discussion forums as students searched for information on the OU's current policies.

Students also mentioned that changing university policies, such as cancelling exams, had been useful and reduced stress. However, during the AL focus group, the policy of providing extensions to students without needing to provide a reason was described as a double-edged sword: it was useful for students but meant that some experienced increased pressure at the end of the module as the effects of multiple extensions compounded. The AL focus group also provided interesting insight into the role that the OU played in providing emotional support. While the students' network maps showed few OU contacts connected to emotional support, some ALs shared stories of supporting students emotionally who had initially come to them with an academic question.

The initial results of this project show the important role that ALs played in providing both academic and emotional support. A common theme across interviews and focus groups was the need for clear, consistent, and transparent communications from the university to all parties. Discussion forums and social media are increasingly becoming avenues that students turn to for information during times of turmoil. The Open University benefited during lockdown from having a large group of dedicated ALs, but also from having active members of the community clarifying questions, such as OUSA. Higher educational institutes should create communication plans in preparation for future unexpected events.

Two Years of the Early Start Opportunity in S294 – what have they achieved?

*Katja Rietdorf, Jane Loughlin, Diane Butler, Kate Fox and Lorraine Waters
STEM Faculty*

The 30 points Cell Biology Module, S294, has completion and pass rates that are lower than Faculty and BoS averages. Revision of the assessment strategy and interventions such as enhanced resit support have led to some improvements in these KPIs but, despite good overall satisfaction rates, students see the module as difficult and demanding.

Since 18J, we have offered an 'Early Start' in S294, to try to help students to consolidate their prior study and gain confidence before embarking on the main programme of study. Registered students can access the module website from early July where all the module materials and activities, though not assessment, are available to them. A team of experienced S294 ALs deliver tutorials covering core topics and skills and support students via an early start forum. The AL-led programme also includes journal clubs to help students gain confidence in preparing and delivering presentations. Resources from the Early Start (forums and tutorial recordings) are accessible for all students beyond the Early Start period.

An evaluation of the 18J and 19J Early Start, supported by eSTEEem, has included quantitative and qualitative analysis of student engagement and perceptions through surveys and interviews with participants, as well as extensive analysis of levels of engagement from forum posts, tutorial attendance and website analytics. Statistical analyses of correlations between engagement and retention / performance have also been performed.

Among those registered during the Early Start period, 46% of students in 18J and 34% in 19J participated in the Early Start to some extent, with participation being highest in tutorials and on the forum. All aspects of support were valued highly by those students who participated in them; however, it is apparent from both surveys and interviews that students primarily see it as an opportunity to get ahead rather than to consolidate or prepare. Whilst students were almost unanimously appreciative of the Early Start opportunity, it was also clear that some felt under pressure to participate and worried that they might be disadvantaged if they did not do so.

In both presentations, students taking part in the Early Start had a significantly higher retention as gauged by both TMA01 submission and completion. They also achieved statistically higher mean final grades in the module in both 18J and 19J. To determine whether stronger performance in prior study was contributing to the apparent improvement in outcomes for Early Start participants, correlations between mean scores from previous modules and engagement and performance in S294 have been examined. Only in 18J did students taking up the Early Start have higher mean results in previously studied modules, indicating that this opportunity does not exclusively attract strong students and that the Early Start potentially improves outcomes for those that engage. We continue this analysis to better understand which students take up the Early Start opportunity and its effect on different student populations.

Parallel Session C: Workshop/Demonstration – Online/Onscreen STEM Practice

Are live virtual visits an effective way of engaging distance learners?

*David Conway¹, Janet Hughes² and Christine Gardner²
Academic Services¹, STEM Faculty²*

Insight visits and field trips have wide ranging benefits to higher education students including reinforcing and expanding upon taught learning (Jakubowski and Marie 2003. Streule and Craig 2016), improved ability to relate theory to practice (Elkins and Elkins 2007), encouragement of social learning (Claiborne et al 2012), increased sense of belonging to a university community (Fedesco et al 2020), influence career planning, increase study motivation and enhance learning enjoyment (Goh and Richie 2011).

Mature students (25 years>) often choose distance learning (DL) due to their personal circumstances and its potential to fit around life priorities (Butcher 2015. Rasheed 2020). However, personal circumstances such as geographical location and disability, as well as time poverty caused by priorities such as employment, can prevent mature DL students from participating in extracurricular activities such as insight visits (Roosmaa and Saar 2006). The inability to engage in visits or trips for many DL students mean they do not have the opportunity to gain from such experiences. This may negatively impact student retention, progression, completion and graduate outcomes (Butcher 2015. Baxter 2019).

Advances in technology mean it's now possible to design and implement live virtual visits which have the potential to produce many of the same benefits as traditional insight visits and field trips. However, the concept of virtual visits has not been fully exploited. Online virtual visits are commonly passive and do not typically provide participants with social learning opportunities. For example, online virtual visits of the Science Museum and National Gallery in London involve use of Google Street View (Science Museum 2021. National Gallery 2021). Through utilising innovative technology and interactive onscreen activities which influence the virtual visit experience, live virtual visits may widen access and participation and provide an alternative method of exposing learners to real world environments.

The Open University School of Computing and Communications (C&C) has over 20,000 students who are located primarily across the UK (Open University 2021). Many C&C students are interested in the work that was completed at Bletchley Park (BP) during World War II and how it relates to present day computing and internet security. C&C student demographic data suggests the majority would find it difficult to visit BP museum in person due to geographical location (Open University 2021). Furthermore, approximately 20% have a declared disability which could further restrict their ability to visit the museum (Open University 2021). Based on student interests and the data, BP museum was a suitable location to investigate the virtual visit concept further.

The aim of this project was to investigate if a live virtual visit to BP Museum using interactive software is an effective way of engaging C&C students and enhancing their experience.

101 students participated in the virtual visit to BP. Results indicated that 42% of students were identified as being in the lowest 50% of the index of multiple deprivation. Participant survey data

revealed that 54% would find it difficult to visit BP in person, yet 100% of students now want to visit BP in person and 100% of students would participate in a relevant future virtual visit.

Results indicate that virtual visits may be an effective way of exposing students to real world environments that they normally would not be able to access in person. Furthermore, virtual visits may be an alternative method of promoting environments as well as a useful recruitment tool.

