The 4th eSTEeM Annual Conference 2015

STEM Futures: Technology Enhanced Learning in Practice

Conference Booklet

16-17 April 2015

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Mahruk Bailey, eSTEeM Manager, Faculty of Mathematics, Computing and Technology

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Peter Scott, Director, Knowledge Media Institute

Open University colleagues who have participated in the conference

Open University Audio Visual, Events and Catering staff

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16 April 2015

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PROGRAMME – DAY 2

17 April 2015

Time	Session	Venue
9:30 – 10:00	**Registration and Coffee**	**Bay Reception / Medlar and Juniper**
10:00 – 12:30	**"Show & Tell"**	**Hub Lecture Theatre**
	Plenary session with real-time demonstrations of remote experiments for higher education	
12:30 – 13:30	**Lunch**	**Medlar and Juniper**
13:30 – 17:00	**Roundtable discussions**	**Hub Lecture Theatre**
	Places for the roundtable discussions are limited; if you would like to attend please contact a member of the eSTEeM conference team. Priority will be given to those actively engaged in bringing remote experimentation into the curriculum.	
17:00	**Close**	

WELCOME AND INTRODUCTION

This 4th eSTEeM[1] Annual Conference is on the theme of STEM Futures: Technology Enhanced Learning in Practice. The effective use of learning technologies at scale is at the centre of much of eSTEeM's scholarship activity; our portfolio of ongoing and new projects presented at this conference includes work on supporting students, technologies for STEM learning, innovative e-assessment and online/onscreen STEM practice. Our second day is focused specifically on the use of remote experimentation for STEM teaching and learning and we are delighted to welcome an international group of colleagues from a number of prestigious distance teaching universities who will be joining us for this innovative workshop.

The aim of this conference is to highlight recent developments in eSTEeM and also to reflect on the future of STEM-specific teaching and learning. The keynote lectures that punctuate the day will introduce cutting edge research including virtual reality, telepresence and rapid prototyping, technology enhanced fieldwork, labcasts and augmented reality, as well as reflecting on the role of scholarship in increasing the impact of technology enhanced learning.

During the parallel sessions, the workshops, poster sessions and breaks for refreshment there will be plenty of opportunities for joining the STEM scholarship debate and we look forward to your contributions.

We welcome you to our 4th eSTEeM conference and hope you have an informative, stimulating and enjoyable two days.

Nick Braithwaite and Clem Herman, eSTEeM Co-Directors

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[1]*The Faculty of Science and Faculty of Mathematics, Computing and Technology launched eSTEeM in December 2010 to promote innovation, scholarship and enterprise in STEM open and distance learning.*

OPENING KEYNOTE SPEAKERS BIOGRAPHIES

Dr Paul Jones is a Research Fellow within the Operations Excellence Institute at Cranfield University. He is interested in both technical and educational methodologies, and is responsible for the development of the 'Cross-Learning Projects'. He is a Chartered Engineer who has worked in the Industrial Robot, Radar and high-speed telecommunication industries. His academic work includes teaching and research in the field of Nanotechnology, Materials sciences and engineering.

Linda is a Senior Lecturer in Educational Technology at the Institute of Educational Technology at the Open University and Professor of Engineering Education at the Engineering Faculty (LTH) in Lund University in Sweden. She has been researching and promoted pedagogically-driven uses of educational technology in a range of contexts in higher education for almost 20 years. She uses her research and that of others to foster academic practice that promotes student-centred learning and engenders scholarly approaches to teaching and learning with technology. Linda has given national and international keynotes, seminars and workshops on these topics. She has also collaborated with international colleagues on how to promote scholarly practices in teaching and learning, through the Carnegie Academy for the Scholarship of Teaching and Learning (CASTL). Her recent research focuses on investigating and developing models of scholarly practices using technology through understanding academics' conceptions of and approaches to teaching and learning.

CLOSING KEYNOTE SPEAKER BIOGRAPHY

Professor Peter Scott is the Director of the Knowledge Media Institute at the Open University. KMI is a Research and Development Unit, which explores the future of learning. He has a BA & PhD in Psychology. Before joining the Open University in 1995, he taught Psychology & Cognitive Science at the University of Sheffield, with a textbook in each of these subjects. From 2007-10 he was elected founding President of the European Association of Technology Enhanced Learning. From 2008-12 Peter was the coordinator of STELLAR, the EU's 7th Framework Network of Excellence in TEL. Peter's research group in the institute, prototypes the application of new technologies and media to learning. Peter's current research interests range widely across knowledge and media research. Three key threads are: telepresence; streaming media systems; and ubiquity. In June 2008 he coordinated the launch of The Open University in iTunes U, which passed 60 Million international downloads in January 2013.

CONFERENCE INFORMATION

Registration
Conference registration will take place between 8:45 – 9:15 on Thursday 16th April and 9:30 – 10:00 on Friday 17th April in the Bay Reception. There is a map of the campus on the back cover of this booklet; the conference venues can be located at numbers 05 and 06.

At registration you will receive a personalised programme reminding you of the sessions you have registered for.

Helpdesk
A helpdesk will be manned by eSTEeM conference staff in the Bay Reception throughout the day to help you with any queries that you may have.

Conference sessions and recordings
The opening and closing keynote presentations will be recorded and made available as replays soon after the conference via the eSTEeM website.

Some of the sessions may be attended by a journalist or photographer; however this should not cause any disturbance. The video footage and photographs may be made available to the public via the internet. Audience members are participants in this process. If you have any concerns please speak to a member of the eSTEeM conference team.

Session etiquette and electronic equipment
We respectfully ask that all delegates use any personal electronic equipment with respect for session presenters and fellow delegates. We suggest using mobile phones and electronic equipment in silent mode.

Posters and demonstrations
There will be a poster presentation session before lunch between 12:00 – 12:45 in the Hub Lecture Theatre. Posters will continue to be displayed throughout the lunch break and day one of the conference.

Session changes
We will try to keep 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 posted on the notice board by the helpdesk.

Conference refreshments
Conference registration includes tea and coffee on arrival, morning and afternoon tea, and lunch.

GENERAL INFORMATION

Parking and transport

Due to the volume of staff on campus parking spaces can be limited. Therefore, we recommend using the South West, Church or East Parking overspill car parks. Any vehicle clearly parked in an unauthorised location will be issued with a parking charge notice by campus security.

Security

For security purposes, please ensure you wear your conference badge while on campus. If you have any emergency security issues please ring ext 53666 for the security lodge, or contact a member of the eSTEeM conference staff. Please do not leave personal items unattended. The University will not accept liability for loss or damage to personal items or equipment.

Disabled access and elevators

All venues at the Open University have disabled access. Please see a member of eSTEeM conference staff if you require assistance. Please contact us immediately if you have any mobility requirements of which you have not made us aware.

No Smoking Policy

The Open University operates a non-smoking policy. We ask you to respect this policy whilst on campus. All premises are designated smoke-free. Smoking is not allowed in any part of, or entrances to, any building, including bars and eating areas. Smoking whilst on site is only allowed outdoors in designated green areas.

Other queries

eSTEeM conference staff will be glad to help you with any other queries you may have.

Feedback

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

BOOK OF ABSTRACTS

Opening Keynote Presentations

Multi-level learning and the use of technology

Paul Jones
Cranfield University

This talk will introduce some of the work being undertaken within the Operations Excellence Institute at Cranfield University, particularly the use of technology to enhance the learning experience.

In the Operations Excellence Institute a purpose built technology enhanced teaching studio has been built. A jointly funded initiative by HEFCE and Rolls Royce, the Institute has academic partners from Schools, Colleges and Universities within the local region. Within this facility we have been bringing students from the partner institutions together, to work on industrially inspired projects using technologies such as Virtual Reality, telepresence and Rapid Prototyping. The aim of these projects is to give students not only an opportunity to develop team working and communication skills but also to experience working with others from different academic backgrounds, something that they will experience when going into industry.

Using technology in teaching and learning: is it scholarly?

Linda Price
Institute of Educational Technology

As technology is increasingly being used for teaching and learning in higher education, it is important to scrutinise what tangible educational gains are being attained. Are claims about technology transforming learning and teaching in higher education borne out by actual practices? Published accounts of TEL practices show limited evidence of a scholarly approach to university teaching. Frequently, TEL interventions appear to be technology-led rather than responding to identified teaching and learning issues. The crucial role of teachers' differing conceptions of teaching and of the purpose of professional development activities is often ignored. In this presentation I will argue that developing a more scholarly approach among university educators is essential if practices are to be improved to maximise the effectiveness of TEL.

Parallel Session A: Structured Discussion / Briefing – Supporting Students

(17) What do we mean by tuition?

Ann Walshe[1], Anne-Marie Gallen[1], Mark Jones[2] and Anne Campbell[2]
Faculty of Mathematics, Computing and Technology[1], Faculty of Science[2]

Perceptions, Expectations and Experience of Group Tuition: towards a shared understanding amongst stakeholders.

This project is concerned with identifying and developing a common understanding across various stakeholders of good (group) tuition practice in the Open University. Although tuition, and in particular tuition of groups, has always been core to The Open University's teaching model, it is not clear that all stakeholders (students, ALs, central academics, learning & teaching research staff, staff developers) have a common conception of what tuition is for and how it should be conducted. That there should be a clearer understanding of tuition is a matter of particular importance as the University moves to implement a new Group Tuition Policy.

As part of our research we propose to investigate current perceptions of the purpose of (group tuition) amongst Open University ALs and internal staff. We expect that delegates to the conference will have an interest in what makes effective and engaging group tuition, and that they will be able to provide examples of good tuition practice, as well as sharing their perceptions of the purpose of a tutorial. We aim to draw out these perceptions during the session using structured questions which will seed group discussions. We will gather data via post-it notes, flip chart notes and rich pictures

Outline of session:

- initial briefing by facilitators, the background of the project, where we are up to, what we hope to achieve in the session
- small groups to discuss the answers to a set of questions designed to prompt their thoughts.
- each group to draw a rich picture / make post-it notes
- plenary - a representative of each group to explain their rich picture / notes - facilitators to record outcomes
- facilitators to summarise what the main perceptions seem to be and outline how they will take this forward

Participants in this structured discussion will reflect on their current perceptions and take away a richer view of group tuition. Facilitators will gain data to inform the direction of the project.

Parallel Session B: Short Oral Presentations – Technologies for STEM Learning

(2) The potential for the use of smart phones in the teaching of environmental science and environmental engineering

Suresh T. Nesaratnam and Shahram Taherzadeh
Faculty of Mathematics, Computing and Technology

Distance-teaching of environmental science and environmental engineering is an important means of transferring crucial knowledge on environmental protection to vast numbers of students at minimal cost. One of the key aspects of the teaching is the inculcation of practical skills in measurement and monitoring of pollution. These can be achieved through 'Home Experiment Kits' but a more accessible means is through the use of application software or 'apps' on smart phones. Several researchers have documented the use of such apps in the monitoring of noise and air pollution, in a number of countries throughout the world. The rapid rise in ownership of smart phones, especially amongst the young, opens the way to using these devices to supplement teaching.

In our presentation we will outline the kind of work that has taken place with environmental apps and present findings from our study to ascertain the apps available (mostly free of charge). We will also give details of the trialling of a Noise app and a Water app, undertaken at an Open University Engineering Residential School in Bath, and a local School in Milton Keynes, respectively, Plans for future work will also be outlined.

