The 2nd eSTEeM Annual Conference 2013

STEM Futures: Innovations and Impact

Conference Booklet

26th March 2013

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exploring the frontiers of STEM education

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eSTEeM Project Leaders and Team Members
The OpenScience Laboratory Principal Investigators, Postgraduate Students and Team Members

The Open University Audio Visual staff and Events and Catering staff

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PROGRAMME

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9:40 – 10:00	**Addressing the Challenges** Steve Swithenby and Keith Williams, eSTEeM Co-Directors			**Hub Lecture Theatre**
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INTRODUCTION

Welcome to the 2nd eSTEeM Annual Conference.

eSTEeM, a joint initiative between the Faculties of Science and MCT (Mathematics, Computing and Technology) brings together STEM academics to promote future innovation, scholarship and enterprise in open and distance learning. Since our first conference the Open University has reconfigured its undergraduate programmes in response to changes to student funding and we face the challenge of transforming our student support systems and enhancing student experience. Externally MOOCs have entered the spotlight as a potentially transformational innovation in higher education. The effective use of learning technologies at scale is at the centre of much of eSTEeM's activity with our portfolio of projects includes work on e-assessment and feedback; mobile learning; teaching practical science and engineering online, integrated with the use of virtual learning environments

The emphasis of this conference will be to highlight recent developments in eSTEeM and related areas. You will have the opportunity to learn of OU led developments in e-assessment and feedback, and in the use of online experimental activities. Contributions from our Spanish counterpart UNED will undoubtedly stimulate discussion debate and reflection on wider issues relating to the future of STEM scholarship within the rapidly evolving international higher education landscape.

We welcome partnerships and are already working with universities and other agencies both within and outside the UK to help develop a distinctive and influential STEM agenda.

We welcome you to our second conference and hope you have an informative, stimulating and enjoyable day.

Steve Swithenby (pictured top) and Keith Williams (pictured bottom)
eSTEeM Co-Directors

OPENING KEYNOTE SPEAKERS BIOGRAPHIES

Phil Butcher has led the OU's use of interactive questions with instant computer-marked feedback from S100 onwards. From mainframes to microcomputers to the internet, he has pushed the technology and persuaded course teams that interactive computer-based applications have educational potential and can be reliably delivered. Perhaps in 2012 with the OU marking over 600,000 interactive eAssessments on 133 modules, he is starting to get his message across but he still has more to say.

Sally Jordan is a Science Staff Tutor and the Science Faculty's Deputy Associate Dean with responsibility for assessment. She has a longstanding interest in all types of assessment and first used interactive computer-marked assignments in her teaching in 2002, to enable the delivery of instantaneous and targeted feedback to students on S151 *Maths for Science*. Since then Sally has worked with a range of module teams and faculties to improve the use of eAssessment for diagnostic, formative and summative purposes. Teaching fellowships from COLMSCT and piCETL enabled her to investigate the use of short-answer free-text questions and to carry out a more general investigation into student engagement with eAssessment. Sally is currently working with eSTEeM and the OpenScience Laboratory to evaluate and improve our assessment practice.

CLOSING KEYNOTE SPEAKERS BIOGRAPHIES

Mr. Daniel Torres Mancera is currently the Director-General of CSEV. Formerly, he was the Director of the National Observatory for Telecommunications and the Information Society at Red.es (2008-2011). He also worked as an Advisor for the Secretary of State for Telecommunications and the Information Society (2004-2008). Previously, he worked as a member of the Board of Directors of the National Institute of Communication Technologies (INTECO, 2005-2008), Deputy Director-General of Telefónica Procesos y Tecnología de la Información (2003-2004), Director of Projects and eBusiness Development at Telefónica de Contenidos and Corporación Admira Media (1999-2003), General Manager of Halconviajes.com (2000-2001), Head of Corporate Human Resources at Telefónica S.A. (1998-1999), Deputy Executive Vicepresident for Business Development at Telefónica del Perú (1997-1998) and Head of Business Promotion and Strategic Planning at Telefónica Internacional (1993-1997). Daniel has a degree in Telecommunications Engineering, an Executive MBA from the IE BUSINESS SCHOOL (1997-98) and an Executive MBA from the ISEM Fashion School (University of Navarra (2007-2008).

Timothy Read obtained an Honours Degree in Computer Science from the University of the West of England and a Ph.D. in Cognitive Science from the University of Birmingham. He is currently a Senior Lecturer in the Department of Computer Languages and Systems at UNED. He is also the Director of Open UNED and before that he was the Associate PVC of Technology and previously the Director of the Centre for Technological Innovation and Development. Since arriving at UNED he has researched on various topics related to the development of tools and systems for collaborative and individual distance learning, specifically those related to second language learning.

CONFERENCE INFORMATION

Registration
Conference registration will take place between 8:45 – 9:30 on Tuesday 26th March in the Bay Reception. There is a map of the campus with the conference venues marked on the back cover of this booklet.

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

Helpdesk
A helpdesk will be manned in the Bay Reception throughout the day; eSTEeM conference staff will be glad 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 turning off mobile phones, and using electronic equipment in silent mode.

Posters and demonstrations
There will be a poster presentation and demonstration session after lunch between 13:30 – 14:15 in the Hub Lecture Theatre. Posters will continue to be displayed throughout 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, as well as 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 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 Presentation

eAssessment: innovation and impact

Phil Butcher[1] and Sally Jordan[2]
Learning and Teaching Solutions[1]; Faculty of Science[2]

The use of interactive computer-marked assignments and quizzes on Open University STEM modules increases every year and 65 modules in the faculties of MCT and Science now use iCMAs. Innovative question types such as STACK (using computer algebra) and Pattern Match (enabling the automatic marking of short-answer free text questions) have been incorporated into Moodle. But how much are these innovative question types used? How much do we know about student engagement with eAssessment? This presentation will discuss these topics, challenge some assumptions and celebrate some successes. We conclude that changes in the detail of what we do can have a major impact on student perception and engagement.

Parallel Session A – Short Oral Presentations

(5) Argumentation Education for Computing and Technology Students

Paul Piwek and John Woodthorpe
Faculty of Mathematics, Computing and Technology

The development of students' critical thinking skills is a widely accepted aim of Higher Education. Critical thinking includes the skill to analyse and construct arguments. Supporting the development of argumentation skills for Computing and Technology (C&T) students presents specific challenges. For example, our experience is that a significant proportion of C&T students view such skills as at best an add-on and at worst a distraction from core C&T skills. We describe how we dealt with the integration of argumentation skills in TU100 ('My digital life'), a large entry-level gateway module for C&T distance learning students.

We focus on three specific dimensions of our approach:

1. The integration of argumentation skills with course content - specifically, a block of TU100 on the social and ethical impact of computing and information technologies.
2. The use of argument diagramming techniques to familiarise students with the underlying structure of arguments.

3. The roll-out of graphical drag-and-drop interactive computer-marked quizzes to scaffold the students' ability to analyse a text in terms of the underlying argumentative structure.

(7) Learning Analytics and disabled student support/accessibility – exploring the potential

Martyn Cooper
Institute of Educational Technology

One of the "hot topics" in technology enhanced teaching and learning is learning analytics. Learning analytics can be defined as the use of data about learners and their contexts, for the purposes of understanding and optimising learning. This presentation explores the potential of learning analytics to particularly support disabled students in STEM subjects and to identify accessibility deficits in learning activities delivered online. These are the themes of the eSTEeM project LA4STEM.