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Parallel Session D: Short Oral Presentations – Supporting Students & Equality, Diversity and Inclusion

Students' perceptions of online tutorials and forums in S294 and/or SK299

Lorraine Waters and Sarah Daniell
STEM Faculty

Attendance at online tutorials and use of forums by LHCS students continues to be low. In addition, participation in student forums, particularly tutor group forums, tend to be sporadic and linked to essential module-based activities, rather than facilitating a routine means of communication and sharing of ideas. The concern is that students may not access these online resources because of a lack of confidence with using the technology, access to them, and fear of the online classroom environment. Students experiencing poor mental health (for example anxiety) may be particularly sensitive to these issues. Once students opt out of trying to attend synchronous tuition events, this may be a pervading pattern of behaviour throughout their studies. Similarly, students may well be utilising social media such as Facebook, WhatsApp and Twitter for study support instead of module-based forums. Overall, these trends may lead to a lack of engagement with the module and key module resources, as well as practical or collaborative work, affecting retention and students' overall learning experience. It is widely accepted that students who engage more fully and feel a greater sense of community have enhanced learning capabilities and a more fulfilling experience.

This study aims to investigate these issues by asking students studying both S294 and SK299 about their perceptions of these synchronous and asynchronous facilities and the barriers to them being used more extensively. We have used a JISC questionnaire to assess students' perceptions of online tutorials and forums. The survey has focused on understanding attitudes and concerns about use of these resources.

Our Jisc survey was sent to 784 students studying either SK299 and/or S294. From this we received 89 responses (11% response rate), of which 27 declared poor mental health. From our initial findings it seems that students experiencing poor mental health are more likely to use social media platforms to support their studies but are less likely to contact their tutor via forums or use the forums as a source of interaction with fellow students. Students with poor mental health are more likely to make use of online tutorials and tutorial recordings, however, they are more anxious about attending tutorials and being targeted during the sessions. They are also less likely to be up to date with their studies. They are also more likely to either only read or not engage at all with forums. One of the main reasons for students not using forums is anxiety about posting (48% of respondents), this was found to be even more so for those students experiencing poor mental health (63% of respondents). The other main reason for not engaging with forums, or attending tutorials, was due to lack of time but this was the case for all students irrespective of their mental health status.

This preliminary data is suggesting that student anxiety is a barrier to engagement with forum use, although this seems to be less of a concern for engagement with online tutorials. We will be exploring these ideas in greater depth through student interviews.

Learning and Development Needs of Autistic Adults Studying STEM Subjects via Distance Learning

Laura Dean
WELS Faculty

Autistic students have distinct needs as aspects of their lived experience which can impact their ability to learn. Autism is related to anxiety and depression (Berthoz et al., 2013) as well as suicide ideation, attempts and deaths (Cassidy et al, 2014, Hirvikoski et al, 2016). All of these issues can create extra general support issues. In addition, autistic graduates' employment outcomes are significantly worse than both disabled and non-disabled peers at 36 % in comparison 51 % and 58 % respectively (AGCAS, 2017). Autistic students have been found to experience organisational problems, especially time management, inability to self-advocate, sensory overload and social skills problems (Fleischer, 2012; Gelbar, Smith, and Reichow, 2014; Madriaga 2010; Madriaga and Goodley 2010; Taylor 2005). Consequently, this project investigated autistic students learning needs and issues faced whilst studying. These specific difficulties may also encourage more autistic students to engage in courses in the STEM field as there are societal perceptions that these courses provide more definitive answers and are therefore more suitable for autistic thinking. Therefore fourteen, level one autistic students who were studying STEM subjects participated. Semi-structured interviews were used to explore their own perceptions of their needs and descriptions of difficulties. Thematic analysis was used to analyse the generated interview transcripts. Emerging themes included: appreciation for being heard; changes in subject studied; abstract communication issues and understanding of support. Based on the themes a number of recommendations will be presented. These include practical changes in supporting autistic students, structural changes in module creation and suggestions for practicalities in future research with autistic people. The outcomes of this research do not transfer just to students who have an autism diagnosis but also to the estimated 1-1.25 % of people who are on the spectrum: a large portion of learners (Pinborough-Zimmerman et al. 2012; APA, 2013).

Understanding the mental health attainment gap in Design modules

Muriel Sippel and Nicole Lotz
STEM Faculty

An analysis of E&I's attainment gap data (Oct 2019) revealed the priority to address the pass rate gaps for learners with mental health (17.7%) issues, physical disabilities (18.6%) and other disabilities (18.9%). Looking at specific modules in E&I, we noticed that Design students with a Mental Health disability have the worst outcomes across all levels in Design compared to other modules in Engineering & Innovation.

This project is looking at the intersecting factors that impact on mental health students' retention in the Design modules: U101, T217 and T317. The overall methodological approach is experiential, longitudinal, and qualitative. Eight students have been recruited for the mixed method study which includes repeat-interviews and experience samples over a period of 4 months. Students have been interviewed twice during their modules' study to ascertain pinch

points and best practice in retaining them. The interviews were focused on the intersecting factors of discipline (knowledge and skills, coursework, assessment), personal circumstances (work and family, caring commitments, life events) and support received during their studies from OU and elsewhere.

In addition to these interviews, an experience sampling 'diary' method has been used to understand the participants thoughts, feelings, behaviours, and environmental factors influencing their study experience in between interviews. Participants have received mobile phone prompts from the interviewer to share their experiences at that moment whilst studying, doing other activities, or preparing for an assignment.

The aim of this project is to gain a deeper understanding of the specific issues experienced by Design students with mental health disabilities throughout their study to derive at recommendations that could inform the learning design of modules in production and the development of positive interventions during presentation of modules to reduce the attainment gap and facilitate progression.

We will present the first insights from the analysis of our empirical data. We will also share our learnings about the approaches we have used to ethically manage sensitive situations for students with mental health disabilities and as support for team members after interviewing students based on the findings from the literature review and our mental health training.

The talk will involve the audience in the following discussion points about:

What do we gain by understanding the cross-sectional aspects of the study experience of design students with mental health disabilities?

How could the insights inform the development and delivery of teaching and learning resources for the Design curriculum and beyond in other subjects?