(6) Teaching by Twitter ... let's leak out into the ether

Andrew Smith
Faculty of Mathematics, Computing and Technology

A perceived challenge for many modules at the OU as well as other academic institutions is their external visibility for both attending students as well as those interested in getting an early view of the learning experience. Along with the challenge of creating a pervasive learning experience that extends beyond the confines of our VLE into the realms of technology commonly used by many of our student community. Since the advent of Web2.0 mLearning and social media provide a unique affordance of content availability on a range of free to use open platforms.

The Cisco module team for T216 Cisco Networking have been working on methods to use social media to improve retention and student engagement (Junco et all 2011). Using Twitter, Facebook and LinkedIn as tools to reach

students, deliver condensed content to support core study objectives and attempt to tap into the space beyond our university.
During the 13J and currently on the 14J presentations, sourced content from Cisco Systems (related to the taught content on the module) has been broadcast via social media, interspersed with reminders covering assessment and study weeks. The content has also been fed into the VLE via RSS, to ensure that all non-participating students have fair access.

Students have engaged using social media to ask questions, retweet, like, favourite, share output as well as add their own experiences. Having a typical output of around 1000 updates per nine-month presentation. 14J is a refinement of work from 13J, where student feedback is guiding development and qualitative/quantitative evaluation of the experience during May 15.

The social content, designed to meet module learning outcomes has the long term objective of raising module visibility within an international community of subject matter specialists. Analysis while inaccurate shows around 25%-30% of a 400 student cohort are participating, yet across all platforms there are 700-800 distinct individuals.

Our long term objective for 15J and beyond is to create a seamless experience where social media engagement is seen as a norm of the module experience.

Reference
Junco, R., Heiberger, G., & Loken, E. (2011). The effect of Twitter on college student engagement and grades. Journal of Computer Assisted Learning, 27(2), 119-132. doi:10.1111/j.1365-2729.2010.00387.x

(9) Diverse approaches to using OpenStudio in STEM learning: case studies

Leonor Barroca, Helen Donelan, Karen Kear, Jon Rosewell, and Elaine Thomas
Faculty of Mathematics, Computing and Technology

OpenStudio, developed by the Open University, enables students to create and upload text and audio-visual resources, and to engage in dialogue with their peers, their tutors and their module team around these resources. This presentation reports on the initial work carried out as part of a project that aims to explore the use of OpenStudio in STEM disciplines. The Using OpenStudio in STEM learning project aims to collate information about the ways in which it is already being used in modules, and provide evidence of good practice.

Focussing students' interactions around artefacts created by students themselves and encouraging them to share and discuss their creative

practices is seen as a valuable approach to learning (Lee et al., 2008). In online 'studio' environments students can learn from viewing each other's work, identifying the quality features, giving, receiving, and reflecting on feedback, and comparing their fellow students' work with their own. This is an important part of the process of reflection in action and reflection on action (Schön, 1987). Similarly, students are becoming part of a 'community of practice' (Lave & Wenger, 1991) through participation in a community of learners focussed on a particular task and learning not only from their tutors and the module team but also from their peers.

Theoretical underpinning for the project may be based on concepts such as: the Equivalency Interaction Theorem (Anderson & Garrison, 1998), which concerns the balance between different types of interaction between the student, the teacher and the learning content; and the Conversational Framework (Laurillard, 2002), which provides a model for designing and using learning interactions.

The main research questions for the project are:

1. How is OpenStudio being used in STEM subject teaching across the Open University?
2. How are students using OpenStudio in their learning?
3. How do tutors use OpenStudio to support students in their learning?

At a recent workshop the project team invited module chairs to make a short presentation on how OpenStudio is used in their module in terms of the intended learning outcomes, the design of activities involving OpenStudio and how the learning is assessed (if at all). We found interesting variations in the ways OpenStudio is being used in STEM disciplines such as Design, Engineering, Environmental Technology Management and Computing and IT. The presentations made at the workshop will form the basis of mini case studies to be displayed on the project website. The next stage of the project entails gathering data from students and tutors about their experiences of engaging in learning activities that use OpenStudio.

References

Anderson, T., and Garrison, D.R. (1998). Learning in a networked world: New roles and responsibilities. In C. Gibson (Ed.), Distance Learners in Higher Education. (p. 97-112). Madison, WI.: Atwood Publishing.

Laurillard, D. (2002). Rethinking University Teaching. A conversational framework for the effective use of learning technologies. London: Routledge

Lave, J. & Wenger, E. (1991) Situated Learning: Legitimate Peripheral Participation. Cambridge: Cambridge University Press.

Lee, M. J. W., McLoughlin, C. & Chan, A. (2008) Talk the talk: Learner-generated podcasts as catalysts for knowledge creation'. British Journal of Educational Technology, 39(3) pp501–521.

Schön, D. A. (1987) Educating the Reflective Practitioner. Toward a New Design for Teaching and Learning in the Professions. San Francisco: The Jossey-Bass Higher Education Series.

Parallel Session C: Short Oral Presentations – Innovative Assessment

(18) Paving the Way for a Common Assessment Model

Soraya Kouadri Mostéfaoui
Faculty of Mathematics, Computing and Technology

Project's Background
The T215 common assessment model is a six criterion framework, split between content and presentation, with the flexibility to accommodate a variety of assessment tasks. The model has been used for assessing students' TMAs as well as for self- feedback and evaluation.

Built upon the promising results of our first eSTEeM project in which we investigated how 'hybrid' product-based assessment elements (for example video, PowerPoint presentations, podcasts) are assessed in other OU STEM modules and whether the T215's assessment model could be applied equally in these other contexts. This project investigates the application of the assessment model at a wider (non-OU context) including face-to-face teaching and assessment environments.

Outline of the issues explored and results
In this presentation we will present the initial results of the structured interviews conducted with module teams of modules assessing students' work through alternative media artefacts including robotics experiments and collaborative web page design.

Additionally, the results of the application of the T215's assessment model in the assessment of non-text artefacts produced during the London Big Bang Fair 2013-2014 http://www.thebigbangfair.co.uk/ are presented. These include amongst others, a walking robot, a miniature crane and a solar powered car.

Last but not least, an initial comparative study conducted in order to compare the outcomes of applying the T215 assessment model and the original marking models is presented.

Our initial results show that the T215's assessment approach not only supports the grading and feedback, but also encourages student self-evaluation and performance improvement, and aides the design of new assessment tasks.

It is worth noticing that these are initial results and the applicability of the T215 model is still to be tested in a variety of other contexts in the rest of the project.

(19) How students' use of language relates to learning, retention, and performance in assessment on MCT module TU100 (My digital life)

John Woodthorpe[1] and Nel Boswood[2]
Faculty of Mathematics, Computing and Technology[1], Faculty of Education and Language Studies[2]

The project continues to analyse and describe language and learning on this level one Computing & IT module. In common with many other modules, language and literacy are central to learning on TU100, alongside the more obvious numeracy, programming and information literacy aspects. This is manifest in several ways, including:

- 60% of total TMA marks depend on producing verbal (i.e. written) texts.
- 40% of total TMA marks depend on producing non-verbal outputs (i.e. calculations and computer programming)
- Programming requires significant verbal (i.e. reading) skills to interpret input material and express logical solutions to problems
- Significant amounts of reading are involved in building the knowledge and skills in the learning outcomes of the module.

The following aspects of the work will be described:

TMA Language and Learning Checklist

The project has generated checklists for the first three TU100 TMAs, describing the features of high and low scoring student texts.

These function as both a research tool and a teaching tool, although these two objectives are in some degree of tension. On the one hand, the language descriptions need to be sufficiently refined to be able to capture differences in students' performance. On the other hand, they must not be too detailed or unfamiliar to be used as a teaching tool by subject specialists. Progress is being made in generating different versions of the checklist for these two purposes. There are problems with their length, detail and complexity which arise from the two uses they are being put to. However, the project is moving towards useable language and literacy descriptions.

Language and literacy knowledge displayed by high and low scoring TU100 students

The purposes that students' language and literacy skills serve across these text types comprise a mix of representing technological knowledge, expressing opinion/evaluation/judgement, and reflecting on own practices.

A linguistic analysis of information reports and self-appraisal texts from low scoring TMAs 01-03 has compared them with an earlier analysis of high scoring TMAs 01-03. This is providing details of differences between high scoring and low scoring students' use of language. Broadly speaking, low scoring students' texts show more features that are typical of spoken language than high scoring student texts.

High scoring assignments were characterised by several features, including the following:

1) strong text structure across a wide variety of different text types,
2) more abstract and technical, field-specific language and closer alignment between the language used in the students' assignment texts and in the course material,
3) sensitivity to a range of audiences for different assignment tasks,
4) more reported speech than directly quoted speech.

Reading in TU100

This is the third strand of the project, and is processing data from a whole module survey of reading practices amongst TU100 students in the hope of obtaining insights into reading skills, especially reading into writing strategies, needed to succeed on the module.

(25) Peer Review in e-Assessment: The First Cohort of Students in Science

Payam Rezaie and Nick Adams
Faculty of Science

Peer review is a key a*ssessment for learning* instrument, and an integral component of effective learning and professional development. In SD815 *Contemporary Issues in Brain & Behaviour: Psychosis and Dementia,* peer review has been integrated within formative e-Assessment, and also informs summative assessment. Presented for the first time in 2014, this Science postgraduate module, developed with input from the Social Sciences Faculty, has supported students through a Tutor-Marked Assignment (TMA) activity centred on preparing and narrating a slidecast presentation (using presentation and audio recording software), and engaging in peer review. A new online tool (the VLE-based Moodle Workshop Tool) was used to manage all stages of the process, including submission and allocation of work for review, commenting and returning feedback. Within tutor groups, students

received comments on their narrated slidecast from two peers, and in turn provided comments on work produced by two fellow students against defined assessment criteria used to assess the execution, structure and scholarship of slidecasts submitted. The assessment criteria mirrored those used by examiners in the formal (summative) assessment. Students were asked to provide constructive feedback comments concerning specific aspects of each criteria, against a five-point feedback scale. Tutors acted as overall moderators.

Each student's slidecast was based on a target research paper of their own choosing (approved by their tutor), published in the last three years, within the field of dementia and/or psychosis, demonstrating their ability to critically evaluate and analyse primary research, and to develop, organise and give an oral scientific presentation. Students completed the assignment over a five-week period, supported by supplementary resources (including templates and 'how to' guides), and OU Live sessions provided by the Module Team. The assignment was closely linked to the End of Module Assessment (EMA). At the end of the assignment, students were able to review and reflect on the set of peer review comments they had received, plus overall comments from their tutor, to inform any revisions to their slidecast, before submitting it as Part 1 of the EMA (30% of overall EMA score). A short reflective statement (up to 250 words) on how comments received from peers had impacted on the final submission (helped to revise or improve their presentation), was required. All students who had completed the module by that stage, successfully engaged with the assignment and its associated activities.

As far as we are aware, this postgraduate module, delivered entirely online, is the first in the University to have formally integrated peer review as part e-Assessment, and successfully supported students through use of innovative e-learning technology, to achieve defined learning outcomes, adding significant value to the study experience. Key learning outcomes focused on enhancing cognitive, key, practical, and professional skills (including critical evaluation, reflection, and communication skills to suit purpose and target audience, as well as time management and organisational skills required to function as an independent learner and as part of continued professional development). This presentation will provide an overview of our experience using this approach in e-learning and assessment.