The presentation explores three use cases and discusses the potential of them and the issues they raise. These are:

1. The use of "clickometrics" from the VLE to monitor student activity level online and use this to promote retention
2. The focussing of support for disabled students ahead of activities that learning analytics had previously identified may be problematic for them
3. The analysis of completion and pass rates on modules, comparing disabled students performance with that of non-disabled students to identify possible intervention points for improving accessibility

Use case 1. is a general application of learning analytics others have explored that needs to be implemented in an accessible way if its benefits are to be extended to disabled students. Use case 2. is a potential new application of learning analytics targeted at particularly supporting disabled students where STEM activities may present particular challenges. Use case 3. rather than directed at the student is an application of learning analytics that would facilitate module teams when reviewing their modules for future presentation and enable areas for accessibility enhancement to be identified.

The presentation presents some of the data issues these use cases raise and discusses both the potential advantages of them and the challenges that will need to be addressed if they are to be practically realised.

(9) Can Computer-marked final assessment improve retention?

Jon Rosewell
Faculty of Mathematics, Computing and Technology

Distance learning modules (particularly low-cost introductory and enrichment modules) may show poor retention compared to traditional campus courses. The perceived difficulty of exams and end-of-module assessments (EMA) appears to deter some students from submitting. In contrast, interactive computer-marked assignments (iCMA) are typically attempted by most students.

Can retention therefore be improved by changing the format of part of the final assessment to an iCMA?

Robotics and the meaning of life was a 10-point, 10-week general-interest Open University module. The assessment comprised a mid-module iCMA and a final written EMA. The iCMA (a Moodle quiz) provided detailed feedback only after the submission deadline. The EMA included short-answer questions, a programming question and an essay. The EMA was script-marked and feedback limited to overall score and performance profile provided well after the end of the course.

The intervention simply replaced the script-marked short-answer questions by a second iCMA covering the same content with similar questions. The programming and essay questions were retained unchanged as a written, script-marked EMA.

The hypothesis to be tested was that retention would increase: students would be more likely to submit the final iCMA, their confidence would increase, and they would be motivated to submit the written EMA. Quantitative data were gathered for patterns of submission, course completion and pass rates for two presentations (124 and 220 students); data were also available for thirteen previous presentations (1814 students). Structured interviews were carried out to probe student preferences, confidence and engagement.

More students submitted the iCMA (86%) than the EMA (81%). Although they had the same deadline, 91% of students submitted the iCMA before the EMA. They submitted the iCMA well in advance of the deadline (median 4 days 15 hrs) but kept the EMA open as long as possible (median 18 hrs before deadline; 11% submitted in the final hour). These patterns strongly suggest that students were more confident with the iCMA than the EMA. Completion rates were the highest recorded: 88% and 89% compared to 79% for pre-intervention presentations. Overall pass rates were also improved (83% and 85% c.f. 76%). This can be ascribed to improved submission rates alone: the pass rate and mean scores among those who submit were unchanged giving confidence that the assessment difficulty was unaltered.

Student interviews suggested that students did attempt the final iCMA before the EMA and had greater confidence in obtaining a good mark for the iCMA than the EMA. Students valued the mix of assessment methods and felt it produced a robust result; although some expressed concern over the correctness of computer marking, they appreciated the detailed feedback it provided.

This intervention suggests that a change of assessment format can improve student engagement and pass rates without compromising rigour.

(13) Exploring student attitudes to formative quizzes

Rita Tingle
Faculty of Mathematics, Computing and Technology

Formative assessment provides opportunities for students to engage with a module, but requires more self-motivation from students. An OU study indicates that students who are short of time tend to work tactically as the module progresses and many only complete summative assessments (Jordan and Butcher, 2010). Two studies have been carried out investigating the factors that motivate students to engage with formative quizzes and the barriers they perceive in using these quizzes as part of their study.

Initially a small, preliminary, study was conducted involving six students who had completed a level 1 computing module which included both formative and summative quizzes. These students were asked about their motivation for doing the various quizzes. During initial analysis several themes emerged amongst which the notion of rewards and the importance of clear signposting within the module were the most prominent. The results of this study were used to inform implementation of a series of short quizzes in a level 2 computing module. Student volunteers attempted these new quizzes and provided feedback. Some of these students were interviewed allowing us to validate the findings of the previous study and further explore some ideas. This will lead to a further trial where the new quizzes will be introduced to all students on a current cohort of the level 2 module this winter allowing analysis of student engagement and further evaluation of the quiz structure to take place.

Parallel Session B – Short Oral Presentations

(1) Assessing the transfer of academic learning into workplace achievement

Kay Bromley
Faculty of Mathematics, Computing and Technology

Employers sponsoring students to study postgraduate courses want to see some benefit within the workplace. Courses to appeal to employers, and employed students, need to combine the teaching of 'academic' theory and knowledge with the application of learning in real-world situations. The development of a Postgraduate Certificate for IT professionals is outlined and the assessment by portfolio explained. The qualification was designed for new graduates, as part of their graduate training programme, with mentoring or other support from their sponsor. The students who have studied so far have come from several different backgrounds: fast stream graduates from various departments within a large public sector employer; recent graduates in organisations with strong centralised support for graduate training; individual students and some more mature employees aiming to consolidate their experience.

Students were required to submit a portfolio including a reflective commentary on their learning experience supported by evidence of their achievement. The Kolb learning cycle was considered as a model for these commentaries. The portfolios have been examined using a three step approach based on grounded theory to determine what benefits have been identified by the students, and where these have been evidenced within the employing organisation. This presentation describes how benefits to the student and the employer can be assessed and discusses the types of evidence presented by students to support their reflective commentary.

(15) Towards a Generic Model for Assessing Alternative Media

Soraya Kouadri Mostéfaoui and Judith Williams
Faculty of Mathematics, Computing and Technology

This project was designed to investigate the feasibility of developing a generic assessment model that could be applied to assess a wider range of alternative media artefacts (such as web pages, videos, posters, PowerPoint presentations, podcasts and graphics), and if not whether it could be extended or an alternative generic model could be developed. The initial motivation arose from our work on developing and using a common assessment model for assessing both text-based and non-text based (video production) artefacts in T215 'Communication and Information Technologies', as well as from the key recommendations proposed by the *MCT assessment*

review such as "Encourage and support research and innovative practice in assessment […]".

The T215's assessment model is constructed around six criteria which are designed to cover all key aspects of the task, categorised into content and presentation elements. As well as being used to grade students' assessment tasks, T215 model is also used to develop students' critical analysis of their own and other's performance and to provide a template for tutors to give feedback.

Our research activities consisted of the investigation of the current practices in assessing alternative media elements through a literature review, online surveys of both tutors and students who have worked with the T215 model, as well as a focus group and interviews.

Evidence from the research suggests that the model does offer great flexibility and consistency for assessing a wide range of alternative media artefacts. However; the T215 model needs to be developed to address some problems we experienced when applying it in different contexts. For example there was some difficulty when applying it to process-based artefacts, and it does not provide a means to holistically assess the artefacts. It also proved difficult to retrofit to some existing assessment tasks. Whilst the holistic assessment issue can be easily addressed by slightly modifying the existing criteria, the other issues are worth further investigation and will be addressed in a further eSTEeM project.

(19) Developing practice in online rooms by peer observation, feedback and reflection

Mark Jones and Anne-Marie Gallen
Faculty of Science

Current training and development for teaching staff in the use of online rooms (synchronous tuition tools, such as Elluminate Live!) tends to focus on technical usage rather than pedagogy. A technique which is widely used to develop the practice of staff in the context of face-to-face teaching is the use of peer observation. We report on a pilot project which explores the issues of implementing peer-observation techniques in an online environment. The project involved a cohort of volunteer tutors who teach OU Physical Science modules, which has the aim of developing their practice by a process of peer observation, feedback and reflection. The design and implementation of this process was guided from a consideration of Gosling's (2002) collaborative model for peer observation. We review the importance of developing a shared understanding of the aims and ethos of the process, and report on some of the practicalities that need to be considered in running such a process for a group of staff in a distributed environment.