How can we generate the enablers for students with mental health disabilities to engage with at qualification level, or which enablers can students self-generate to engage the rest of the qualification and minimise the effect of the known barriers?

Is the methodology we are using suitable for different research teams to use when working with disadvantaged groups at the OU (other disability, ethnic background, low socio-economic background)?

Parallel Session E: Short Oral Presentations – Supporting Students & Equality, Diversity and Inclusion

Through a glass darkly: challenges of making tutorials accessible

Hayley Ryder and Toby O'Neil
STEM Faculty

We use cognitive load theory [S-11] and self-efficacy [B-86] as frameworks to examine the issues raised when considering how to produce accessible recordings of online lectures and tutorials.

For an online tutorial to be considered accessible, it requires at the least some form of transcript or closed captioning together with descriptions of any figures or diagrams included in the session.

Cognitive load theory [S-11] suggests that working memory can only manipulate (and remember) a small number of concepts at any one time. This means that students need to successfully 'chunk' ideas that are made up of many different notions in order to be able to manipulate them effectively. Many disciplines use technical language and notation to facilitate this chunking [H-02]. We discuss the implications of this when considering how to produce transcripts and figure descriptions for online tutorials. We also look at the challenges presented by the dynamic nature of diagrams produced during tutorials as opposed to the static nature of those in textbooks and consider how 'dynamic figure descriptions' might be effectively produced.

Self-efficacy, one of the foundations of motivation, is a belief in one's ability to influence events by acting [B-86] and can be developed vicariously by watching others [B-86]. We discuss the implications of this when considering what to transcript and record during online tutorials. The current Open University policy on recording of online tutorials [OU-20] states that any student Q&A sessions should be unrecorded. This means that someone using only the recordings will have a less effective opportunity to vicariously develop self-efficacy.

We conclude by considering how careful thinking about auditory chunking and dynamic description can be used to measure the effectiveness of speech and diagrams in tutorials in general and show how, by looking through the lens of accessibility requirements, we gain ideas that improve the tutorial experience for all attendees.

Attendees are recommended to have pencil and paper (or tablet and pen) to hand for this session.

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Cluster tutorials - what do the students think?

Helen Jefferis, Frances Chetwynd and Chris Gardner
STEM Faculty

In this project we have been investigating level 1 (TM111) students' views and experiences of online tutorials.

We started with a pilot group of students from 2 regions on the 20D presentation using surveys at the start and end of the 6-month presentation and we are in the middle of getting feedback from a sample of students across the whole 20J cohort. The response rate to the surveys has been good (30% and 17% for the pilot surveys; 29% and 17% for the full cohort) and has provided us with a lot of useful and rich first-hand data. This gives us confidence that we are discovering what a range of students know, or think they know about tutorials at the beginning of the module (and often this is at the very start of their studies). The end of module survey is giving us insight in to how they feel when they reflect on their actual experience of tutorials towards the end of this short module.

Overall this means that we have also have gained some understanding of student behaviour around booking and attending tutorials; when are the best times to run tutorials for students and some ideas of what they look for and have gained from attending tutorials.

Welsh-medium tuition in Level 1 Mathematics/Addysgu Mathemateg Lefel 1 trwy gyfrwng y Gymraeg

Andrew Potter, Delyth Tomos and Chris Hughes
STEM Faculty

Welsh-medium education has attracted increased attention over the past 50 years. Much research has been conducted in secondary and higher education contexts, including the teaching and learning of mathematics in Welsh. However, there is a gap in research which explores the topic of Welsh-medium mathematics tuition in a distance learning context.

A natural first question to ask is: "What are the factors which affect student engagement in a bilingual Welsh/English mathematics distance-learning context?"

For many students, MU123 Discovering Mathematics will be the first OU module they study as part of a range of different study intentions. Some students approach MU123 with a degree of apprehension about their mathematical ability. We have been exploring whether offering

bilingual tutorial sessions, tutor support and a Welsh-language forum is a factor in affecting student engagement on MU123.

This project seeks to explore the experiences of the broad range of Welsh competencies that we assume to exist amongst MU123 students. We will share our initial findings from focus groups, with a view to following up with student interviews.

We hope that the findings of this project will help increase understanding of the factors surrounding student engagement in bilingual distance-learning contexts, on MU123 in future presentations, and for Level 1 study in STEM subjects more generally.

Parallel Session F: Workshop/Demonstration – Online/Onscreen STEM Practice

Remote pair programming

*Janet Hughes, Ann Walshe, Brendan Murphy and Bobby Law
STEM Faculty*

New graduate programmers thrive on communication with their peers in the workplace. In the “new normal” of remote working, these day-to-day physical proximity communications will be reduced, and programmers are more likely to be collaborating remotely. Remote pair programming learned in an education setting offers real employability skills development for our distance learning students.

Our recent eSTEEeM project trialled three methods of OU TM112 student participating in remote pair programming using the Python programming language:

- I. Passively, by watching a video of two experienced tutors pair programming in a face-to-face environment.
- II. Indirectly, by interacting with two experienced tutors who were pair programming “live”, but remotely.
- III. Directly, paired with another student of similar programming experience “live”, using Microsoft Teams.

Results included that students perceived directly pair programming to be helpful for developing their non-technical skills such as communication skills. One student commented: “Having done this exercise, I now think I have points to work on to improve communication”. They also perceived social benefits, even when partnering with a student they had never met, e.g. “Was a great idea. Allowed me to connect on a personal level by chatting socially as well as regarding the task at hand” and “pair programming with an actual student made me feel very connected”. Students had been paired according to previous experience, availability, and any special issues disclosed such as preference for working with someone of the same gender.

Even the indirect participation method had perceived benefits, e.g. “I was programming the solution along with the presenting pair. So it was interesting to see where I started and where they started.” “It was good to see so new faces and hear their questions and comments.”

This workshop will begin with TM112 tutors Brendan Murphy and Bobby Law demonstrating the indirect participation method by live pair programming using Microsoft Teams. The second part of the workshop will invite two volunteers to experience direct pair programming, one with Brendan and one with Bobby. The final part of the workshop will open the event for discussion about the benefits and challenges of remote pair programming for distance learning students.