Parallel Session D: Workshop/Demonstration – Technologies for STEM Learning

(30) How students learn in Massive Open Online Courses

Allison Littlejohn
Learning and Teaching Centre/Institute of Educational Technology

The Open University is acknowledged as a world leader in Open Distance Education. The market has been altered by the introduction of Massive Open Online Courses (MOOCs): online course, usually free of charge and open to anyone regardless of their pre-requisite knowledge or qualifications. MOOCs are shifting expectations around the ways in which people can access education. An underlying assumption in the design of MOOCs is that students have the ability to self-regulate their own learning (see Fiedler, this volume). The ability of learners to direct their own learning could trigger a significant shift in the position of the academy in society, therefore it is not surprising that universities want to influence the direction of MOOC development.

MOOC learner experiences have been reported as (largely) positive, emphasising the expansion of learner access and empowerment. However, conflicting perspectives around MOOCs divide education communities and not all education professionals agree the value of MOOCs, voicing concerns around instructional design, quality and accreditation (ibid).

This workshop explores how students learn in MOOCs, drawing on research on two MOOCs offered by Harvard and the University of Washington via the EdX and Coursera platforms. The research was funded by the Bill and Melinda Gates Foundation as part of the MOOC Research Initiative.

Parallel Session E: Short Oral Presentations – Supporting Students/Technologies for STEM Learning

(7) Use of a Moodle Questionnaire on a module website, to gather feedback from students on an online activity they had undertaken

Janet Haresnape
Faculty of Science

An online collaborative tutor group activity based on students' contributions to a wiki in a Level 3 science module (S366 Evolution) was developed in 2009 from an activity which worked well in a face-to-face tutorial setting, which enabled weaker students to work with more able students, to understand a difficult concept in evolution theory. In the online version of the activity, students shared both data and discussion points on a wiki. They drew on both

their data and the discussion on the wiki to answer a TMA question. The aim was to give weaker students an opportunity to build on suggestions from others in order to answer a challenging and complex question, rather as they might have done in face-to-face tutorial activity on which the online activity was based.

A Moodle questionnaire was posted alongside the activity on the module website in 2013, and used to gather information from students on which aspects of the activity had most helped them to engage with it. It was an optional questionnaire, but presented alongside the activity itself, and 31 students completed it, out of 240 who engaged with the activity. The questions were presented using radio buttons, and a Likert scale, as used by Nix and Hall (2015).

The relative importance of different aspects of the activity (its visual appearance, its authentic/practical nature, its collaborative nature, the feeling of responsibility to the group and its leading to a deeper understanding of the topic) was compared for more and less able students. The weaker students (those who gained a grade 3 or 4 pass or fail grade for the module overall) gave a higher importance to certain collaborative aspects of the activity and to the responsibility aspect, and the more able students (those gaining a grade 1 or 2 pass) gave a higher importance to the authentic nature of the activity.

Such Moodle questionnaires offer a quick, simple and inexpensive method for module teams to get rapid feedback on online activities used on their module. Although it tends to be the more engaged students who complete such questionnaires, the data obtained can provide useful insights into students' perceptions of an activity, and in particular, what aspects of it they found most valuable. There are limits on the number of times we can ask individual students to complete questionnaires, but because the questionnaire is optional and is completed at the time of undertaking the activity, it does not have to be included in this count. Moreover, students can be asked if they would be willing to be contacted to discuss their perceptions further and invited to give an email address if they are. This identifies students who could be contacted in future, for example to give telephone interviews. It is appreciated that there may be ethical issues involved in using such methods, and these need to be considered, but such methods do offer great potential for evaluating online activities, and are not currently used by module teams as extensively as they might be.

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(23) Social interaction and peer learning in the Online Design Studio (ODS)

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The Open University's OpenDesignStudio (ODS), also called OpenStudio or Sharespace, has been originally designed along the principles of proximate design studio education. In design studio education, students produce and exhibit physical artefacts in a shared space. A central feature of the studio pedagogy is that students follow the work of their peers' through informal conversations and formal presentations to their tutors and peers. Much research has been carried out to understand the tutor-student relationship within the studio. However, studying how peer interactions contribute to studio learning has been neglected. ODS offers the opportunity to investigate the relation of learner interactions to the learner achievements without a tutor present or with only minimal tutor engagement in the studio. We have analysed ODS data from 457 students in the 13J presentation of the level 1 undergraduate design module U101 Design Thinking. We were interested in several data points and their relations: number of uploads, number of views, number of comments made and study outcome (rank, failure or withdrawal). We have found a strong correlation between the level of engagement, sharing work, viewing others' work and comments made with study results. The more students engaged with ODS the better was their study outcome. We will report and discuss this and other insights we have gained from the statistical analysis of ODS usage. The module set out to facilitate design studio-like learning in an online environment employing innovative technologies to allow students to share their design work with their peers over a distance. The presentation will discuss in how far ODS achieves this goal and we will also consider what can be done to improve the learners' experience in ODS.

(16) 'Before it's too late': early prediction of student failure

Frances Chetwynd, Chris Dobbyn, Helen Jefferis and John Woodthorpe
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In this paper we describe an on-going project in which an Artificial Neural Network (ANN) is used to identify students who are at risk of failing the End of Module Assignment (EMA) on the OU module TU100: My Digital Life, and explore the efficacy of early tutor intervention with these students.

The aims of the project are to explore the following questions:

1. what indicators might distinguish students at risk of narrowly failing the EMA;
2. whether an ANN can be trained to predict such at-risk students;
3. what impact an academic tutor can have in helping students in the at-risk category through to a pass.

Elements of historical student data, known here as predictors, including grades achieved, timeliness of assignment submissions and background factors (e.g. age, gender), were used to train an ANN to predict which of three categories of result a student's EMA would fall into – pass, fail, or at-risk (predicted EMA score of 30 - 50). Further historical data was then presented to the ANN to test the trained network's predictive ability.

Much of the work in creating effective ANNs involves careful preparation of the input data (Lean Yu et al 2007). Our early investigations revealed that the student input data is very noisy; however, by removing anomalous elements, and with the right combination of predictors, we found that an ANN could achieve reasonably accurate categorisation. A number of networks, using different combinations of predictors, were trained. Tested against known results, the best of these was able to successfully predict 56% of students in the at-risk category – the one of most interest.

Live student data (where EMA scores were as yet unknown) from the 14B presentation of TU100 was then presented to the best ANNs, for sorting into the three categories given above. Post module end analysis, demonstrated a success rate of 38% in predicting at-risk students.
Given the influence of motivation on the likelihood of a student persisting (Alarcon and Edwards, 2013; Anderson, 20062), the role of academic staff in promoting motivation cannot be underestimated. Therefore, on the 14B TU100 presentation, tutors were asked to telephone all students that had been categorised as 'at-risk' to discuss progress, (and to attempt also to reach those students predicted to fail). Tutors reported back to the project team on the results of this exercise. Analysis of these reveals that for students categorised as 'at-risk':

EMA Result	**Tutor spoke to student**	**Tutor did not speak to student**
Pass	73%	56%
Offered Resubmission	8%	20%
Failed	13%	20%
Withdrawn	6%	4%

Current work is underway to gather and pre-process live student data for the 14J presentation, to be presented to an improved ANN. Once again, tutors will be asked to contact 'at-risk' students. Further analysis of the 14B cohort results is also on-going.

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Parallel Session F: Workshop / Demonstration – Innovative Assessment

(26) The Moodle Workshop Tool in e-Assessment: Peer Review in Practice

Nick Adams and Payam Rezaie
Faculty of Science

The Moodle Workshop Tool is a new VLE-based tool that has been used in the Science postgraduate module, SD815 Contemporary Issues in Brain & Behaviour: Psychosis and Dementia, to manage all stages of a peer review process including submission and allocation of work for review, commenting and returning feedback. This workshop will provide participants with a practical online demonstration of the use of the Moodle Workshop Tool in e-Assessment.

Parallel Session G: Structured Discussion / Briefing – Technologies for STEM Learning

(28) 3D Multidisciplinary Virtual Field Trip Service: Challenges and Opportunities

Shailey Minocha[1], Steve Tilling[2], Tom Argles[3] and David Burden[4]
Faculty of Mathematics, Computing and Technology[1], Field Studies Council[2], Faculty of Science[3], Daden Ltd[4]

Many physical and virtual field trips are based in a single site for a specific topic (for instance geology, ecology, geography, and environmental science) – similar to how we designed and developed the 3D virtual geology field trip Virtual Skiddaw (https://learn5.open.ac.uk/course/format/sciencelab/section.php?name=skiddaw_1) in The OpenScience Lab (OSL).

However, our evaluations of the OSL's Virtual Skiddaw in the eSTEeM-funded project (http://www.open.ac.uk/about/teaching-and-learning/esteem/projects/themes/teaching-laboratory-practice-online/evaluation-the-openscience-lab's-3d-virtual-skid) and the TSB/Innovate UK-funded 'Design for Impact' project (http://www.daden.co.uk/conc/index.php/trainingscapes/design) have affirmed that this model may limit wider adoption. The evaluations have suggested a more multidisciplinary approach. If the same location or 3D terrain hosted several different strands of learning (in different disciplines such as geology, geography, ecology, environmental science, hydrology, engineering, archaeology), the 3D virtual field trip (VFT) service would be more widely adopted and users would gain much richer experiences.

We are, therefore, proposing the design a 3D multidisciplinary VFT service that features the best innovations and 3D affordances of Virtual Skiddaw (avatar-based environment, multi-user collaboration, immersive landscape, accessibility, combining realistic and non-realistic activities), sited in a new location that offers the potential for multiple learning opportunities in (at least) three or more disciplines. This would derive the maximum benefit from a single location, and increase the potential for adoption across schools and higher education institutions.

In this session, we will first report on the evaluations of OSL's 3D virtual geology field trip and how the evaluations led to the idea of a 3D multi-disciplinary virtual field trip service. Thereafter, we would like to discuss with the participants about the following aspects:

a) their perceptions of the proposed 3D multi-disciplinary virtual field trip service – opportunities for student learning and engagement alongside physical field trips

b) challenges in the design and development of the proposed service
c) how we can integrate formative and summative assessment within 3D virtual field trips
d) what are the challenges in incorporating learning analytics for early interventions by educators?; what are the ethical considerations?

Parallel Session H: Structured Discussion / Briefing – Innovative Assessment

(15) Interactive computer-marked assessment: Where are we now? What have we learned? Where should we go next?

Sally Jordan[1], Frances Chetwynd[2], Tim Hunt[3], Ingrid Nix[4] and Anna Proudfoot[5]
Faculty of Science[1], Faculty of Mathematics, Computing and Technology[2], Information Technology[3], Faculty of Health and Social Care[4], Faculty of Education and Language Studies[5]

Online interactive computer-marked assessment was first introduced into an Open University module (*Maths for Science*) in 2002. Since then, it has been introduced into many other modules, with around 65 OU modules currently using interactive computer-marked assignments (iCMAs) summatively or with thresholding. In addition, there are many uses across the University of formative and diagnostic quizzes, and computer-marked questions are embedded directly into Module websites.