The pilot scheme is currently being evaluated on the basis of structured conversations that were held with the participants following the completion of the pilot. We report on how this pilot study informs some of the identified themes around peer-observation such as briefing and training for the process, the nature of the feedback, and the effectiveness of the process (e.g. Cosh, 2006 and Bell, 2010), but in the context of synchronous online teaching. We offer some recommendations about how peer-observation schemes might be adopted more widely to develop pedagogic practice for online tuition.

Parallel Session C – Demonstrations and Structured Briefings

(O3) Interactive Scatterplots and Bubble Charts

Michel Wermelinger
Faculty of Mathematics, Computing and Technology

This demo session will show how to create and use interactive scatterplots and bubble charts for data exploration, using the iChart tool. The session will have two parts, the first covering the student perspective, the second the module team and tutor perspective.

In the first part, participants will be shown how to use a given chart, and will explore what kinds of questions can be answered about the data.

In the second part, participants will be taught step by step how to create their own charts: how to lay out their data in a spreadsheet program, how to export it to comma separated value files, how to create a web page that displays a chart and how to configure the chart. No knowledge of HTML or Javascript is needed, since the creation and configuration of the chart is based on modifying a pre-defined template.

Although participants may just wish to follow the presentation, they may bring their own laptops to use and create charts. In that case, a URL to download the necessary files will be provided, and the required software is: a spreadsheet program (like Excel or Numbers), a modern browser (like Safari, Chrome, Firefox, or IE 10 on Windows 8), and a plain text editor.

Parallel Session D – Demonstrations and Structured Briefings

(12) Hybrid Digital/Material/Networked Learning - scruffy mongrel or sleek new breed? Practices and implications of blending physical and digital resources for learning in HE

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

Technological change in areas such as holographic projection, 3D printing, ubiquitous computing and the internet of things has led to the blurring of boundaries between the digital and material worlds. These developments may hold the potential for radical innovation in education. In this project we are investigating the experiences and implications of using such digital/material/networked combinations (or 'hybrids') for science and technology learning. Is this hybrid a sleek new breed or learning, or a scruffy mongrel of mixed parentage?

We are using the word 'hybrid' in our project to refer to objects which combine digital and material elements (Knutsen et al, 2011) in ways which may be of value in the context of networked learning. We are seeing the emergence of networked learning resources that go beyond the purely digital (such as blogs, forums and wikis) but which can, for example, be linked together at a distance or be accessed remotely by students. We know a lot about student learning in a laboratory setting and in fieldwork. We also know a lot about students learning online. But what happens when we put the two types of learning together? This project aims to address that gap using ideas derived from a critical realist view on sociomateriality. Examples from the Open University's teaching include the use of the SenseBoard in TU100 My Digital Life; it is both physical and digital, the SenseBoard microprocessor, is used in conjunction with a computer network to share data with other students as part of the learning experience. The PIRATE project has demonstrated the use of a remote telescope by a group of astronomy students where the students work as a small group to access a powerful telescope in another country through a computer network. They gain valuable practical experience of 'hands on' astronomy and teamwork as they carry out various tasks. There is a growing number of such examples in the science, technology and engineering education literatures.

The aim of our project is to carry out a 'state of the art' review to establish the key themes, opportunities and obstacles that are emerging from these experiences. The first stage of the research involves a systematic literature review. In this structured discussion we will share some of the results of our literature review with a view to gathering feedback on our work. In addition, we invite conference participants to share their knowledge and experience of such digital/material/networked hybrid learning to advance our knowledge of this emerging field of research.

Reference:

Knutsen, J., Martinussen, E. S., Arnall, T., & Morrison, A. (2011). Investigating an "Internet of Hybrid Products": Assembling Products, Interactions, Services, and Networks through Design. Computers and Composition, 28(3), 195–204.

Parallel Session E – Short Oral Presentations

(6) Enhancing professional networking and engagement using social media

Helen Donelan
Faculty of Mathematics, Computing and Technology

This project explores how social media is currently being used by STEM academics to engage with existing professional networks but also to extend the boundaries of these networks to reach broader communities. It is concerned with the drivers for, and barriers against, the use of social media and looks at ways to support STEM academics in the development of online professional identities and the use of social media to engage with different user communities.

This presentation will summarise findings from the completed first phase of the project and outline plans and preliminary results for the second phase.

Phase I included a literature review and a small number of interviews with STEM academics within the OU. The literature review contextualises this research in terms of the career development literature as well as more recent work on academic identity and social networking user profiles. The interviews that have been performed have highlighted a range of activities that demonstrate how OU academics are using social media. Blogs, Twitter and maintaining online professional networks and online profiles on social networking sites such as LinkedIn and Academia.edu are the three main activities but some staff are using many other tools that enable sharing of information and content. The different motivations for using these tools that have been identified will be summarised. The outcomes of this phase have enabled the provisional development of a framework for social media user profiles. These profiles extend the existing literature on social media user groups by adding activities and motivations that describe work related or professional networking and engagement activities to existing user group profiles.

The plan for Phase II is to extend the research beyond the OU to other HE institutions to examine patterns of engagement amongst UK academics more generally. A large scale online survey will be used to explore the concept of an 'online professional identity' further, and attempt to validate or otherwise, the

user group profiles that have been developed in the initial phase. Phase 2 will also attempt to obtain feedback from individuals not using social media in order to explore the barriers. The use of a large scale survey will also enable a more detailed investigation into whether gendered and/or STEM discipline differences in styles and levels of engagement exist.

Participants attending this session will learn about the use of social media for work-related purposes and the potential outcomes, particularly in terms of increasing engagement with different user communities that have been identified through the project so far.

(11) Personal profiles in VLE forums: do students use them?

Karen Kear, Frances Chetwynd and Helen Jefferis
Faculty of Mathematics, Computing and Technology

Low social presence can be a problem in text-based, asynchronous communication environments such as discussion forums (Gunawardena & Zittle, 1997). In an educational context this may lead to feelings of impersonality and disengagement from online learning. However, features of online communication systems have the potential to increase social presence. One possibility is the use of personal profiles, including photos, to help participants learn something about each other and feel more connected (Arnold & Paulus, 2010).

This presentation discusses research findings from a small-scale study to investigate learners' use and perceptions of personal profiles in OU online forums and public social networking sites. Data were gathered from two tutor groups on the Level 1 Computing and IT module *My Digital Life* (TU100). The methods used were: an online survey; online focus groups via *Elluminate*; and observation of students' VLE profiles at two points during the module presentation.

The findings suggest that personal profiles and photos help some students to feel in touch with each other when using online forums. However, other students do not feel the need for these facilities, do not understand them, have privacy concerns or prefer to focus on the forum postings. These findings are in line with recent literature which suggests that participants in forums may not find it helpful to share personal details, as they might on a social networking site (Tanis & Postmes, 2007; Schwammlein & Wodzicki, 2012). We will present and discuss our findings, together with the educational and technical implications for practice in supporting students online. We will also consider some methodological/ethical issues which arose during the research.

Attendees at the presentation will have opportunities to:

- Learn about the advantages and problems of personal profiles in online environments
- Discover why, in OU forums, some students use profiles and some do not
- Consider the implications for supporting students and building learning communities.

References

Arnold, N. & Paulus, T. (2010) 'Using a social networking site for experiential learning: appropriating, lurking, modeling and community building', *Internet and Higher Education* 13 pp. 188–196.

Gunawardena, C. & Zittle, F. (1997) 'Social presence as a predictor of satisfaction within a computer-mediated conferencing environment', *American Journal of Distance education*, 11(3), pp. 8-26.