Parallel Session G: Short Oral Presentations – Supporting Students & Technologies for STEM Learning

Remote sighted helper support for visually impaired students: exploring good practice

Richard Walker, Sarah Mattingly and Chris Gardner
STEM Faculty

Every module has an accessibility guide, and every guide foresees the need for continuous improvement. Here's the passage from TM111. It's the standard form of words.

'The module team is actively exploring how the accessibility of these components can be improved, engaging with third parties to see how the various challenges might be addressed, for the benefit of all users, not just those studying TM111.'

In practice change is difficult and seldom happens. But it can.

The disruption from Covid-19 forced rapid change in the form of remote online support for a group of TM111 students with severe visual disabilities. A sighted helper was recruited via an agency that specialises in non-medical help for students whilst at university. In the past such a helper would have worked with students face-to-face but this became impossible because of the public health emergency.

One of us (Richard Walker) is the accessibility lead for TM11 and was responsible for liaising with the helper, which provided a unique opportunity to observe how visually impaired students cope with learning programming, the kinds of sighted assistance they need, and how this can be delivered remotely.

We captured the support response as it happened, in the form of action research, and documented what worked well or not. Our findings have already allowed us to improve the accessibility of TM111 for visually impaired students in important ways; and are being disseminated to other related modules.

Supporting Apprentice Learners by Evaluating their Study Needs

Chris Thomson, Marina Carter and Dave McIntyre
STEM Faculty

At the Open University (OU) we are still learning about the best way to support our apprentice learners in their module study. Apprentices are provided with 20% of their paid working time for study, which is often during the working day, however to accommodate their study intensity of 90% per year they often also need to study within their own time. The OU's all-inclusive flexible study approach ensures the learners can study whenever is appropriate, but we also provide synchronous tutorials.

In this research we investigated how apprentice learners engage with synchronous online

tutorials and the barriers they face to participation. We used three activities to investigate their engagement. We surveyed and interviewed the learners and used action research to evaluate learner retention in a pilot study.

The survey and interviews highlighted that the apprentice learners valued the online tutorials over face to face due to issues including the ease of access and concerns related to coronavirus. Whilst many learners could attend tutorials on weekday daytimes, not all could. Most could attend in the evenings and one only at weekends. Work and life commitments both prevented engagement with most students joining from home during the pandemic. This diversity is not unlike that seen in our non-apprentice learner cohorts.

Currently apprentice learners are allocated to tutors in the same way as other learners. An initial pilot was undertaken for TT284 20J, to explore the benefits for apprentice learners in being allocated together in the same cluster and in apprentice tutor groups. As these learners are all on the same qualification pathway it was hoped that we can build on a sense of community and that the learners through the cluster forum can benefit from peer support.

For this presentation we had 62 learners which is an increase of more than 50% from the previous presentation. The tutors allocated to these groups also teach on TMXY130 and thus have an understanding and prior knowledge of working with apprentice learners.

The cluster was a large one with 300 learners in total. Alongside the usual Saturday and weeknight tutorials offered in the cluster, daytime tutorials were provided to allow learners to attend while at work as 20% of their work time is allocated to OU study.

An evaluation of the student's tutorial preference was undertaken alongside the monitoring of the use of the cluster forum to establish whether it is beneficial for apprentice learners to be allocated in this way. We will continue to have rising numbers of apprentice learners and as such as an institution we may want to ensure we provide a study framework appropriate for their needs.

A classification scheme for OpenSTEM Labs experiments

*Helen Lockett, Kay Bromley, Kevin Gowans, Claire Richardson and James Smith
STEM Faculty*

The OpenSTEM Labs deliver authentic practical experiences to the Open University's distance learning students in STEM subjects using real time instrumentation, data and equipment for practical enquiries over the internet. We are undertaking an eSTeEM project to understand the breadth of activities, skills and educational outcomes developed in OpenSTEM Labs experiments. In this project, a classification scheme for remote and onscreen experiments is being developed and will be used to create a database of OpenSTEM Labs experiments. The database, once populated, will help us to understand the range of experiments in our labs and will help module teams to search for existing experiments that are relevant to their needs.

Several researchers have developed classification schemes for remote and onscreen laboratories. Zutin et al. (2010) classify online laboratories in terms of laboratory type (remote/ virtual/ hybrid) and experiment type (observation/ fixed/ adaptive) and Orduna et al. (2016) classify of online laboratories in five models: remote laboratories, simulations, datasets, dataset-based simulators and hybrid dataset and reality labs.

Remote and online laboratory experiments have also been classified in terms of their educational outcomes. Mead and Bennett (2011) developed a framework for assessing engineering outcomes building on Bloom's taxonomy. Brinson (2015) classified learning outcomes from remote/ onscreen laboratories using the United States ABET defined technical outcomes for Engineering Accreditation; and Feisel & Rosa (2005) developed a set of 13 learning objectives that can be used to assess the effectiveness of laboratories in distance education.

This paper will review previous classification schemes for remote and online laboratories from the literature and propose a new classification scheme for OpenSTEM Labs activities that includes attributes for both laboratory types and educational outcomes.

Parallel Session H: Short Oral Presentations – Equality, Diversity and Inclusion, Learning Design and Delivery & Technologies for STEM Learning

Learning Analytics and Fairness: Do Existing Algorithms Serve Everyone Equally?

Vaclav Bayer, Martin Hlosta, Miriam Fernandez
STEM Faculty

Systemic inequalities still exist within Higher Education (HE). Reports from Universities UK show a 13% degree-awarding gap for Black, Asian and Minority Ethnic (BAME) students, with similar effects found when comparing students across other protected attributes, such as gender or disability. Degree-awarding gaps in HE translate into socio-economic gaps and further inequalities. For instance, educated people are less dependent on public aid and are more resistant to economic downturns. In line with the UK sector, one of The Open University's (OU) goals to be reached by 2024/2025 academic year is reducing the BAME awarding gap from the existing 31.1% to 11.1%.

In this work, we present a study that analyses whether existing prediction models identifying students at risk of not submitting their assignments (and hence providing early and adequate support to students) do work equally effectively for the majority vs minority groups. These models are currently deployed via OUAlyse in all undergraduate OU modules. We also investigate whether different configurations of these models could enhance their fairness by comparing the results of these configurations with the results of the original model. These configurations include: (i) removing the protected attributes (gender, ethnicity, disability) for model training and (ii) disaggregating data and building individual prediction models for each subgroup (e.g., a specific prediction model for females vs the one for males).