The Open University has taken a leading role in the development of OpenMark and the Moodle Quiz engine, extending the range of question types that can be employed. For example the STACK question type enables the assessment of sophisticated mathematics, by employing a computer algebra system, whilst the Pattern Match question type in Moodle (PMatch in OpenMark) allows free-text short answer questions to be automatically marked. Interactive computer-marked assessment offers the potential to improve the student experience directly and also to provide information (learning analytics) to educators about student engagement and misunderstandings (Chetwynd et al, 2014; Jordan, 2014; Nix & Wyllie, 2011). However, badly designed assignments can have a detrimental effect.

In some parts of the OU, the use of interactive computer-marked assessment is expanding, driven by the philosophy that “little and often” assessment (Gibbs & Simpson, 2004-5) drives learning. Elsewhere, the formal use of interactive computer-marked assessment is being reduced, driven by an anxiety that over-assessment might contribute to poor retention. This structured discussion will explore the issues.

Two recent projects have pointed towards some contradictions between what students report of their engagement with computer-marked assessment

(Comas-Quinn et al, 2014), and the role of cut-off dates in scaffolding learning (Jordan et al, 2014). These are just two results in our growing body of knowledge about the effectiveness of interactive computer-marked assessment, and ways in which we can increase that effectiveness.

This structured discussion will address the above issues and look for answers to the following questions:

- How are iCMAs best used as part of an assessment strategy?
- Can student engagement with iCMAs be enhanced?
- Where next for iCMAs at the OU?

This structured discussion follows on from an open meeting (to be held in March 2015) for those researching student engagement with iCMAs, and opens the discussion to a wider audience.

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Parallel Session I: Short Oral Presentations – Supporting Students

(12) Putting Gender on the Agenda - or why gender should be a threshold concept for STEM educators

Clem Herman[1], Rachel Hilliam[1], Katie Chicot[1], Vic Pearson[2] and Simone Arthur[3]
Faculty of Mathematics, Computing and Technology[1], Faculty of Science[2], University Secretary's Office[3]

During the past two years our STEM departments have been engaged in a deep analysis of gender issues as part of preparing submissions for Athena SWAN and Juno awards. As well as analysing and presenting staffing data and discussing issues to do with career progression, this process has involved collating data about student enrolments, retention and progression, disaggregated by gender. While this data has always been available, this is the first time we have access to detailed analysis of gender patterns and trends across programmes and modules, with some surprising results. Each department produces an action plan as part of the submission and this has resulted in a number of scholarship/ research projects starting up to investigate specific points of attrition and concern.

This paper will present (a) a summary of the findings relating to student gender data from the departments that have completed submissions (b) an outline of the scholarship and research being planned or currently being undertaken as part of the departmental action plans. However, although the data gives us a starting point, it is not just about numbers. To understand why there are fewer women on certain modules and programmes we need to delve deeper. We will argue that gender in STEM should be regarded as a threshold concept for both STEM educators and students. In other words, we all need to understand how gendered assumptions, whether deliberate or unconscious, influence our own work and the behaviour of our students. We also need to understand more widely the gendered cultures within STEM knowledge production and practice that may impact directly on the creation and delivery of our curricula, and our support for students. The process of reflection and engaging with gender issues via Athena SWAN has moved many colleagues into transitional territory where the concept is troublesome and not yet fully understood or integrated into practice (Meyer and Land 2003).

(1) Understanding the tutor's experience of teaching programming on TT284

Chris Douce, Dave McIntyre, Jon Williams
Faculty of Mathematics, Computing and Technology

To gain a thorough understanding about the software that makes 'the web' work, students need to learn about a range of different software systems and technologies. These include database systems, languages that manipulate XML documents, through to client and server-side languages such as Javascript and PHP. It is generally understood that some students can fundamentally struggle when understanding certain aspects of computer programming. Another question is: what are the tutors views and experiences of teaching programming, particularly in instances where students might struggle? This presentation discusses research that aims to understand the experiences of tutors who are tutoring web technology students 'at a distance'. The objective of the research is to learn more about the collective experience of tutors with a view to considering how they and their students could be best supported. Twelve tutors were interviewed as a part of a study. The interviews were transcribed and then subjected to thematic analysis. This short paper presents some initial findings. The results have impact on the development of associate lecturers, types of material that may be useful for students, and the pedagogic design of modules that aim to teach programming.

(24) Mind the Gap: drawing on post-study work experiences for radical pedagogy design

Martin Reynolds
Faculty of Mathematics, Computing and Technology

The presentation reports on the 2nd phase of an eSTEeM project - Building a community of practice and employer engagement to enhance Systems Thinking in Practice. The phase 2 and ongoing phase 3 challenges might be summarised as designing a learning system for transforming the 'threats' of a gap between postgraduate study experiences and post-study work experiences into 'opportunities' for radical pedagogic adaptation and (re)design.

There is perhaps an assumption in postgraduate provision that PG qualified students have the capabilities of applying their PG skills to their workplace. The assumption might be reinforced at the OU where PG students tend to be mature-age and part-time. For some PG courses where the focus is on developing technical skills of, say, software design or environmental technologies, there might be some legitimacy in holding such expectations. With other courses where technical skills-development are supplemented with

the questioning of institutional and professional practices that embed such skills, the assumption that students can effortlessly transfer study skills to the workplace may have less cause for optimism. The gap may not only point to potential systemic failure in pedagogy, but possible potential opportunities for developing alternative models of pedagogy.

One such course where the gap is evident is with the postgraduate suite of qualifications in Systems Thinking in Practice (STiP) launched at the OU in 2010. The success of the course suggest an appetite for systems thinking skills from mature students working in a variety of different sectors ranging from healthcare and education to development, environmental and technology management.

Several questions arise from the challenge of post-study engagement:

1. What conditions are necessary for employers to support their OU students?
2. What are the design criteria for learning systems based on community of practice building and employer engagement?
3. What opportunities might exist for supporting postgraduate students through alumni-mentoring?
4. How might an effective demand-pull marketing environment involving employers, alumni, students and ALs be cultivated to supplement internal OU marketing?

Addressing the gap between study experiences and work experiences might be useful across many areas of postgraduate curriculum development. With attention given to increasing demands for PG provision globally, the OU has a significant suite of under-employed resources in terms of skills and experiences of ALs and alumni working with employers under a variety of challenging and changing situations. The presentation will explore some initial findings from the research.

Parallel Session J: Short Oral Presentations – Online / Onscreen STEM Practice

(21) How Are Virtual Experiments Perceived by Different Science Disciplines? Informing Future Design Through Undergraduate Perspectives

Marcus Brodeur
Faculty of Science

In recent years higher education institutions have been exploring the potential of deploying virtual representations of laboratory facilities for science instruction, but the question remains of how well such online experiments deliver on the benefits typically believed to derive from on-site practical work. Some studies indicate that substituting simulations for specific hands-on investigations does not lead to adverse learning outcomes and indeed a few universities have gone so far as to implement entire labs in fully-realised virtual environments. However, a factor that has received little attention to date is whether students studying different scientific fields would benefit from dissimilar approaches to virtual experiments, and indeed to what extent student perspectives and priorities should inform the design of such investigations.

A large-scale (n=1148) mixed-methods study was undertaken of students in two undergraduate science modules at The Open University, one of Europe's largest distance learning institutions. Both cohorts consisted of students who were required to engage with virtual experiments in the course of their module work, the overall sample representing five broad scientific disciplines (chemistry and analysis; environmental science; geology; health and life sciences; physics and astronomy). Pre- and post-engagement opinions of the online investigations were gauged via multi-stage survey instruments – consisting of Likert-type, ranking, and open-ended questions – followed by module-end interviews and subject-specific focus groups. Basic demographic data and assignment scores were collected for each student in the sample. This permitted us to test hypotheses regarding the impact of sub-group membership on attitudes towards virtual experiments and whether these correlated significantly with assessed outcomes.

Statistical analysis of the quantitative data revealed significant differences in perceptions held between those studying different scientific disciplines, between males and females, between those at different course levels, and between those based within the UK and abroad. Student rationales for these differences were then examined via qualitative data analysis of the free-form survey responses and the interview and focus group transcriptions. Key themes were explored, including the authenticity of the virtual laboratory experience, which social learning modes they considered most relevant for

online practical work, and to what extent these experiments should offer advanced features that would not be possible in a real-world setting.

The results of this study provide useful insights into student perspectives of online labs, and show how the same experiment may be viewed quite differently by those studying in other disciplines. Recommendations are provided for how to tailor specific types of virtual experiments to the expectations and priorities of the intended users and thereby secure improved student engagement and outcomes. Our findings will be of particular interest to the designers of online scientific investigations and to educators who plan to deploy them at the undergraduate level.

(4) Remote laboratories: lessons from the literature

Sarah Davies[1], Elaine Thomas[2] and Steve Walker[2]
Faculty of Science[1], Faculty of Mathematics, Computing and Technology[2]

Boundaries between the digital and material worlds are becoming blurred as the internet increasingly connects us to things as well as people and information. This is relevant to education as initiatives which significantly combine digital and material elements in networks are becoming a reality for Science, Engineering and Technology (SET) learning. We report on the initial findings of a project to carry out a 'state of the art' review of literature into the key themes, opportunities and obstacles that are emerging from the development and use of these 'hybrid' systems in learning. We look at the extent to which this new domain of study is being reported in the literature and investigate the depth of research in this area by going beyond the technologically descriptive to focus on pedagogical and organisational issues raised in the literature.

To identify the state of current research we carried out a systematic search of databases of Science, Engineering and Technology education literature. We found 808 papers relating to the hybrid learning initiatives we are interested in, of which the majority, 81%, involved the Engineering and Technology disciplines while 6.8% related to Science. The vast majority of papers referred to remote laboratories and most of these were concerned with describing the technologies involved.

In order to explore issues reported in the literature, we carried out an in-depth text review of a particular subset of the papers mainly concerned with remote laboratories and focussing on evaluative and pedagogical issues. The three main themes that emerged were: first, the importance of real data and authenticity in learning; second, the importance of a sense of presence (e.g. telepresence, social presence and/or immersion) and third, the locus of control in, and responsiveness of, a hybrid system. We conclude that, as well as providing us with lessons about effective learning through remote

laboratories, these new remote laboratories offer a lens with which to view both the more traditional material pedagogies, e.g. laboratory-based learning, and purely digital pedagogies, e.g. virtual labs.

This session aims to provide participants with a greater understanding of:

- digital, material, networked approaches for Science, Engineering and Technology learning, including remote laboratories, from the current literature
- important themes emerging from the literature on remote laboratories.

(8) Student Perception of Online Practical Science – project update

Victoria Nicholas
Faculty of Science

Student perceptions of the value of practical science, as delivered on-line through distance learning, are likely to be influenced by their expectations of the experience of studying online. Online courses with a practical component are becoming more prevalent. We are in the process of capturing experience and perception of students from two online practical science modules "Scientific investigations" and "Investigative and mathematical skills in science". Anecdotal evidence suggested that students have a negative perception of the value of online practical science before starting such modules. Many enrol simply because the module is a compulsory part of the qualification they are following. They are sceptical about how much "real science" they will be learning. After they have completed the modules, students appear to be more positive about the experience and value of online practical science.