Schwammlein, E. & Wodzicki, K. (2012) *Journal of Computer-Mediated Communication* 17, pp. 387-407.

Tanis, M. & Postmes, T. (2007) 'Two faces of anonymity: paradoxical effects of cues to identity in CMC', *Computers in Human Behavior*, 23, pp. 955-970.

Parallel Session F – Short Oral Presentations

(14) Researcher-lead on-line science modules – towards a pilot module

David Robinson and Manfusa Shams
Faculty of Science

Against the background of declining practical work in a laboratory and increasing availability of technology, it is timely to look at new models of distance learning linked to practical work. The presentation in this session describes progress in developing a model that would enable individual academic researchers to offer a personally-led module as part of an honours level programme in an on-line distance learning curriculum. The academic would take responsibility for presenting the module and assessing it, using a standard module design. The use of new technology should make this personal link between academic researcher and students a practical proposition. A key element of the module would be a practical component that would build on the practical science ladder of learning, developed at Levels 1 and 2.

In order to test the concept of a researcher-led module, a potential pilot has been devised, which could be offered to volunteers for evaluation. In this presentation the structure of the pilot will be outlined together with the questions that a pilot would aim to answer. Substantial use has been made of existing resources, demonstrating that the production requirements of such a module need not be high. The potential for modules in other areas is also being examined and the results of this investigation will be outlined, with the aim of encouraging future module teams working at third level to incorporate this type of practical module.

(18) Working with Central Asian Universities to develop e-learning platforms and pedagogy

Peter Taylor and Sam Smidt
Faculty of Science

The CANDI project is an EU funded TEMPUS project that brings together partners from five Central Asian universities, in Kazakhstan and Uzbekistan, with European partners from Austria, Germany and the UK. The project's aims are around building HE capacity in Central Asia but also about developing the e-learning skills amongst HE staff. The project has focused on developing courses in the areas of computer science and chemistry. The OU's involvement has been primarily on the distance learning and e-learning side, helping establish platforms for shared delivery of materials between the partner universities but also working to ensure that the distance courses produced are more than a reproduction of existing face to face materials copied to a website. Workshops have been held on topics including: Establishing a VLE; fundamentals of e-learning; media training and there is a planned Assessment workshop for spring

2013. Since the project started in early 2010 there are currently 17 courses available on the CANDI website. They are quite varied in terms of content, pedagogy and the use that is made of tools and AV content but this still represents a huge effort in the time period.

This session will look at some of the issues involved in working on an international project. Uzbekistan and Kazakhstan have particular, but different, issues around internet provision and access to websites, state control of curricula, access to resources and support for developing distance education. Both have education systems rooted in the Soviet system so there are constraints around didactic and language issues. Both countries are looking to develop courses along vocational lines and there is an emphasis, particularly in Kazakhstan, on the oil, gas and mining areas. Geopolitically, this is a fascinating part of the world too and interest in the region comes from Europe, Turkey, Russia and China. In terms of the OU, this is a project that has done much to enhance our reputation in Central Asia. Kazakhstan in particular is developing very rapidly and keen to work with international partners and there is a great demand for education and training so this is part of the world where an increased awareness of the OU could be important.

Closing Keynote Presentation

Redefining Higher Education: The Case of CSEV – UNED

Daniel Torres Mancera[1] and Timothy Read[2]
Director General, CSEV (The Centre for Higher Virtual Education) [1]; Director, Open UNED (The National University of Distance Education)[2]

After centuries of steady yet calm evolution, the last two years have established new foundations in the world of University and Academia. Concepts such as 'classroom', 'student', 'faculty' and, overall, 'learning', are showing a strength and will of their own to change and surprise us again and again, in a matter of months or even weeks. Collaborative, massive learning, learning analytics, content and community curating, are all terms already inserted into our everyday vocabulary. And they come with their own set of new questions: What's the new pedagogical trend? Are new paradigms ground-breaking innovations or just new fads? What's the key to the financial sustainability of MOOCs? Where will value in higher education and life-long learning be found in five years time? Will universities as we know them still be here in ten years time?

CSEV Foundation and its parent University, UNED, are working on real projects, implementing real innovation and working with the most advanced partners on a global basis to help find answers to all these questions. In this session we will open a dialogue about everything we are discovering and learning in the process.

POSTER PRESENTATIONS

(1) Assessing the transfer of academic learning into workplace achievement

Dr Kay Bromley
Faculty of Mathematics, Computing and Technology

Same abstract as short oral presentation (1) on page 17.

(5) Argumentation Education for Computing and Technology Students

Paul Piwek and John Woodthorpe
Faculty of Mathematics, Computing and Technology

Same abstract as short oral presentation (5) on page 13.

(8) How it is different to before? Science student perceptions of the study experience in an era of curriculum and technological change

Laura Hills and John Rose-Adams
Centre for Inclusion and Collaborative Partnerships

The offering of the Open University has undergone radical change in the past year, and the Science faculty has been at the forefront of this change. OU students beginning their Science studies today are expected to pay more their studies, register for qualifications rather than modules and increasingly engage with technology. Little is known, however, about how students will perceive and respond to these changes and a particular concern is that students from widening participation backgrounds may be adversely affected by the changes, with possible implications for the Open University's curriculum and support structures.

The purpose of this project, therefore, is to investigate the perceptions and experience of students studying Science at the OU and, in particular, to understand more about the experience of students from the five priority groups identified in the Widening Access and Success Strategy 2012-15. It is a collaboration between staff from the Centre for Inclusion and Collaborative Partnerships and members of the Science faculty and is intended to contribute to the OU's Widening Access strategy and to the Faculty's widening participation objectives.

The research will feature three main elements:

1. An analysis of how the curriculum and use of technology has changed in recent years, and the reasons given for this change.
2. An analysis of existing documentation and research on students' perceptions of the study of Science at the Open University, in particular relating to the curriculum and the use of technology to support learning.
3. Qualitative and quantitative research with current Science students, both under the 'new' and 'old' regime, on their perceptions of the Open University and their experience of study.

The project is in its very early stages and the purpose of the poster is to identify the key methods of the project, including choice of Science modules, and to seek feedback from participants.

Please see page 33 for poster.

(10) Opening up multiple choice: Assessing with confidence

Jon Rosewell
Faculty of Mathematics, Computing and Technology

Multiple choice questions (MCQ) are the basic fare of e-assessment. MCQs are robust and easy to implement, but are pedagogically not ideal: open questions are preferable but automated marking of free text answers is problematic.

A possible squaring of this circle is to appropriate the technique of confidence-based marking (CBM).

In CBM, a student both selects an answer and also their level of confidence: they score full marks for knowing that they know the correct answer, some credit for a tentative correct answer but are penalised if they believe they know the answer but get it wrong. There are several motivations for CBM: it rewards care and effort so engendering greater engagement, it encourages reflective learning.

This project will appropriate CBM and, with one simple change, enrol it for quite a different end. Here the MCQ is presented in two stages. Initially, the question is presented with no answer options visible; instead the student must set their confidence level that they know the answer. Only then are the possible answers are revealed and the student answers as a normal MCQ. The marking scheme follows standard CBM practice.

Mechanically the question remains a simple MCQ: answer matching is trivial and robust, questions are easy to implement, and existing question banks can

be reused. However, to the student, the question is effectively transformed from closed MCQ to an open question. They need to formulate an answer first before they can decide their confidence in their answer, so they must decide their answer in the absence of any positive or negative clues, reducing the chance of misconceptions, or working backwards.