Our experiments, conducted over 35 067 students and evaluated over 403 140 predictions, show that existing prediction models do indeed seem to favour the majority group with their predictions. Among the tested configurations, we observe that creating individual models do harm both the accuracy and fairness of the predictions. On the other hand, removing the protected attributes from model training helps to enhance the fairness of these models for some subgroups.

Our results show that specific configurations of prediction models positively affect accuracy and fairness. Therefore, more extensive research should be conducted to achieve a more general view and understanding of the problem.

Update on the search for collaborative improvements: using learning networks and learning analytics to drive module improvements in STEM at The Open University

Lesley Boyd
WELS Faculty

This presentation provides a final update on a collaborative action research project in LHCS. It is both a funded eSTeEM scholarship and a PhD project and was presented at the eSTeEM and Horizons in STEM conferences in 2019.

The project investigates how technology-enabled learning networks can be used to facilitate a collaborative and equitable problem-solving process, especially amongst geographically separated and disparate practitioners involved in distance learning design and delivery. The research may prove to be of interest in other contexts where practitioners are necessarily separated such as the recent global events of Covid-19.

A learning network is defined in this research as a technology-enabled and structured way of collaboratively learning how to problem-solve and improve, connecting together disparate and geographically scattered practitioners across various contexts and boundaries. Each network participant can contribute their experiences, insights and expertise in order to 'construct' a series of issues or challenges being faced by both students and tutors. Together they can identify, plan and provide evidence for possible improvement actions, and evaluate them afterwards. The emphasis in this type of 'organisational' learning network is on collaborative and equitable participation, and joint ownership of the unfolding improvement process and outcomes from it.

In the first phase of the project, a learning network was hosted in a specially developed VLE (Virtual Learning Environment) site for a Level 2 chemistry module. The tutors were initially asked to supply feedback on Tricky Topics, or aspects of academic work that students consistently find tricky or challenging. They also identified a list of critical issues for students, the module team and learning design. These included incomplete prerequisite knowledge, and pace and volume of material.

In the second phase, a further cycle of collaborative research built on the analysis of the first. Various learning analytics produced by the University were presented as visualisations and interpreted for tutors, to assist in the planning and taking of action. 'Signposting' interventions designed by tutors were implemented and have now been evaluated with students at module end, and during subsequent module delivery. This enables effective support of the current cohort of students with challenges in pace and volume of material.

The project has been able to effectively support the collaborative and equitable identification of issues, and to integrate views on these issues from tutors, the module team and students. The feedback from tutors and students has provided a key part of the evidence for module interventions and adjustments in a Mid-Life Review.

Connecting the theory and practice elements of the project, a new framework has been proposed: ULTIMATE (Using Learning Technology in Making Action-based Transformative Enhancements), which will aid implementation of the approach in other contexts.

A work in progress paper describing the innovative research methodology and initial grounded theory conceptualisation of the improvement process was published at <https://jime.open.ac.uk/articles/10.5334/jime.529/>.

Improving the Learning of Programming at a Distance Through Collaborative Coding

*Ade Adeliyi, Michel Wermelinger, Karen Kear and Jon Rosewell
STEM Faculty*

Pair programming is one of the key aspects of eXtreme Programming (XP), which encourages informal and immediate communication over joint coding work. The technique involves two developers; one developer in a driver role writes the code, controlling the keyboard and mouse and the other developer, the navigator, reviews the code as the driver writes it. There is now a substantial body of evidence in support of improved learning outcomes when pair programming techniques are used in teaching. Despite these proven benefits recorded in collocated classroom settings, students learning to program remotely are yet to benefit. This points to an urgent need for research into how learning can be improved for students learning programming at a distance. This paper explores the requirements for pair programming through a systematic literature review, details of user study undertaken, and future research work.

Parallel Session I: Workshop/Demonstration – Supporting Students

Supporting students through their study journey: the use of qualification wide subject websites

*Georgy Holden and Rachel Hilliam
STEM Faculty*

This workshop will begin with presentations of the findings of two eSTeEM projects, by Rachel Hilliam on the Maths and Stats study site, and by Georgy Holden who examined the use of study sites across STEM.

Using a mixture of qualitative and quantitative research Georgy's study found that usage of study sites and awareness of their existence differs between subjects with some having far greater student engagement than others. It identified issues with students finding and accessing sites, and a lack of time and integration with the main module study materials. The study concluded that the full potential of sites to support the student journey has yet to be realised and made a number of recommendations about the use of the sites and their availability to registrants and also to students not registered for qualifications.

The mathematics and statistics study site is one of the most established in STEM, due to its creation on one of the pilot study sites. Evaluation of this site, using over three years of analytics and student questionnaire have shown that students who use the study site find it extremely valuable and use it on a regular basis. However, many students do not realise the study site exists. In addition, results from a staff questionnaire showed that Educational and Senior Advisors in the Student Support Team regularly use the Study Site during their conversations with students. However, Advisors in SRF and many Associate Lecturers were unaware of the existence of the site. The study concluded with a list of recommendations around the visibility of the study site and staff development.

Using a mix of techniques, the workshop will open up discussion on the findings of both projects to invite participants to consider the student study journey throughout their studies and to look for ways in which this might be better supported and improved.

Closing Workshop

Celebrating the Impact of Scholarship in STEM

Shailey Minocha and Trevor Collins
STEM Faculty

The Scholarship of Teaching and Learning (SoTL) challenges us to critically engage with educational research, systematically investigate our teaching and learning practices, and share our findings for others to review and build upon. In this closing workshop, we will encourage you to consider how scholarship has impacted your teaching and learning and reflect on the processes you instigated to enrich your practice. We will introduce an impact evaluation framework that we developed for SoTL and share a selection of inspiring impact stories to demonstrate how eSTEEeM scholarship projects have enhanced the student experience, improved retention and progression, influenced discipline-based teaching, and facilitated the professional development of project team members. Reflecting on these examples, we will identify some of the environmental and cultural factors that can be barriers and enablers for impact. Through celebrating the ways that scholarship has informed teaching and learning in STEM, we hope this workshop will help identify potential pathways to impact for your scholarship.