To determine whether their perceptions are affected by the study experience, we have used telephone interviews with a small number of individuals, followed by an online questionnaire to a larger population of students. Once all of the data has been collected we will be able to demonstrate any shift in perception as a result of study. The outcomes of this research will inform the development of online practical science in the science curriculum and will have a wider value for other parts of the sector that are moving towards more teaching and learning online.

Closing Keynote Presentation

Getting data into your eye: live in the field, live in the Lab, and augmenting reality

Peter Scott
Knowledge Media Institute

This talk will present some recent Knowledge Media research that is aiming to bring STEM research to life for learners. First we will reflect on some of the technology-enhanced fieldwork frameworks we are now supporting via the EU funded WeSPOT project and our Field Network System (FNS) research, which aim to integrate the field and mobile experience of the learner with social connection and the work of other 'field researcher students' directly in a field context. Secondly, we will look at some of the wider live science-in-the-laboratory work we have begun with the OU Science Faculty, exploring how we might socially enhance live and interactive web broadcasts, referred to as labcasts, to provide a more engaging student experience of remote lab work. And finally, we will aim to glimpse a virtual and augmented reality future of the science lab via the work we have been conducting in an industrial and manufacturing context of the EU TELLME project which is augmenting the view of workers and learners.

POSTER PRESENTATIONS

(3) Investigating communications sent to students studying level 1 MCT and science modules

Linda Robson[1], Nicolette Habgood[2] and Lynda Cook[2]
Faculty of Mathematics, Computing and Technology[1], Faculty of Science[2]

Students receive electronic communications from a variety of sources such as central systems as well as personal contact from their tutor. A review of the communications sent to a selected number of students on all level 1 MCT and Science 14B presentation modules revealed a varied and significant number of communications (of up to 100 over a nine month period) from a variety of sources (such as OUSA, tutor, exams, regional centres, SST, eTMA system).

There are two main areas this project is studying:

1) A quantitative evaluation of the number and source of communications sent to students on 14 B presentations. Modules to be included in the evaluation are SDK125, S142 and U116.
2) A qualitative evaluation of the impact of some of these communications sent to students on 15B presentation of modules; SDK125, S142 and U116 by means of student questionnaires and focus groups.

Our poster will report on the quantitative evaluation of communications sent to 14B students and present an early summary of findings from interviews with 15B students.

See page 48 for poster

(5) Engaging programming

Jon Rosewell
Faculty of Mathematics, Computing and Technology

TU100 and TM129 (and previously T184) are first level courses that both include introductory programming. They have radically different programming environments: Sense for TU100 uses a full graphical metaphor whereas RobotLab for T184/TM129 has text-based drag-and-drop program construction closer to the conventional languages that students encounter in second-level modules.

Many students are now studying both TU100 and TM129 and this provides an ideal opportunity to probe how students learn with these two styles of programming environment. It is particularly opportune because students are

studying the two courses with different permutations of start dates, meaning that students may encounter the two environments at different times in their learning.

This project will take several approaches. Firstly, statistical analysis will probe pass rates, retention and TMA submission (e.g. patterns of late submission) and relate these to study patterns (i.e. students studying TU100 and TM129 consecutively, simultaneously or with overlapping calendars). Secondly, surveys and interviews will probe student attitudes to programming. Finally, feedback from tutors will be sought to highlight student problems.

This project should contribute to the debate about effective methods of introducing programming to Computing and IT students. By recommending the best sequence of experiences, the project may contribute to improved retention on the Computing and IT program. Students are now encountering programming in their first Computing and IT modules and it is critically important that we help them to succeed and not fall at this early hurdle.

(10) Investigating the careers of Staff Tutors in the STEM departments

Rachel Hilliam[1], Vic Pearson[2], Shirley Northover[1], Elaine Thomas[1], Jean McCloughry[2], Katie Chicot[1], Martina Gibbons[1] and Carol Calvert[1]
Faculty of Mathematics, Computing and Technology[1], Faculty of Science[2]

In addition to appointing and managing ALs there are a number of ways in which staff tutors contribute to the running of their departments including contributions to writing teaching material, taking key roles in the presentation of modules and undertaking scholarship and research. The distribution in depth and breadth of such contributions of staff tutors differs between the STEM departments. A questionnaire has been compiled, which together with focus groups, will aim to address the following questions.

- Is there a difference between the STEM departments in range and depth to which Staff Tutors engage with all areas of their academic roles?
- Why does the staff tutor role seem to attract a greater proportion of females and why does this differ between departments?
- How do staff tutors feel their role is perceived within the different departments, faculties, the university and the wider HE sector?

See page 49 for poster

(11) Enabling Mathematics and Statistics ALs to achieve their potential

Rachel Hilliam, Katie Chicot, Martina Gibbons and Carol Calvert
Faculty of Mathematics, Computing and Technology

There is limited understanding into why ALs undertake the role, if this is gender specific and how we might best support this group of staff through their career journey. Results of a questionnaire to address the following issues will be analysed together with information from focus groups.

- Why do ALs take up this role and is there is a difference in expectations of the role based on gender and career aspirations?
- Do ALs take up the post at a particular point in their career trajectory?
- Do the needs of ALs change throughout their time with the OU?
- What career and professional development is needed to provide ALs with the appropriate skills to enable them meet the challenges of their role and therefore have a positive impact on teaching?
- How can knowledge from this study be fed into scoping out the implementation of the group tuition policy?

See page 50 for poster

(13) Enabling access to the chemistry curriculum for visually impaired students

Vic Pearson[1], Elaine Moore[1], John Clarke[2], Eleanor Crabb[1] and Hazel Carr[1]
Faculty of Science[1], Student Services[2],

Chemistry uses a number of visual elements including diagrammatic representations of molecular structures. Recognising and drawing molecular structures is an essential skill embedded into all chemistry modules, including S215 Chemistry: Essential concepts. This therefore presents problems for visually impaired (VI) students.

Module Teams are required to anticipate and adjust materials, activities or assets that may be inaccessible for disabled students. The increase in the number of disabled student declarations, and decrease in numbers claiming Disabled Students' Allowances, means MTs will face increasing demands to deliver appropriate accessible formats.

The variety of figures used in S215 is vast, ranging from single molecular structures to combined molecular structures, simple graphs to complex spectra. Written, textual descriptions were generated for all 'figures' (those with figure captions) in keeping with the University's 'standard' reasonable adjustment for figures. However, S215 also contains several thousands of chemical structures that are provided 'in-text' (akin to mathematical equations). These are displayed as images, and so are not screen readable.

During the writing process, many figure descriptions were identified as being exceptionally long and their usability was questioned. Further, figure descriptions for in-text items were not generated because of the sheer number required and concerns over the usability of existing descriptions.

Producing tactile diagrams is a common approach to enabling access to visual content and the OU Disability Resources (Alternative Formats) Team has the facility to print a small number of these, usually on request. At scale and for complex figures, tactile diagrams present the same challenges as figure descriptions with respect to resource and usability and new challenges because of navigability.

We are exploring viable alternatives that can enable S215 to be fully accessible for VI students, surveying the existing static visual assets and identifying solutions that can be used across the Science curriculum where chemistry is taught.

See page 51 for poster

(14) Gender differences in completion and credit on Physical Science Module S207

Niusa Marigheto, Vic Pearson, Pam Budd, Jimena Gorfinkiel, Richard Jordan and Sally Jordan
Faculty of Science

Examination of historic data since 2009 for a Level 2 "gateway" physics module (S207) has identified that barriers to success may exist for women compared to men; there are significant statistical differences between men and women for both completion and credit. For the total student cohort of women registered over 5 years (n=946), the completion and pass rates are both 10 percentage points less than the corresponding figures for men (n=2415). The numbers of women registered are slightly higher than sector averages; typically 28% of students on this module are women compared with the sector average of 23% (Institute of Physics, 2012).

Similar trends were seen on other level 2 modules in the physical science curriculum but not on equivalent Level 2 gateway modules in other science

disciplines. Interestingly, investigations of similar data for Level 3 physical science modules indicated that women perform slightly better than men.

For the most recent presentation (2013/14) of the Level 2 physics gateway module, the performance of women has further and significantly diminished; for this presentation there was a 19 percentage point difference in completion between men and women and a 22 percentage point difference in pass rate. Since other gateway modules show such a decline in achievement, local changes e.g. to assessment may be contributing factors.

We will present the results of a data analysis study that compares men and women's success in Physical Sciences in relation to: submission rates and scores for individual continuous assessment tasks, performance in initial computer-marked assessment by question, performance in separate parts of the examination (with different question types). We will also present comparisons with "feeder" modules, where data is available. Non-assessment factors such as online forum activity will also be considered.

See page 52 for poster

(20) On Assessing the London Big bang Fair Artefacts through the T215 Common Assessment Model

Soraya Kouadri Mostéfaoui
Faculty of Mathematics, Computing and Technology

Project's Background

The T215 common assessment model is a six criterion framework, split between content and presentation, with the flexibility to accommodate a variety of assessment tasks. The model has been used for assessing students' TMAs as well as for self- feedback and evaluation.

Built upon the promising results of our first eSTEeM project in which we investigated how 'hybrid' product-based assessment elements are assessed in other OU STEM modules. This project investigates the application of the assessment model at a wider (non-OU context) including face-to-face teaching and assessment environments.

Outline of the issues explored and results

In this poster we will present a first case study and analyse the results of the application of the T215's assessment model in the assessment of the non-text artefacts produced during the London Big Bang Fair 2013-2014 http://www.thebigbangfair.co.uk/. These include amongst others, a walking robot, a miniature crane and a solar powered car.

Our findings are that the T215 model offers a high degree of consistency and flexibility when used to assess such non-text artefacts. This is due to the level of generality offered by the different criteria and the facility to adjust the weighting of such criteria. However, it is lacking holistic assessment criteria to assess the overall functionality of the presented artefacts.

See page 53 for poster

(22) Students' study of online modules

Elaine Moore[1], Bob Everett[2], Vicky Taylor[1], Kadmiel Maseyk[1], Vikki Haley[1], Catherine Halliwell[1], Jim Moffatt[2], Richard Moat[2]
Faculty of Science[1], Faculty of Mathematics, Computing and Technology[2]

Science and MCT have recently produced a suite of modules delivered entirely online. We are looking at how students study this material. For example do they read it online, read it on a tablet, print off the pdf version… and which interactive elements do they find helpful? The following methods are being used:

Data warehouse portal – the number of students accessing the module website and interacting with specific module items is being monitored from the weekly reports. We are also noting the proportion of visits of 60 minutes or longer.

Questionnaire – questionnaires are being inserted into the module websites. We already have data from one module.

Usability laboratory – we intend to observe small groups of volunteers as they engage with the various online materials. A questionnaire will be given to these volunteers after the experience.

Tutor Group discussion – we plan to ask one tutor on each module to engage in discussion with their students as to their use and perception of the material.

Student consultation forum – we have put forward a suggestion that how students approach online learning be a topic for a student consultation forum. This will be considered by OUSA.