The project has implemented a CBM question type in OpenMark and trialled it for revision quizzes. Further evaluation plans to use a controlled experimental design to probe whether students using CBM will engage better with questions, improve their learning, and become more reflective learners. Measures of assignment scores and time on task will be collected, together with a survey and/or interview to probe attitudinal aspects.

Please see page 34 for poster.

(16) Developing a pilot researcher-lead science module delivered on-line

David Robinson and Manfusa Shams
Faculty of Science

On-line teaching and learning is expanding rapidly. In the STEM subjects, models are needed for integrating the practical skills concerned with observation and experimentation. Academic staffs in many universities generally offer a short course, often linked to practical work, to students in their final year. Such a course links a member of staff with a small group of students interested in their own research area. The course can often be presented using the most up-to-date research findings as the staff member is teaching in their research area. Despite the specialized nature of the subject area such courses teach generic skills.

We describe the background to the development of a pilot that could be used to evaluate the educational effectiveness of a model of distance learning at third level in which a researcher presents a module with a practical component in their own area of expertise, to a relatively small group of students. The researcher would have substantial control over the module, within a broad framework of appropriate skills development. This type of module combines production and presentation and can be kept up to date. By directly linking students with researchers it has the potential to further strengthen the link between teaching and research and compete more effectively with other educational providers. The aim of this poster is to generate interest in experimenting with this – and other – new ways of presenting 3rd level science.

Please see page 35 for poster.

(20) Activities to improve the engagement of international students in online teaching

Simon R. Collinson and Catherine Halliwell
Faculty of Science

Online teaching enables students to study from all around the globe to produce a diverse student cohort. As UK universities expand online provision and target international students key questions arise:

- What are the levels of engagement and the experience of international students and how might we improve it?
- Are there any specific issues found for the online teaching of international students compared to traditional teaching?
- What role can context based learning play?

The diverse range of students at the Open University provides a great opportunity to answer these questions.

Literature concerning traditional university teaching suggests potential areas of contention include their level of English, misunderstandings arising from differences in their educational and cultural background, difficulties in attending synchronous tutorials and feelings of isolation. This research will yield a general guide for best practise in the design of online teaching and learning activities. It is hoped our findings will be relevant to the teaching in other STEM subjects and of international students at more traditional universities.

In this teaching development project funded by a HEA:

- We have developed online chemistry tutorial activities involving internationally relevant context based learning considering trace metals in the diet, on which student feedback is now being sought.
- We have sought feedback from international and UK students face to face (level 1 students) and via an e-mail (level 3 students) to explore their successful study.
- We aim to survey academics within STEM subjects for student engagement with online activities, tutorials and forums, with a focus on international and science students.

Please see page 36 for poster.

The integration of knowledge based learning with professional body CPD and employer appraisal in STEM professions

Dr Kay Bromley

What?

TM893 is a 60 credit postgraduate module for the B2B market, assessed by portfolio, developed in collaboration with e-skills in direct response to employer needs. Its learning outcomes are related to the SFIA framework.

The articulation of achievement is important in demonstrating to the student and their sponsoring employers the benefit of continuing education at postgraduate level in their working life. However the first portfolios to be submitted show that students are then beginning to see how the study on the module has enabled them to make more impact in the work environment.

Who?

Students differ from the majority of our student population in being *pressed* rather than *self-selecting* and display differing attitudes to study and its relation to their working lives.

Two specific student groups are evident.

i) Graduate recruits who need, within one to three years, to be able to make significant contribution in their training placements.

ii) Talent management - experienced employees with potential for future promotion.

When?

The first TM893 students started studying in October 2009 and submitted portfolios in March 2011. Further students are due to submit in September 2011, March 2012 etc.

The project will look at students in different stages of their study and professional development.

How?

1. **Mapping of existing TM893 assessment against existing good practice.**
2. Review of tutor experience of supporting/motivating students
3. **Survey of students and summary of student articulated application of learning to professional context in submitted portfolios**
4. Identify trends, if present, in student engagement.
5. **Development of recommendations and dissemination of findings**

Why?

- Rapidly changing technologies mean that employers need employees who have good understanding of underlying principles that can then be applied in new areas.
- The Kolb learning cycle is widely used to rationalise knowledge based learning, and its assessment demands investigation of evidence based reflection. Students find difficulty in demonstrating their achievements.
- The project intends to understand better the student point of view so that their motivation can be stimulated and supported. This will improve student experience and reduce workload for supporting staff, as well as improving relationships with employers.
- Government funding for e-skills has been reduced and further collaborations in the current form are less likely. The project may support future work of a more loosely coupled nature, if the outcomes enable student achievement with less intensive support.
- Improved marketability of postgraduate modules, especially to new graduates, should build lifelong learning with professional who will be able to identify learning with the OU as having significant benefits for their career, and return for Masters study and future modules for CPD.

Argumentation Education (ArguEd)
Paul Piwek, John Woodthorpe

What? Improve students' critical thinking skills - in particular, argument analysis and construction skills.

Why? The ability to analyse and evaluate arguments is a key transferable skill. Firstly, it is an indispensable skill for study at Higher Education level. From the University's point of view, retention is likely to be better for students that have mastered it. Secondly, it is central to many employability skills. Finally, it is a skill that helps citizens to assess their own and other people's arguments both on issues of personal importance and questions about the society they live in.

How? In TU100 (*My Digital Life*) Part 5, Block 5 (*Digital Freedom: the Good, the Bad and the Internet*) students are introduced to *argument mapping*, a technique for diagramming arguments (see Fig. 1). Through activities and iCMAs (see Fig. 2), they practise their argument mapping skills and are then assessed in a TMA. We have analysed data from student work and tutor feedback to find out which aspects of argument analysis are particularly challenging and reported the findings in Piwek (2013).
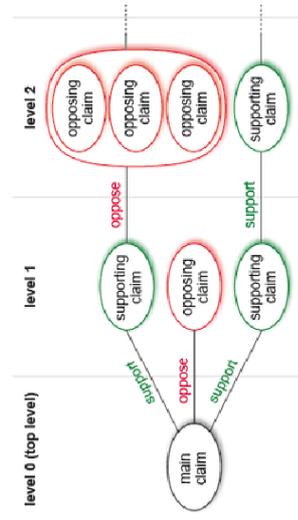
Figure 10 Argument maps can be thought of as being arranged in levels, with the main claim at the top (leftmost) level

Long description

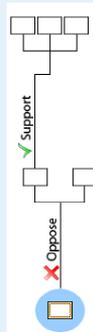**Figure 1 The structure of argument maps – a figure from the TU100 module materials**

TU100

Question 2 (of 6) • You have 3 attempts.

In 2010, several US companies that had dealings with WikiLeaks came under pressure from politicians. This included Amazon which, at the time, hosted WikiLeaks data. Shortly thereafter, Amazon removed the data in question. In response to reports that this happened as result of political pressure, Amazon said in a blog post:

"[Amazon Web Services] does not pre-screen its customers, but it does have terms of service that must be followed. WikiLeaks was not following them. There were several parts they were violating. For example, our terms of service state that "you represent and warrant that you own or otherwise control all of the rights to the content… that use of the content you supply does not violate this policy and will not cause injury to any person or entity". It's clear that WikiLeaks doesn't own or otherwise control all the rights to this classified content. Further, it is not credible that the extraordinary volume of 250,000 classified documents that WikiLeaks is publishing could have been carefully redacted in such a way as to ensure that they weren't putting innocent people in jeopardy."

Below is the structure of an argument map for the argument that is put forward in Amazon's blog post. Complete this map by matching the statements to the appropriate labels. (Hint: start by identifying the main claim, which Amazon is arguing against, and drag it into the box in the blue circle.)