INTERACTIVE POSTER PRESENTATIONS

Exploring the extent of maths anxiety amongst students within the STEM faculty at the Open University

Susan Pawley and Sally Organ
STEM Faculty

Maths Anxiety can be described as “an emotion that blocks a person’s reasoning ability when confronted with a mathematical situation” [Spicer 2004]. Unsurprisingly, students with maths anxiety frequently react with avoidance techniques such as delaying study or not studying regularly, putting them at high risk of failure. Whilst maths anxiety has been recognised by academics for over half a century, little work has been done within the Open University to establish its extent within our population, how it is affected by distance learning and what techniques can be used to mitigate its effects.

Our project uses the recognised Maths Anxiety [Betz 1978] and Maths Resilience [Kooken et al 2013] scales augmented with additional questions to investigate factors specific to distance learning together with in-depth interviews to measure the extent of the problem amongst students on core introductory level one modules across STEM.

References:

Betz, Nancy E. (1978). Prevalence, distribution, and correlates of math anxiety in college students. *Journal of Counseling Psychology*, Vol 25(5), 441-448. doi: 10.1037/0022-0167.25.5.441

Kooken, J., Welsh, M., McCoach, D., Johnston-Wilder, S., Lee, C. (2013). Measuring Mathematical Resilience: An application of the construct of resilience to the study of mathematics. Paper presented at national conference of the American Educational Research Association, San Francisco.

CA. Spicer, J. (2004). Resources to combat math anxiety. *Eisenhower National Clearinghouse Focus* 12(12).

See page 43 for poster, visit the [eSTeEM & Co VLE website](#) for the interactive presentation.

Black Student Experience and Attainment: Improving a Level 1 STEM module

Louise MacBrayne, Jennie Bellamy and Elaine McPherson
STEM Faculty

Preliminary data collected for S112 suggests that there is an awarding gap for Black students on S112 when looking at module pass rate. To address this significant problem, this project was designed to help us better understand the problems that exist on S112 with the aim of improving the experience and outcomes for future Black students on S112.

At this preliminary stage the project has two overarching research questions:

- What are the needs of Black students in S112 and barriers in S112 to their study?
- What reasons could be influencing the exam performance of Black students in S112?

The project will start by gathering and analysing S112 data around Black students focusing on the student journey:

TMA and exam scores across presentations, and other factors including study intensity, concurrent/ previous modules, credit transfer, employment status. We hope this will help up to identify pinch points on the module and other factors which we need to further consider when supporting our students.

Subsequently, we plan to run student-led focus groups to identify issues faced by Black students on S112, including issues relating to the revision period and the exam.

It is anticipated than longer-term outcomes will include developed understanding of issues contributing to the awarding gap for Black students. It is hoped this will lead to changes including more inclusive teaching/tuition practice and a positive impact on student experience.

See page 44 for poster, visit the [eSTeEM & Co VLE website](#) for the interactive presentation.

The value to students of drop-in tutorials to support assessment

*Maria Townsend, Wendy Berndt and Emma Champion
STEM Faculty*

Many online tutorials have a structured didactic style and are a top-down approach to learning. For a variety of reasons, the online environment can hinder student active participation. However, students see these online tutorials as valuable but are consuming them in different ways, such as reviewing recordings (Butler, Cook and Hayley-Mirnar, 2018).

This scholarship project is assessing the place for less formal drop-in tutorials to support assessment on U116 (Level 1 core environment module). The approach is bottom-up, where students lead the direction of the tutorial and complement, rather than replace, existing tutorials.

Forty-eight drop-in tutorials are being delivered, and an anonymous poll of student confidence in completing assessment run at the end of each event. As well as this, the students are being surveyed twice to understand how they value the tutorials and their experience of attending them. Student-led focus groups, for students who attend at least one drop-in tutorial, will take place. As well as this, the tutor perspective on delivering the tutorials is being gathered, with the aim of producing a best practice guide for tutors.

The data has not been fully analysed yet, but early results indicate that students are choosing to attend the drop-in tutorials. The vast majority feel more confident about completing their assessment, most would attend drop-in tutorials in the future and would recommend them to other students. Tutors report that most students attend the whole tutorial, rather than asking their question and leaving, and that students mostly use the chat box to ask questions rather than speaking. Early ideas on best practice include managing student questions by dealing with

one aspect of assessment at a time and having a standard set of slides covering common questions, such as referencing and maths examples.

See page 45 for poster, visit the [eSTeEM & Co VLE website](#) for the interactive presentation.

Student co-design of formative assessment for Level 1 Computing & IT students

*Paul Piwek, Simon Savage, Matthew Nelson and Cameron Watkinson
STEM Faculty*

This poster reports on an eSTeEM project in which staff and students co-designed formative assessment quiz questions. We will focus on three components of the work: the co-design activity, evaluation of the activity outputs and experience of the student partners. Firstly, we will describe how we engaged a small group of students in the co-design activity. We will describe both the process and the pitfalls we encountered. Secondly, we will discuss an evaluation of the results of the co-design activity. The questions that were co-designed were used on a subsequent presentation of the module. We collected the quiz question statistics and student feedback on these questions and analysed these data with help from one of the student co-design partners. Finally, we will report on the experience of the co-design process from the students' point of view. This is based on a debriefing session which was moderated by a staff member who was not involved in the original co-design session. This leads us to some more general reflections on co-design of assessment with student partners

See page 46 for poster, visit the [eSTeEM & Co VLE website](#) for the interactive presentation.

Engineering Residential School or Home Experiments; creating a practical experience for students

*Alec Goodyear, Iestyn Jowers, Jan Kowal and Carol Morris
STEM Faculty*

The Covid-19 pandemic has had a significant impact on students working towards an engineering degree who would normally attend compulsory residential schools to undertake laboratory and field work. These schools, usually held at the University of Bath during July and August, had to be cancelled in 2020 and 2021 resulting in 1800 students requiring replacement practical experience. The module teams for T176 and T276 (Engineering, professions, practice and skills 1 and 2) have devised a series of practical activities, which will be delivered to students in the form of an experiment kit for use at home over a six-week period. Students will be supported throughout by Activity tutors who will advise on specific experiments, and Group tutors who will each provide pastoral support for a group of approximately 20 students.