See page 54 for poster

(29) 3D Virtual Field Trip Service

Shailey Minocha[1], David Burden[2], Tom Argles[3], and Steve Tilling[4], Faculty of Mathematics, Computing and Technology[1], Daden Ltd[2], Faculty of Science[3], Field Studies Council[4],

In 2013 and as a part of the Wolfson-trust funded OpenScience Lab project (http://www.open.ac.uk/researchprojects/open-science/), The Open University (OU) and Daden Limited (http://daden.co.uk) worked together to create a 3D virtual geology field trip in Unity 3D based around Skiddaw mountains in the UK's Lake District (please see the details here: https://learn5.open.ac.uk/course/format/sciencelab/section.php?name=skiddaw_1). Since then Daden and the OU have been looking at how to make such virtual field trips more widely available, and we now have UK Government funding (Innovate UK) to look at the feasibility of a national/global Virtual Field Trips service (http://www.daden.co.uk/conc/trainingscapes/design) - not necessarily for Science but other disciplines too. The service will include making vital field trips available for different levels of education (including schools), flexibility to educators and field workers to adapt the lesson plans, and enabling institutions to contribute to the database of virtual field trips.

This poster will present the technical ecosystem, user-journeys or personas, and demonstrator of the proposed VFT service.

(32) Using OpenStudio in STEM learning

Elaine Thomas, Leonor Barroca, Helen Donelan, Karen Kear and Jon Rosewell Faculty of Mathematics, Computing and Technology

Same abstract as short oral presentation 9 on page 20

See page 55 for poster

Investigating communications sent to students studying level 1 MCT and science modules

Linda Robson*, Lynda Cook, Nicolette Habgood
Faculties of MCT* and Science, The Open University, Milton Keynes, MK76AA, UK

The Open University

Introduction

The main method of communication to Open University students is electronic messages, i.e. email. The overall aim of this research project is to determine the effectiveness of email communications to students. Are students overwhelmed by the number of emails sent from the university or do students value the electronic communications received?
The findings presented in this poster are from the initial research phase which determined the quantity and origin of emails sent to students studying level 1 MCT and science modules in 2014B. The second phase of the project will be a qualitative study of the student's experience.

Method

For each of the level 1 MCT and Science modules, a sample of four students was randomly selected from those who had completed the 2014B presentation. VOICE records were used to determine the number of emails sent. Three modules, U116, SDK125 & S142, were selected for further investigation.
Communications to each of the four sample students were analysed in greater depth to identify the origin of messages.

Discussion

Quantitative analysis of the number of email communications (logged on VOICE) sent to students studying one MCT or science level 1 module in 2014B (Table 1) revealed:

1. Significant variation in the number of emails sent to individual students studying the same module. The number of messages sent varied from 32 to 145 for individual students on S142.
2. Variation in the average number of emails sent to students on different modules. (55 emails on MU123 and 124 on S142).
3. No correlation between the average number of emails sent and credit rating of the module.
4. No correlation between the 2014B retention rate and average number of emails sent.

These finding are in line with those reported by the Initial Learner Engagement Project who looked at AA100 students studying in 13J [1].
Further analysis of 4 students on S142, SDK125 and U116 (Table 2) showed that the majority of messages are sent by the Tutors office and eTMA system. The increase in emails sent on S142 was due to an increase in emails sent from the faculty, region and 'all other areas'.

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Results

Table 1: Level 1 MCT and science modules showing the total number of email communications logged in Voice sent to 4 students who completed their study of the module in 2014B. Messages sent from module start to result notification.

Module	Credit	Total number of emails sent (to 4 students)	Average (n=4)	Retention % completion
M140	30	43,50,64,100	64	74
MST124	30	37,54,62,90	61	42
MU123	30	30,57,60,75	55	70
S104	60	76,87,107,112	71	45
S142	30	78,114,145,160	124	58
SDK125	30	32,52,82,86	63	46
TU100	60	71,75,76,81	76	49
T174	30	44,46,49,61	50	58
U116	60	42,47,57,84	58	72

Table 2: Origin of email communications logged in VOICE sent to 4 students on 3 level 1 modules in 2014B

Origin of message	Average number of emails per student		
	U116	SDK125	S142
Tutors Office	11	20	27
eTMA system	15	14	19
Student services	6	7	9
MSD Computer centre	5	7	9
Region & SST	5	5	10
OUSA	5	6	5
Faculty	3	4	13
Exams	3	5	9
Library	4	1	3
All other areas	1	7	20

Data excludes emails sent directly to the students from private mail addresses, such as from their tutors

Further work

This quantitative analysis gives an overview of electronic messages being sent to students on level 1 MCT and science modules. However, it is thought that students do not read all the emails they receive.
The second phase of this project involves qualitative research in which 20 students on S142, SDK125 and U116 on the 2015B presentation will be interviewed about their experience of communication from the university. It is hoped to establish a student perspective of which emails they want to receive and find useful.

Reference

1. Initial Learner Engagement Project (2014) Early Project Recommendations Paper

Investigating the careers of Staff Tutors in the STEM departments

Rachel Hilliam, Victoria Pearson, Shirley Northover, Elaine Thomas, Jean McCloughry, Katie Chicot, Martina Gibbons and Carol Calvert

The Open University

Introduction

The staff tutor role is varied and complex. Whilst a key part of this role is the responsibility for appointing and managing Associate Lecturers, there are a number of ways in which staff tutors contribute to the running of their respective departments including contributions to the writing of teaching material, taking key roles in the presentation of modules and undertaking scholarship and research. The distribution of the depth and breadth of the range of contributions by staff tutors in each of these areas differs between the STEM departments at the OU.

In Spring 2014 both the Mathematics and Statistics department and the Department of Physical Science received bronze awards from Athena SWAN, a national body that provides awards to recognise the work in advancing the careers of women in STEM. The Department of Physical Sciences also obtained a Project Juno Practitioner award, the Institute of Physics equivalent of Athena SWAN. Part of their respective three year action plans, and a point identified as requiring additional work in all three sets of feedback to the awards, includes looking in more detail at the staff tutor role. The Department of Engineering and Innovation and the Computing and Communication Department are currently in the process of preparing their bronze applications; this work will feed into the submissions within each of these departments.

Background

The proportion of women differs between the departments;

Department	Maths and Stats	Computing and Communications	Engineering and Innovation	Faculty of Science
No. of staff tutors (No. female)	17 (11)	17 (11)	15 (9)	22 (16)

The dispersed nature of the staff tutor role means career progression goals for this group of employees is particularly complex and difficult. There are areas of support which need to be explored if staff tutors wish to engage in certain activities to a greater depth.

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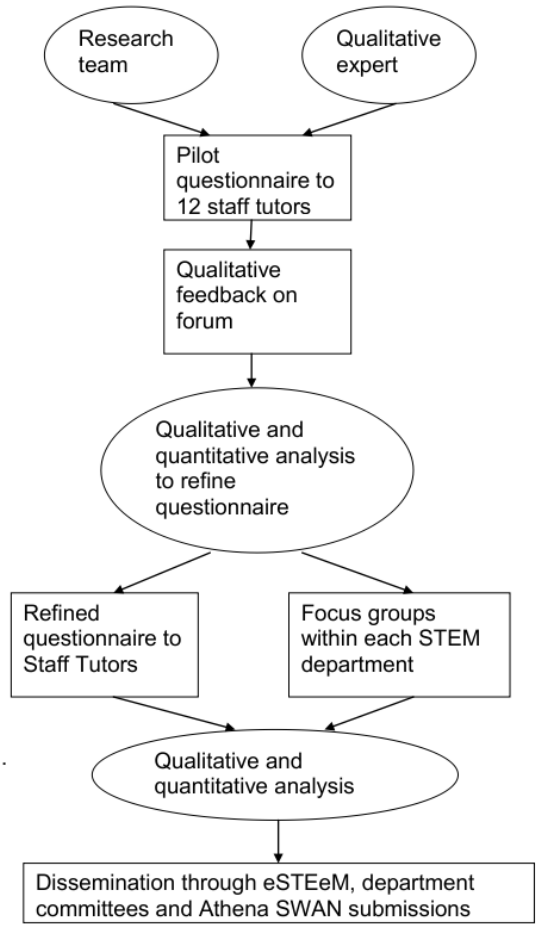
The new promotions criteria and the development of the Academic Development Framework also dictates that investigating the recruitment and development of staff tutors is urgently needed, particularly within STEM where such activities are now under external scrutiny.

Questions of interest

- Is there a difference between the STEM departments in range and depth to which Staff Tutors engage with all areas of their academic roles?
- Why does the staff tutor role seem to attract a greater proportion of females and why does this differ between departments?
- How do staff tutors feel their role is perceived within the different departments, faculties, the university and the wider HE sector?

Methodology



Enabling Mathematics and Statistics ALs to achieve their potential

Rachel Hilliam
Katie Chicot, Martina Gibbons and Carol Calvert

The Open University

Introduction

In April 2014 the Mathematics and Statistics department received a bronze Athena SWAN award and has an action plan which includes research into the Associate Lecture (AL) role. The AL cohort is the largest body of staff within the department and currently there is limited understanding into why ALs undertake the role, if this is gender specific and how we might best support this group of staff through their career journey.

Background

Previous work from the Associate Lectures in Science project (Donovan et al, 2005) showed the OU to be a major employer of women in science and technology teaching at HE level. This project will build on this work with all the mathematics and statistics ALs and will include analysis of gender differences.

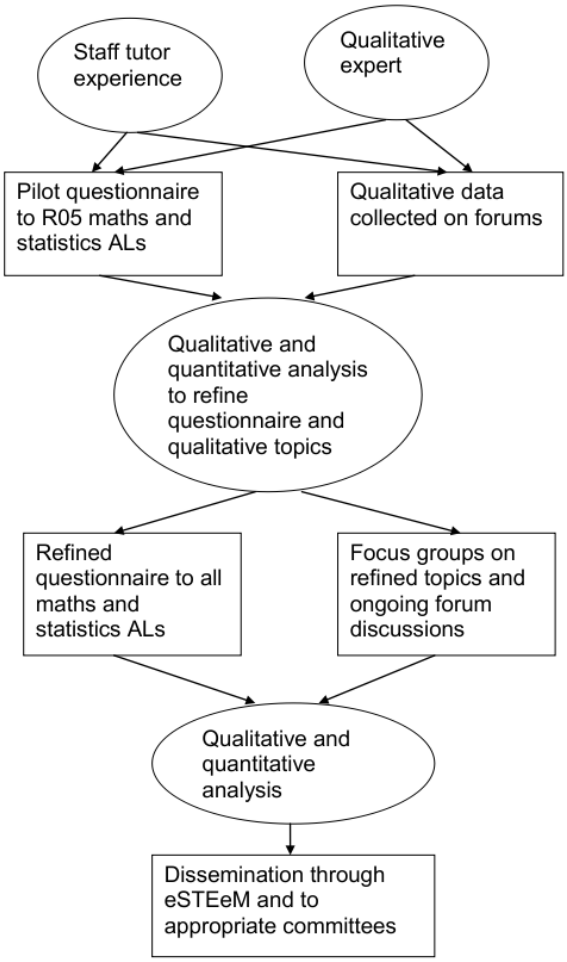
As the OU provides employment to such a large sector of the potential HE employment base a greater understanding of why ALs undertake this work, their career journey and career goals will be advantageous, particularly when recruiting ALs to modules where the pool of suitable candidates is sparse.

Mathematics and Statistics appears to have a greater proportion of female ALs with 43% female compared to 34% for the whole of MCT. Recruitment of ALs to a new level 1 statistics module in 2013J resulted in an AL cohort of which 52% are female.