A	A	Wikileaks was not following Amazon's terms of service.
B	B	Wikileaks doesn't own or otherwise control all the rights to the data.
C	C	For example, Amazon's terms of service state that 'you represent and warrant that you own or otherwise control all of the rights to the content… that use of the content you supply does not violate this policy and will not cause injury to any person or entity'.
D	D	Amazon removed the Wikileaks data because of political pressure.
E	E	It is not credible that the extraordinary volume of 250,000 classified documents that WikiLeaks is publishing could have been carefully redacted in such a way as to ensure that they weren't putting innocent people in jeopardy.
F	F	Amazon has terms of service that must be followed.

Figure 2 Example of an argument mapping iCMA in OpenMark (implemented with support from Phil Butcher and Callum Lester)

Reference

Piwek, Paul (2013). 'Supporting Computing and Technology distance learning students with developing argumentation skills'. In: *Proceedings of IEEE Global Engineering Education Conference (EDUCON)*, 13–15 March, Berlin.

How is it different to before? Science students' perceptions of the study experience in an era of curricular, financial and technological change

Laura Hills and John Rose-Adams, Centre for Inclusion and Collaborative Partnerships

The Open University

What we are going to do

"Investigate the perceptions and experience of studying Science at the OU, and, in particular, to understand more about the experience of students from widening participation backgrounds"

How we are going to do it

Desk

- Analysis of existing OU data:
  - How the curriculum and use of technology has changed in recent years
  - Student experience of studying Science
- Literature review
  - How do we define widening participation students?
  - Students' responses to change
  - WP students' responses to change

Quantitative

S104 – 2011J | S104 – 2012J | Old World — WP / Not WP | New World — WP / Not WP
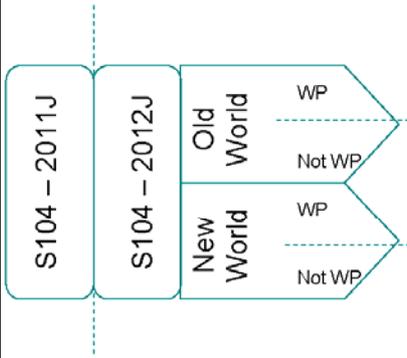
- Identification of baseline for study based on
  - Use of technology
  - Curriculum development
  - Funding arrangements
- Selection of module: S104
- Surveys with current Science students on experience of study in 'new' and 'old' worlds

Qualitative

- Analysis of student forum contributions
- Follow up interviews with students to follow up themes identified in surveys

Outcomes
- Better understanding of student experience
- Identification of risk factors for satisfaction and success

Outputs
- European Access Network Conference
- *Widening Participation and Lifelong Learning* article

Evaluation
- Appropriateness of methods
- Relevance to Science and OU WAS strategy

eSTEeM
exploring the frontiers of STEM education

Opening up multiple choice: Assessing with confidence

Jon Rosewell

Dept Communication & Systems, MCT

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Closed multiple choice question

What is the meaning of this road sign?

- Youth hostel
- Hazardous load
- Motorway diversion

Submit

Benefits	Drawbacks
Objective marking	Distractors may be trivial
Reliable marking	Distractors may engender misconceptions
Easy to implement	Working backwards

Open confidence-based question

What is the meaning of this road sign?

Confidence: Low ▼
Medium
High

Score:	correct	wrong
	1	0
	2	-2
	3	-6

- Youth hostel
- Hazardous load
- Motorway diversion

Confidence must be set **before** options are revealed

Benefits	Drawbacks
Open question	Intimidating?
Encourages reflection & self-assessment	Depends on personality?
	Open variant not always applicable

Multiple Choice Questions (MCQ)

Basic fare of e-assessment:
- Robust, easy to implement
- But pedagogically not ideal

Open questions:
- Pedagogically preferable
- Difficult to provide robust and valid marking

Confidence-Based Marking (CBM)

Student selects:
- Answer **and** level of confidence/certainty

Marks awarded:
- Confidently correct: .... Full credit
- A tentative correct answer: ....Some credit
- Cocksure & wrong:.............................Penalty!

CBM motivations

- Rewards care and effort
- Greater engagement
- Encourages reflective learning & self-assessment

Open CBM: two-stage question

Initially:
- Question (but no MCQ options)
- Student sets confidence level

Next:
- MCQ options revealed

Finally:
- Marking and feedback as for normal MCQ / CBM

Open CBM advantages

Mechanically, question remains simple MCQ
- Answer matching trivial
- Easy to implement
- Possible to reuse existing question banks

But have transformed closed to open question
- Student must formulate answer first
- Must decide answer without +ve or –ve clues
- Cannot work backward
- Will not be led into misconceptions

Therefore must answer the question as set

Project plan

- Implement open CBM question type in OpenMark
- Trial in T216 *Cisco networking* as formative quizzes
- Paired design: same bank of questions presented:
  - in MCQ format
  - in Open CBM format

Measures:
- Assignment scores
- Time spent on task
- Interviews to probe attitudinal aspects

Possible benefits

- Better engagement
- More reflective learners
- Improved learning

eSTEeM

exploring the frontiers of STEM education

Developing a pilot researcher-lead science module delivered on-line

David Robinson and Manfusa Shams

The idea
Over the past two years we have been developing a project that combines two ideas:
- linking research and researchers directly to Level 3 modules, as happens in the final year at most other universities;
- providing the top end of a ladder of learning for undergraduates in practical science - in an on-line world.

Practical knowledge/'learning by doing' is an effective way of delivering scientific concepts. It is based on an enquiry-based learning approach. There is evidence that enquiry-based scientific pedagogy enhances students' scientific knowledge and understanding (for example, Liu et al., 2009).

Background
Academic staff in other universities generally offer a short course, often linked to practical work, to students in their final year. Such a course links a member of staff with a small group of students interested in their own research area. The course can often be presented using the most up-to-date research findings as the staff member is teaching in their research area. Despite the specialised nature of the subject area such courses teach generic skills. In the Open University, such direct links with staff engaged in research rarely – if ever – occur.

Building a pilot
We have developed a model that will enable an individual member of the academic staff to offer a course in their own research area, able to evolve as the subject area moves forward. Short modules such as this would be embedded in the Level 3 curriculum. The model is flexible as possible, to allow the academic to present the course in the most suitable way for their subject and encourage innovation. All modules would include some element of practice, such as literature review, review writing, data handling, website construction, video/audio/photo presentations, dependent upon the research of the academic. The pilot has been constructed on the basis that a member of staff would run it themselves with self-generated material and appropriate learning resources. This project builds on work on a Level 1 on-line course in Science investigation (Robinson, 2011) and aims to provide Level 3 learning experience linked to research. As such, it would be part of the practical pathway now being developed in the Science curriculum. However, the module model would be applicable across the STEM area, and beyond.

Outline of the pilot

Week	Activity (generic)	Staff actions	Pilot – Human evolution
0	Website live		Set book purchase – no mailings
1	Introduction	Review article(s) and/or set book chapters and podcast	Podcast Set book (SB) chapters 1 to 4
2	Problem/discussion 1	Seed VLE forum discussion	Forum discussion Primate and anthropoid origins
3	First on-line tutorial	Publish reading list First lecture/tutorial	Review papers on 'Out of Africa' – SB Ch 5 to 8 Tutorial - Out of Africa versus multi-regional origin
4	Problem/discussion 2 Set-up practical task.	Seed forums on practical Podcast intro to practical	Task – How DNA sequencing of the Denisovans reveals relationships with modern humans
5	Forums and practical work		Literature searches and group work on forums
6	Second on-line tutorial	Tutorial on practical task	
7	Problem/discussion 3	Seed forums	SB Ch 8 to 10
8	Forums and practical work		SB Ch 11 and 12 and group work on forums.
9	Final on-line tutorial	Tutorial on practical work	
10	Work on EMA	Final podcast	Write up practical task and submit as EMA
11	Cut-off date for EMA	Start marking period	

Next steps
We would like to try out the pilot on a group of volunteers to test the feasibility of delivery by one/two members of staff and the outcome of direct contact/engagement with the researchers. 'We would be interested in working with teams developing the new Level 3 curriculum in Science. We hope the pilot model will provide a stimulating and enjoyable virtual learning experience, in which the learner takes an active role to negotiate and develop partnership with the learning environment ((Moss et al., 2011).