Our project aims to gain a detailed view of student engagement with the practical activities and whether the online support structure has enabled them to complete the activities successfully. We plan to use a variety of tools and methods, from surveys and individual interviews, to data analytics to gather information that will help us identify those aspects of conventional residential schools and home experiments which students and tutors value, and those which present

difficulties. Our final aim is to develop a set of principles for the design and delivery of practical work as a compulsory element of engineering qualifications. Any principles should contribute to maximising student participation and ensuring that the qualifications are accessible to the widest possible group of students.

See page 47 for poster, visit the [eSTeEM & Co VLE website](#) for the interactive presentation.

Establishing the Middle Ground in Support for Both the Student & Tutor Experience

Cathryn Peoples, Richard Foley and Leonor Barroca
STEM Faculty

In response to an identification that some students want more from their tutors, module deferrals and TMA extensions, a personalised programme of support has been offered to Level 3 students of Software Engineering over the last two years. This involves asking students exactly how they want to be supported and providing that. The support can adapt across the academic year, and the expectation is that this is driven by the student.

There have been unexpected situations in both years of offering the support: In both years, it has been a minority of students in the cohort who opt into the support programme. In the first year, it was the more competent students who opted into the programme. In the second year, around the same proportion of students engage with the programme, and they do not form part of the stronger cohort. Interestingly, however, in the first year of running the programme, one student requested several Independent Support Sessions to fulfil their needs, and in the second year of running the programme, one student requested an alternative tutor because they believed they were not receiving enough support. Both students were dissatisfied with the increased support they were receiving, yet both continued to seek further opportunities to respond to their needs.

These experiences have led to thoughts as to how to establish a middle ground:

Some students want 1-to-1 tuition, while other students do not want any tuition. Both situations are less than ideal, one from the perspective that the student experience is reduced (when they are not receiving their desired level of tuition), and the other from the perspective that the tutor experience is affected (when a student is dissatisfied with their student-tutor relationship, and make this known).

The aim of this session is therefore to examine the requirements to provision a middle ground when providing student support, which exploits the benefits of a personalised support programme, yet manages student expectations.

See page 48 for poster, visit the [eSTeEM & Co VLE website](#) for the interactive presentation.

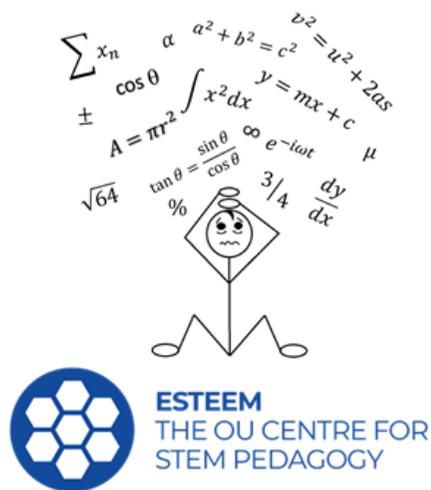
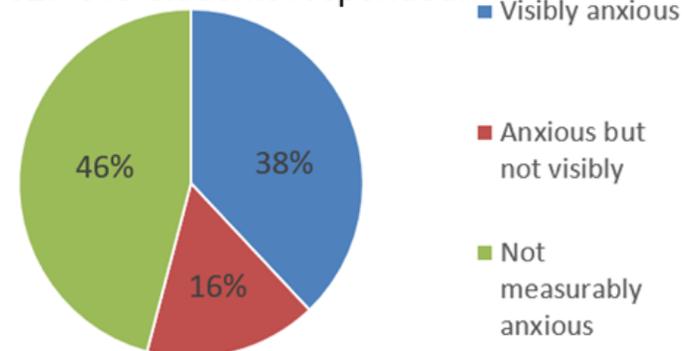
Exploring the extent of maths anxiety within the STEM faculty at the Open University

Susan Pawley, Sally Organ



Aims and Objectives: This project is intended to be the first of several, which will culminate with a STEM-wide program for supporting students with Maths Anxiety. It will identify the extent of maths anxiety within the community of STEM students and aim to identify some underlying reasons for the issues.

Survey Pilot: We piloted the survey on the 21D cohorts of TM111 and T192. 340 students responded.



Project plan Survey students across the level 1 STEM curriculum to establish the extent of maths anxiety within the OU. Conduct interviews to further investigate specific issues.

Outcomes: Highlight the extent of maths anxiety for distance learning students at the start of their studies in STEM.

Future projects: Create practical methods for addressing maths anxiety with a faculty wide program for supporting students, which will feed into additional projects on mental health issues in general.

Poster 2

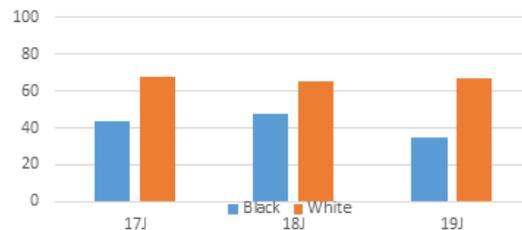
Black student experience on S112: improving a level 1 STEM module

Louise MacBrayne, Jennie Bellamy, Elaine McPherson, Angela Richards

Registrations for Black students in the School of Environment, Earth and Ecosystem Sciences (EEES) are low and currently the majority are studying S112.

Preliminary data collected for S112 suggests that there is an awarding gap for Black students on S112 when looking at module pass rate

S112: Comparison of Pass Rates Black vs White Students



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At this preliminary stage the project has two overarching research questions:

What are the needs of Black students in S112 and barriers in S112 to their study?

What could be influencing the experience and outcomes for Black students in S112?

The project will start by **gathering and analysing S112 data** around Black students and will focus on the student journey:

TMA and exam scores across presentations, and other factors including study intensity, concurrent/ previous modules, credit transfer, employment status, caring responsibility, PEQ, socio-economic status.



AL and student-led focus group (planned September 2021) will focus on identifying issues faced by Black students on S112, including a focus on the revision period leading up to and including the exam.

It is anticipated that **longer-term outcomes** will include developed understanding of the needs of minority students and more inclusive tuition practice.

It is hoped that this will provide a positive impact on students' experiences and success including fostering a greater sense of belonging for the minority student demographic.

We would welcome suggestions for how best to encourage Black student engagement with our project.