Questions of interest

- Why do ALs take up this role and is there is a difference in expectations of the role based on gender and career aspirations within the mathematics and statistics disciplines?
- Do ALs take up the post in a particular point in their career trajectory?
- Do the needs of ALs change throughout their time with the OU and what should we do to support them?
- What career and professional development is needed to provide ALs with the appropriate skills to enable them meet the challenges of their role and therefore have a positive impact on teaching, whilst also furthering their career aspirations?
- How can knowledge from this study be fed into scoping out the implementation of the group tuition policy?

Methodology



References

Donovan, C., Hodgson, B., Scanlon, E. and Whitelegg, E. (2005) 'Women in higher education: Issues and challenges for part-time scientists', *Women's Studies International Forum,* 28 pp247-258.

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Enabling access to the chemistry curriculum for visually impaired students

Vic Pearson, Elaine Moore, John Clarke, Eleanor Crabb and Hazel Carr

The Open University

Motivation

Chemistry uses a number of visual elements including diagrammatic representations of molecular structures. Recognising and drawing molecular structures is an essential skill embedded into all chemistry modules, including S215 Chemistry: essential concepts, in which there are several thousands of visual assets. This therefore presents problems for visually impaired (VI) students.

Module Teams are required to anticipate and adjust materials, activities or assets that may be inaccessible for disabled students. The increase in the number of disabled student declarations, and decrease in numbers claiming Disabled Students' Allowances, means MTs will face increasing demands to deliver appropriate accessible formats.

We are exploring viable alternatives to enable S215 to be accessible for VI students, surveying the existing static visual assets and identifying solutions to be applied wherever chemistry is taught in the science curriculum. Successful VI chemists use a combination of solutions, often requiring sighted support but examples are predominantly from face to face learning environments [1,2].

Survey of figures/structures

There are over 300 figures in S215 i.e. those visual assets that have figure captions, and these can be categorised into a number of recognised types (Table 1). There are over 2000 additional visual assets (Table 2) that are not categorised as 'figures'.

Table 1 Types of figures on S215

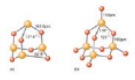
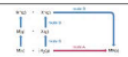
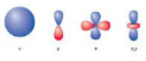
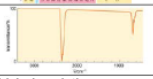
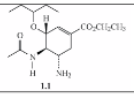
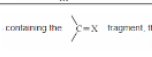
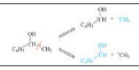
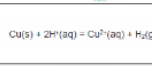
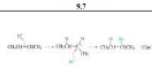
Type of figure	Example	Number
Ball and stick*		42
Born-Haber		8
Energy level		21
JS mol*		17
Orbital diagram		24
Periodic table*		5
Spectra		31

Table 2 Additional 'non-figure' visual elements

Type of asset	Example	Number
Structures*		89
In-text structures*		845
Compound structures*		132
Equations		863
Lewis structures*		17
Reactions with curly arrows*		179
Structures on other figures*		10

*Those figures for which descriptions are non-viable alternatives due to complexity and length.. There are an additional 230 figures that do not fit into these simple categories

Possible in-house alternatives

1. Extended figure descriptions

- Figure descriptions are 'standard' provision during module production.
- On S215, descriptions were generated for all 'figures' (those that have captions), but many were long and their usability was questioned.
- Other visual elements did not have accompanying descriptions because of the sheer number required (Tables 1 & 2) and concerns over usability.
- Survey of figure descriptions of structures from Table 1 and 2 indicates figure descriptions are not a viable alternative for many.

2. Tactile diagrams

- Non-standard & produced only 'on request' by OU Disability Resources Team
- For S215, the number needed, the lack of a formal mechanism for producing these at this scale (CAU-LTS process) and the complexity/navigability of tactiles presents additional challenges.

Outcome: Figure descriptions and tactile solutions do not present viable alternatives for many of the complex structures at this scale. Further work focuses only on molecular structures, i.e. more complex assets.

Non-standard solutions

1. Pedagogical figure description system

- System based on describing structural building blocks to reduce length of extended descriptions
- Needs to be introduced at Level 1 for students to be familiar with it on S215
- Similar system developed for S104 for reading structures for DAISY versions, but not used on more complex structures – in need of additional development

2. Navmol

- Java-based molecular editor for visually impaired students
- Geometry-based navigation with speech synthesiser.
- Developed by New University of Lisbon, Portugal [3,4]
- Can import .mol files created in existing chemistry drawing software (e.g. Chemdraw)

Outcome: A selection of S104 descriptions have been selected for user testing that are analogous to S215 materials. Collaboration with Navmol team initiated and testing with S215 structures to begin soon.

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References:
[1] Wedler, H. (2012) *J. Chem. Educ.* , 89 (11) 1400-1404; [2] Supalo, C. and Kennedy, S. (2014) *J. Chem. Educ.*, 91 (10) 1745-1747; [3] Pereira, F. et al., (2011) *J. Chem. Educ. 88*(3), 361–362; [4] Fartaria, R. et al., (2013) *E. Jnl. Org. Chem.*, 8, 1415-1419.

Gender differences in completion and credit on Physical Science Module S207

Niusa Marigheto, Victoria Pearson, Pam Budd, Jimena Gorfinkiel, Richard Jordan and Sally Jordan

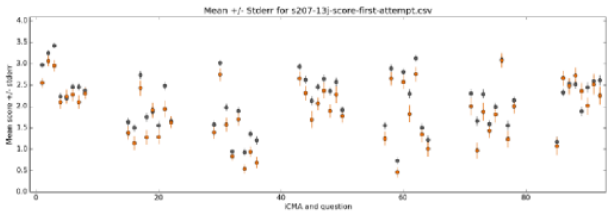
The Open University

Introduction

Gender differences in attitude to assessed tasks have been reported (e.g. Gipps & Murphy, 1994) whilst Bates et al. (2013) report on a similar gender difference in outcomes on the Force Concept Inventory (Hestenes et al, 1992), a well-established inventory of understanding of physics concepts whose reliance on multiple-choice questions has been questioned (Rebello & Zollman, 2004).

Performance in interactive Computer Marked Assessment (iCMA) by question

The figure shows separate iCMA questions. Female students do less well than male students for almost all questions, but the amount by which they do worse varies from question to question. Different types of question (e.g. multiple choice) do not appear to be particularly well or badly answered by women – it is more abstract questions that women do particularly badly. (Key: orange: female; dark grey: male)



Exam

Consists of three parts: Computer Marked Examination (a), short 'descriptive' type questions (b) and long 'problem solving' type questions (c).
The results below show the average scores as percentage of male or female population in more details

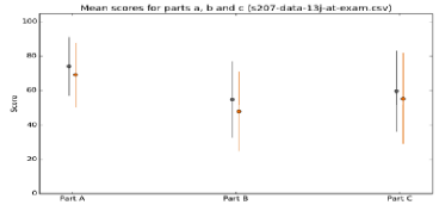
Background – from 2009 to 2013 for L2 'Gateway' Physical Sciences Module (S207)

- Open University students: distance learners and no imposed entry qualifications, most will have studied a preparatory science module with OU first
- Of the total student cohort since 2009, women constitute 28% of the annual cohort (~2% fluctuation)
- Women constitute 25% of those students who complete and 24% of all students who complete/pass
- In 2013-2014 presentation of the module women constituted only 20% of the completers, and only 18% of all students who completed/passed
- The difference in outcome for men and women is statistically significant
- The aim of the current research was to find any reasons for the difference in outcome

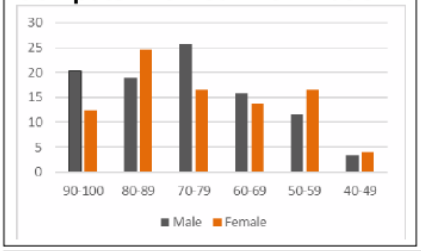
Information from Demographics (2009-2014):

- The overall student population is getting younger
- Fewer students with previous HE qualifications
- Increase in white women of low SES,
- Decline in white women of high SES
- Increase in white non-UK women but not men
- Increase in young non-UK women but not men
- Overall there is an increase of non-UK students

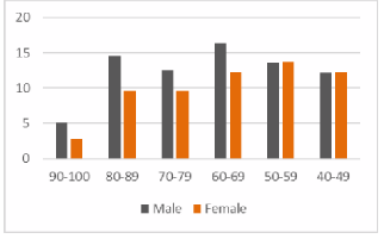
Mean scores for each part of the exam



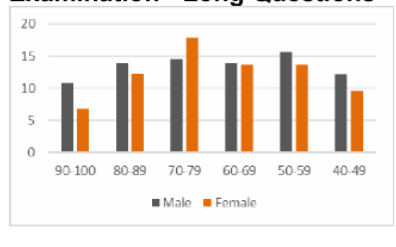
Computer Marked Examination



Examination - Short Questions



Examination - Long Questions



Conclusions and Future Work

- It seems that men do better than women on all three parts of the exam (MCQs are not a particular problem)
- From analysis of Tutor Marked Assignment and iCMA data, it appears that particular parts of the module (for example, Newtonian mechanics) causes the majority of the gender difference
- We looked at student participation in forums and online tutorials and found no significant difference
- We are currently finding out about student demographics and previous educational qualifications in more detail

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References:
Bates, S., Donnelly, R., MacPhee, C., Sands, D., Birch, M., & Walet, N. R. (2013). Gender differences in conceptual understanding of Newtonian mechanics: a UK cross-institution comparison. *European Journal of Physics*, *34*(2), 421-434.
Gipps, C. V. & Murphy, P. (1994). *A fair test? Assessment, achievement and equity*. Buckingham: Open University Press.
Rebello, N. S. & Zollman, D. A. (2003). The effect of distracters on student performance on the force concept inventory. *American Journal of Physics*, *72*(1), 116-125.

On Assessing the London Big Bang Fair Artefacts through the T215 Assessment Model

Soraya Kouadri Mostéfaoui

The Open University

What?

- Investigate the applicability of the T215 assessment model to assess 'alternative media' artefacts
- Explore the feasibility of developing a common assessment model

How?

- Survey existing models
- Interviews and focus groups
- Desk research
- Model mapping
- T215 model enhancement

Expectations?

- Produce a generic 'alternative media assessment' model
- Produce a set of recommendations

The T215 Assessment Model

- Content
  - Meeting the brief
  - Factual accuracy and understanding
- Presentation
  - Appropriateness of components used
  - Ordering of ideas
  - Technical level
  - Narrative

The London Big Bang Fair

- National science and engineering competition
- Open to all 11-18 year olds living in the UK and in full-time education
- Rewards students who have achieved excellence in a science, technology, engineering or maths project
- http://www.thebigbangfair.co.uk/

The Big Bang Artefacts

Miniature crane

Walking robot

Solar powered car

The Assessment

- Three judges per project using a score sheet, judges sit together and decide upon a score
  - Many score discrepancies
- Assessing some artefacts using the T215 model
  - High degree of consistency and flexibility
  - Fewer score discrepancies
  - Facility to adjust the weighting of the criteria

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The OU centre for STEM pedagogy

Students' Online Learning

Elaine A. Moore, Bob Everett, Vicky Taylor, Kadmiel Maseyk, Vikki Haley, Catherine Halliwell, Jim Moffatt, Richard Moat

The Open University

Methods students

1. Questionnaires embedded in website.
2. Tracking of students accessing items on online websites.
3. Comparison of demographics of student populations.
4. Useability Lab.
5. OUSA consultative forum on online study.