Liu, T-C., Peng, H., Wu, W.-H.,& Lin, M-S. (2009) 'The Effects of Mobile Natural-science Learning Based on the 5E Learning Cycle: A Case Study', Educational Technology & Society, vol.12, no.4, pp.344–358.
Moss, M. C, Brookhart, M.S. and Long, A. B. (2011) 'What Students Need to Learn: knowing your learning target', Educational Leadership, vol. 68, no.6, pp. 66-69.
Robinson, D. J. (2011). Collaborative experiments on-line in a course presented globally. Bioscience Education. 18

Activities to improve the engagement of international students in online teaching

Simon R Collinson and Catherine Halliwell

Feedback from interviewing international students about online distance learning

- Often found wording of questions was overly complicated
- Students felt a duty to contribute to online forums
- Reluctance to talk online
- Time difference can be an issue
- Rate of study and level of staff support is higher in UK
- UK courses have more applied and up to date content

This informed our activities below for students studying the level 3 course Metals and Life in 2013.

International Context Based Learning online tutorial activity

1. Provided Powerpoint slides for tutors and pre-tutorial tasks for students
2. Extracts from *Is the Western diet adequate in copper?*, *J Trace Elem Med Biol*, 2011, 25, 204
3. Students asked to find (i) RDAs for transition metals in home country and (ii) typical values in foods

Reflections on the online tutorial group activity

- Tutors used slides or merged with their own
- Tutors more confident as discussing same material as others
- Liked the level of interactivity included & contextualising the material
- About 14-17% of students per group studied material in advance
- Student feedback via e-mail was limited but positive
- Salt in diet was mentioned – this inspired the next activity

International CBL forum activity on salt in diet

1. Key skills and scientific knowledge
2. *Salt in bread in Europe: potential benefit of reduction*, *Nutr Rev*, 2012, 70, 666
3. Skim read paper, taking notes, then assess abstract, conclusion & full paper
4. Asked to critically evaluate the paper
5. Contrast with weaker paper *Influence of exogenous iron, calcium, protein & common salt on the bioaccessibility of zinc from cereals*, *J Trace Elem Med Biol*, 2009, 23, 75
6. Calculated salt from bread in their own diet and values from data for another country
7. Study and discuss Na^+ in ion channels on RCSB protein databank

Reflections on the forum activity

- Only 8% of students posted as it was optional and 44% of students lurked on forum
- 33 students posts with some posts explored the topic further citing other work
- Students valued skim reading and felt topic was relevant to them and the course
- No-one critically evaluated the paper, which has been shown as a generic weakness of students

Quote from a student, 'Being able to apply one's understanding of the principles to real-life problems is fundamental to maintaining the motivation for the study. I think that for a distance learner who is relieved of the pressure to level with their peers, it is important that there be an alternative source of inspiration. Contextualising the theory certainly works for me.'
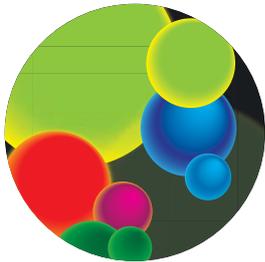
We are keen to hear about best practise from other academics teaching international students.

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POSTERS AND DEMONSTRATIONS FROM THE OPENSCIENCE LABORATORY

The Open University are developing The OpenScience Laboratory, an online laboratory for practical science teaching, funded through a £1m grant awarded by the Wolfson Foundation.

Guided by rigorous research, the laboratory will inspire students and transform access to the world of science. As well as housing existing Open University practical science applications we are developing new applications using cutting-edge technology.

Some of the experiences available will include:

- remote access to laboratories and observatories: students can operate real physical equipment controlled remotely – a method already established in astronomy
- virtual laboratories and instruments, such as the virtual microscope: interactive screen experiments will include photo-realistic recordings of physical experiments and replicate the behaviours of real specimens
- online field investigations: these can involve electronic access to a conventional field trip or offer a virtual experience using satellite-borne and remotely-operated sensors
- citizen science: a distributed way of gathering data, where non-professionals collect or process data as part of a scientific enquiry. This data can be combined to offer new insights.

The laboratory will provide online access to data from real physical instruments and equipment – not only to OU students but to students across the globe.

The OpenScience Laboratory welcomes partnerships for online practical science projects.

To find out more please visit www.open.ac.uk/openscience
Twitter: @OpenScienceLab

treezilla
the monster map of trees

Mike Dodd and Jonathan Silvertown
Science Faculty

General features

• Mapping and recording Britain's trees using citizen science.
• A platform for a wide range of enquiry lead scientific investigations using real data from trees.
• Possible topics include: assessing ecosystem services provided by trees, tracking emerging pests and diseases, evaluating the effect of climate change on tree growth and condition, and studying macroecology.
• Open to anyone, school, university or general public.
• Bulk upload of large inventories of tree data held by local authorities instantly turns every town into an arboretum.
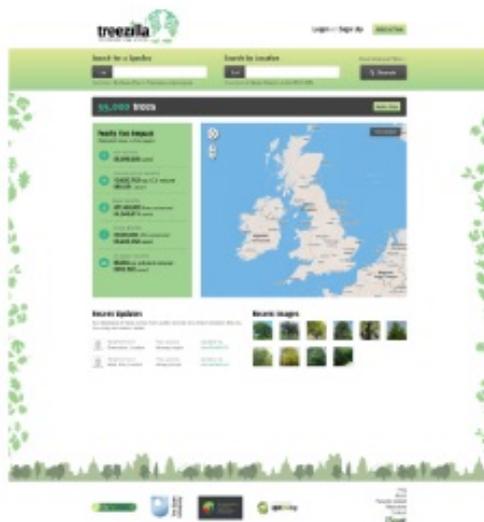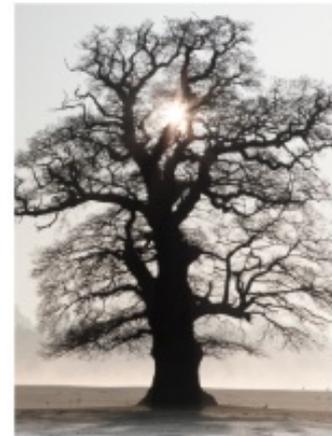
Current status

• System starting to be used in USA where it has stimulated considerable community engagement, hundreds of thousands of trees mapped.
• Currently working with Forestry Research UK and other collaborators to adapt the parameters to more closely match UK trees and climate.
• Looking for more tree inventory data from councils.

New opportunities

• Already have a number of collaborators wanting to use the system to collect data from the general public but we are still looking for more collaborators.
• Enhanced engagement with the local environment especially in urban areas.
• Synergy between research and education.