The value to students of drop-in tutorials to support assessment on U116 (Level 1 Environment module)

Maria Townsend, Emma Champion, Wendy Berndt



Aims

To develop an understanding of:

1. the value that students attach to drop-in tutorials to support assessment
2. the experience ALs have when facilitating drop-in tutorials.

Tutorial data

1. around 800 individual attendances across 48 drop-in tutorials
2. average attendance per tutorial 17 students
3. 23% students attended at least one tutorial

Anticipated outcomes

1. increased student confidence with assessment
2. inform tuition strategies
3. provide best practice guide for tutors.



Early survey highlights

1. **95%** more confidence in completing assignments
2. **72%** very likely to attend drop-ins in future
3. **68%** very likely to recommend to others
4. **37%** had a preference for their own tutor

Observations from tutorials

1. students mainly use the chat to ask questions
2. students don't drop-in: arrive at the start, stay to the end
3. most students reported increased confidence in assignments.

Tutor reflection

'I confess I was a little doubtful at the outset... But it seems the lack of any formal tutor presentation changes the way students approach the tutorial – a switch from relatively passive consumption to much more active co-production.'



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For one student:

'It is the best hour I spend each month since I have been with the OU.'

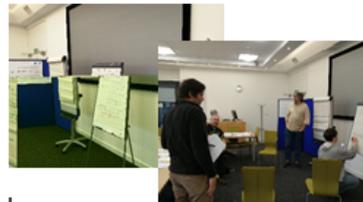


Students as partners in scholarship of teaching and learning

Paul Piwek, Simon Savage, Cameron Watkinson, Matthew Nelson

Aim

The aim of this project was to understand better how to involve students in the design of effective formative quiz questions.



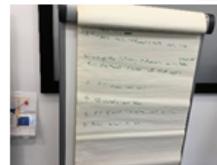
Method

We trialled and evaluated the following approach:

- **Invitation** to circa 30 students. Had to readvertise twice via SRPP. 6 students agreed to participate (5 male, 1 female), but 3 dropped out (2 for personal circumstances, 1 passive withdrawal).
- **Pre-workshop:** Students were asked to review two quiz questions each.
- **Workshop in MK:** 3 teams of 1 student + 1 staff. Revised and drafted new questions, followed by general discussion about OU study.
- **Revision, implementation and use of quiz questions**, for the next presentation of the module (Intro to comp. & IT, TM112).
- **Pre-debriefing:** Stats and feedback (anonymised) on question shared with student partners before the debriefing meeting.
- **Debriefing:** Discussion of questions and evaluation of the co-design approach by students with third-party moderator. *See table with summary*



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What were your expectations?	none/opportunity to help improve quiz questions
Were those expectations met?	Yes. Happy with equality in discussions/partnership.
If you wanted to get students involved in codesigning formative assessment, what would you keep the same/do differently?	Try to involve a more representative sample, including those who struggled.
Was there anything you found challenging in taking part in this project?	Face to face in MK was great/good fun. "online would not have been the same". Pre-workshop work was challenging, being uncertain about expectations.
Was there anything you found exciting/interesting/useful in taking part?	Interesting to see question design process and effort going into it.
Has the experience of taken part in the project impacted your studies in any way (positive or negative)	Learned about designing questions, but no academic value so far, but there may be for Year 3. Enjoyed helping OU and felt proud to be involved.
Now that you have been involved in designing some educational material, can you see other types of material that students could add value to?	There is value in more perspectives. "There will always be things which lecturers just don't see from their one perspective"

Engineering residential school or home experiments? Creating a practical experience for students

Alec Goodyear, Iestyn Jowers, Jan Kowal, Carol Morris



Background

Undergraduate engineering residential schools had to be cancelled due to Covid-19 in 2020 and 2021 resulting in 1800 students requiring replacement practical experience. The module teams for T176 and T276 devised practical activities, delivered to students in the form of experiment kits for use at home over a six-week period.

Student support

A practical engineering website hosts activity notes and resources. Support is provided asynchronously via forums and synchronously using live events and meeting areas. Students are supported by Activity Tutors, advising on specific experiments, and Group Tutors providing pastoral support and team project guidance.



eSTeEM project

Our project aims to gain a detailed view of student engagement with the practical activities and the online support structure. We are using surveys and individual interviews, together with data analytics to gather information that will help us identify those aspects of conventional residential schools and home experiment kits which students and tutors value, and those which present difficulties.

Final aims

Our aim is to develop a set of principles for the design and delivery of practical work as a compulsory element of engineering qualifications. Any principles should contribute to maximising student participation and ensuring that the qualifications are accessible to the widest possible group of students.



With thanks to all colleagues involved with the practical engineering activities



Establishing the Middle Ground in Support for both the Student & Tutor Experience

Dr Cathryn Peoples, Dr Richard Foley, Dr Leonor Barroca

Hypothesis: Offering personalised one-to-one support does not fulfil the needs and expectations of all students.

<p>Student A “Any help is good, I think you’d be silly not to opt in!” “I’m just happy that as a tutor you’ve decided to put on extra support so anything you decide I’m sure will be helpful”</p>	<p>Student B “”</p>	<p>Student Reactions</p>	<p>Student Reaction: The day after not responding immediately to the student, he contacted student support to request an Individual Support Session with me, on the basis that he needed to clarify TMA questions. The request was cc’ed to my Staff Tutor, with an attachment to the email about ‘Respecting Students’. I replied and let Student Support know that I would be able to support the session, and informed them that I had already responded to 58 questions from the student.</p>
<p>Student A Distinction, Grade 2 Pass, Grade 2 Pass, Grade 2 Pass, Pass, Pass, Grade 3 Pass, Distinction</p>	<p>Student B Grade 2 Pass, Distinction, Grade 2 Pass, Grade 2 Pass, Grade 2 Pass, Grade 2 Pass, Distinction, Distinction, Pass</p>	<p>Student Reaction: “He is finding a particular aspect of TMA 2, question 3 quite challenging and has approached his tutor about how to approach this. He feels that although tutor did offer some support to a degree, other queries he has raised have had responses telling him to think differently and this has caused upset.”</p>	
<p>Student Profiles and their Interest in the Programme</p>		<p>Research Questions:</p>	
		<p>What do students think they want?</p>	<p>What do students hear?</p>