How do students tackle modules delivered online?

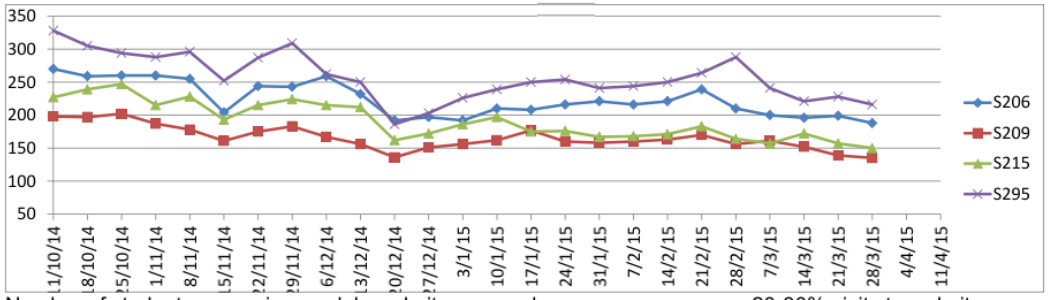
What adaptions do tutors have to make?

Modules studied S206, S209, S215, S295, SXF206, T176. For these modules, all material is delivered online via the module website.

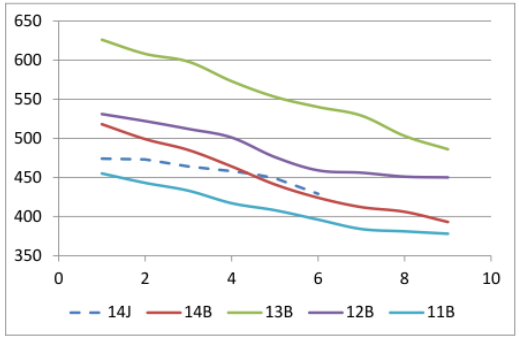
Methods tutors

1. Questionnaires embedded in Tutor website.
2. OULive discussion.

Some preliminary results



Number of students accessing module website per week.



Retention: student numbers S206+ SXF206 (14J) vs S216 (predecessor module).

20-30% visits to websites were >1 hour..

Student questionnaire

Respondents: S215 33% of registered students, S295 40% registered students. Questionnaires not yet in place for other modules.

2/5 respondents **did not realise the modules were online** before registering. However the majority of these would still have done the module.

About half the respondents downloaded and used the pdf version of the texts.

However 73% of S15 and 80% of S295 respondents gave the module webpages as one of the options they mainly used to study.41% of S215 and 37% of S295 respondents Gave mobile devices as one of the options they mainly used to study.

A number of students on both modules mentioned difficulties with downloading videos mostly due to slow broadband.

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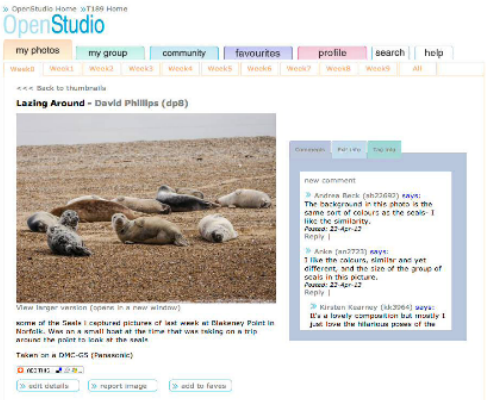
Using OpenStudio in STEM learning

Elaine Thomas, Leonor, Barroca, Helen Donelan,
Karen Kear, Jon Rosewell

The Open University



OpenStudio:

OpenStudio, developed by the Open University, enables students to create and upload audio-visual resources, and to engage in dialogue with their peers, their tutors and their module team around these resources. The project aims to explore the use of OpenStudio in STEM disciplines, with a view to providing information about the ways in which it is already being used in modules, and collating evidence of good practice. OpenStudio goes by many names: ShareSpace, OpenDesignStudio, DisplayWall, Open Engineering Workspace.

The main research questions for the project are:

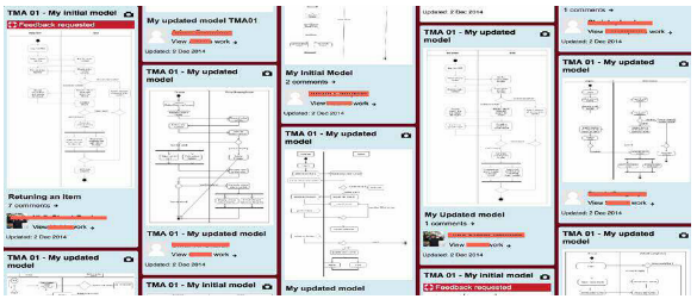
1. How is OpenStudio being used in STEM subject teaching across the Open University?
2. How are students using OpenStudio in their learning?
3. How do tutors use OpenStudio to support students in their learning?

Two phases:

1. Identify the aims and objectives of module teams from STEM disciplines in the design and development of learning activities involving OpenStudio.
2. Carry out a small-scale study to explore:
   a) the experiences of students in using this environment.
   b) the views of tutors supporting students in using this learning environment.
   c) the value of an artefact-centred conversation in students' learning

First used in T189 Digital photography

Now used in
M258 IT project and service management
T174 Engineering the future
T217 Design essentials & T317 Innovation
T219 & T319 Environmental Management 1 & 2
TM354 Software engineering
TU100 My digital life
U101 Design thinking
Y033 Science, technology and maths access module … and others?



[Using OpenStudio in STEM learning – project blog
http://www.open.ac.uk/blogs/OpenStudioinSTEMLearning/](http://www.open.ac.uk/blogs/OpenStudioinSTEMLearning/)

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The OU centre for STEM pedagogy

NOTES

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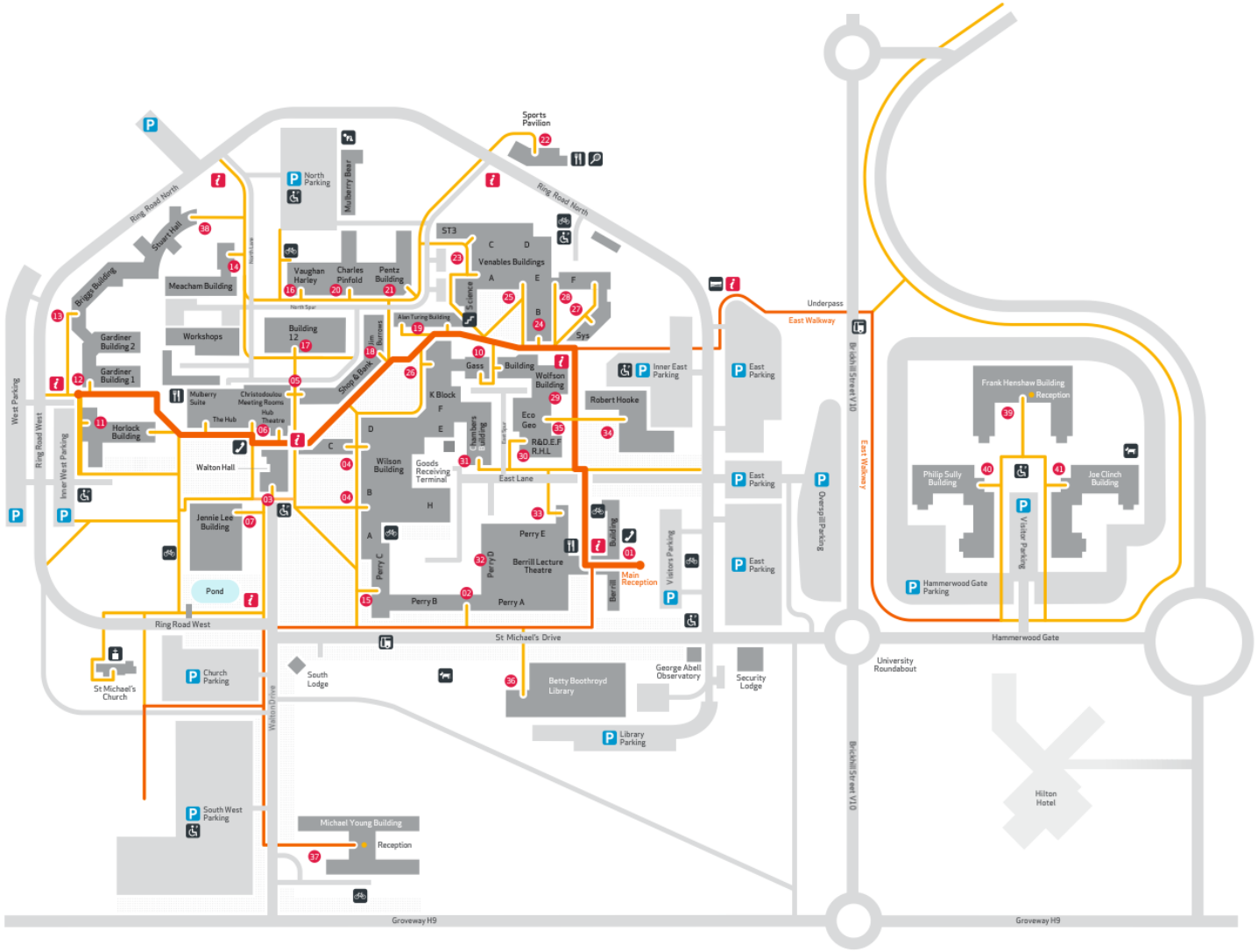
NOTES

The Open University
Walton Hall
Milton Keynes
MK7 6AA
United Kingdom

OU CAMPUS MAP

Walton Hall
Campus Map

Key to Building Entrances	
Alan Turing Building	19
Audio Recording Centre	39
Berrill Building	01
Berrill Lecture Theatre	01
Betty Boothroyd Library	36
Briggs Building	13
Building 12	17
Chambers Building	31
Charles Pinfold Building	20
Christodoulou Meeting Room	05
Ecosystems & Geobiology Labs.	35
Frank Henshaw Building	39
Gardiner Building 01 & 02	12
Gass Building	10
Horlock Building	11
Jennie Lee Building	07
Jim Burrows Building	18
Joe Clinch Building	41
K Block	26
Meacham Building	14
Michael Young Building	37
Pentz Building	21
Perry A	02
Perry B	02
Perry C	15
Perry D	32
Perry E	33
Philip Sully Building	40
R & D and Engineering Facility	35
Reinhold Hermann Labs.	30
Robert Hooke Building	34
Sports Pavilion	22
Stuart Hall Building	38
The Hub, Suites and Theatre	06
Vaughan Harley Building	16
Venables Entrance A & C	23
Venables Entrance B	24
Venables Entrance D	28
Venables Entrance E	25
Venables Entrance F & Systems	27
Walton Hall	03
Wilson Building	04
Wolfson Building	29



Key to Symbols

- Bus Stop
- Car Parking
- Car Parking for Disabled
- Bicycle Parking
- Childrens Centre
- Church
- Dog Run
- Gate
- Information Points
- Public Telephones
- Refectory
- Shop & Bank
- Sports Pavilion
- Stairs
- Building Entrance

Key to Walkways

- Footpath
- Central Walkway