In partnership

The Open University

The OpenScience Laboratory
An initiative of The Open University
and The Wolfson Foundation

iSpot
.org.uk

Jonathan Silvertown, Janice Ansine, Martin Harvey
Science Faculty
Richard Greenwood, Doug Clow, Mike Sharples
Institute of Educational Technology

General features

- Overcomes the taxonomic obstacle that confronts anyone studying ecology and allied subjects
- A social network linking > 20, 000 beginners and experts who help each other put correct names to species they have observed
- The unique iSpot reputation system motivates & rewards learning and is used to validate species' names

Current status

- More than 90 natural history organizations are represented on iSpot
- 150,000 observations of c 7,000 species made to date
- Now also in use in South Africa – a hotspot of biodiversity
- Available on Android smartphones

New opportunities

- Global demand for the iSpot service will be met thanks to funding from the OpenScience Laboratory
- Ecological interactions will be added in 2013
- Quizzes to be developed to motivate and track learning
- iSpot data now a valuable scientific resource

In partnership

3D Virtual Geology Field Trip

Tom Argles, Brian Richardson, Sarah-Jane Davies, Sara Hack,
Shailey Minocha, Nick Braithwaite and Colin Chambers

Students experience Geology in 3D environment

- authentic and interactive 3D simulations
- realism and high degree of fidelity
- virtual embodiment in the form of avatars
- visual and spatial experience not constrained by a 'flat' 2D user interface
- helps internalise the sense of exploration
- real-time interaction and collaboration

An immersive experience

- sense of space
- sense of presence, co-presence
- spatial perception of sounds
- feeling of 'flow' and sense of engagement
- collaborative and contextual learning

Opening up opportunities for students and educators

- practice for and reflect upon real life field trips
- learn by self-exploration and in teams
- seeing and doing what you can't in the real world
- cutaways into a mountainside to see the geology beneath
- flying across the landscape
- explore, observe and gather data within a context, e.g. using a virtual microscope
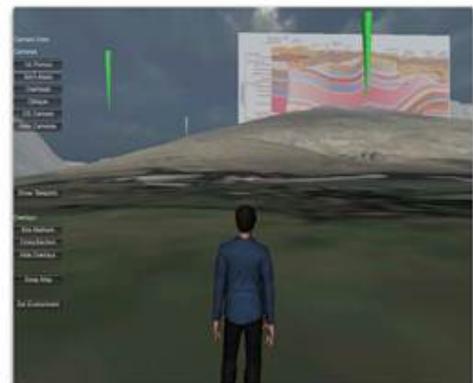
nQuire: supporting Inquiry Based Learning

Eloy Villasclaras, Mike Sharples, Eileen Scanlon
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Outline

nQuire is a tool for Inquiry Based Learning (IBL) that guides users along a series of activities to scaffold their investigations. Through nQuire, users can create their own personally relevant questions and try to answer them.

With the integration of nQuire into The OpenScience Laboratory, new opportunities arise to create inquiries around scientific tools such as *iSpot*, Virtual Microscopes, and the remote telescope PIRATE.

Inquiry Based Learning cycle
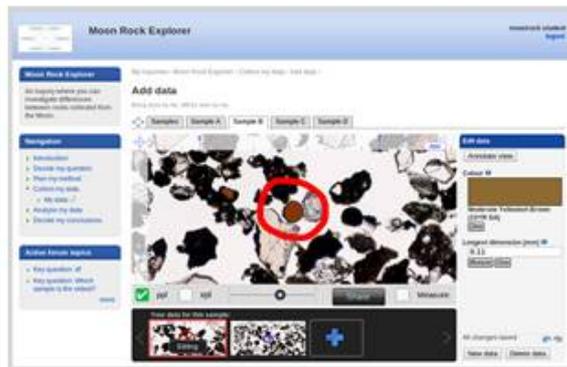
A Virtual Microscope based inquiry

Moon Rock Explorer inquiry

The *Moon Rock Explorer* inquiry demonstrates the new possibilities of the integration of nQuire and The OpenScience Laboratory.

- Explore samples of Moon rock, using the Open University's Virtual Microscope.
- Pose **scientific questions**, collect **data** to answer them, and reach **conclusions**.
- **Share** questions, data, doubts and expertise in an **open user community**.

Objectives and challenges

Educational objectives:

- Create engaging and effective IBL activities in distance learning environment.
- Understand the role of collaboration and user communities to support IBL.

Technology objectives:

- Understand the requirements for authoring and management of user-created inquiries.
- Develop common data exchange protocols between scientific tools and nQuire.
- Ensure new scientific tools integrated will be interoperable with nQuire.

Moon soil studied in the Moon rock Explorer inquiry
(photograph courtesy of NASA)

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The OpenScience Laboratory
An initiative of The Open University and The Wolfson Foundation

Open Inquiry Learning in Citizen Science

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Institute of Educational Technology (IET)

Overview

Amateur rock and fossil hunters could assist geologists all over the world! Citizen Science can benefit the field of geology by mediating between professional and non-professional geology researchers in large scale scientific studies.

The Open Inquiry Learning in Geology Citizen Science project aims to explore and evaluate the:

- scientific inquiry skills and participation levels of citizens during the project;
- changes in collaboration between geologists and citizens;
- co-creation of knowledge by citizens and geologists.

Exploring rock formations

The nQuire Toolkit in the Personal Inquiry Project

Methods

A design-based research method will be adopted:

- Participants: geology experts and citizens interested in geology.
- Iterative collaboration with the participants for the project design and integration.
- Customization of the nQuire inquiry learning toolkit for Open Inquiry Learning.
- Investigation of social interaction for knowledge co-creation during the Open Inquiry process.
- Evaluation of the project through qualitative and quantitative methods.

Impact on Society, Science & Education

The aim of Open Inquiry Learning in Citizen Science is to promote active and successful participation of citizens in the scientific process. The participants should develop new skills such as critical attitudes and questioning. These skills, when properly structured, can characterize scientific research and contribute to scientific understanding.

The Open University student fieldwork

Supervision team: Prof Mike Sharples & Prof Eileen Scanlon

The OpenScience Laboratory
An initiative of The Open University and The Wolfson Foundation

Helping Citizen Scientists Read and Write Like Scientists: Learning Analytics & Authentic Inquiry

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Knowledge Media Institute

Overview

When scientific projects invite citizen engagement, it is mainly for gathering and classifying data. BUT the *OpenScience Laboratory* vision is that, citizens can also be engaged with different aspects of the scientific ecosystem, thus enriching scientific projects.

Aims

❖ Enable citizens to become *citizen scientists*.
❖ Develop citizens' everyday language and *scientific* thinking, reading and writing *abilities*.

They started out as citizen scientists, now we know them as some of our greatest scientists

Approaches & Methods

❖ Engage adult citizens by using Web 2.0 tools within inquiry based learning.
❖ Develop citizens' scientific abilities by enabling them to:

- Create evidence-based arguments and claims.
- Annotate the important ideas within documents.
- Blog about their arguments and claims. Then go on to engage in longer forms of reflective writing about their work.

❖ Explore different analytic technologies to investigate how citizens learn through the inquiry-based process.
❖ Scaffold citizens' learning progress by using learning analytics technologies to provide automated timely feedback.

Developing citizens' scientific abilities through an inquiry-based process and learning analytics

Impact on the end-user community

"If you don't feel engaged in what you're doing, you won't care about it, and you're unlikely to succeed."
- learningfutures.org.

❖ Citizen scientists will be able to engage more with the spirit of science.
❖ Scientific projects will be richer in content.
❖ The number of success stories will increase.

Some of the successful citizen science projects

iSpot — *Your place to share nature*

Supervision team: Dr. Simon Buckingham Shum, Dr. Anna De Liddo & Dr. Rebecca Ferguson

In partnership

The Open University

# Engagement and Learning Through Remote Access to Practical Science

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Overview

Distance learning models of science education are becoming ever more popular. A growing area of interest is the provision of effective hands-on experiences of practical science online: measurement skills and the use of scientific equipment. Such technology can likewise be used to engage, inform and motivate the general public.

Aims

- review existing approaches to remote access practical work
- assess their effectiveness
- design protocols for improved learning of practical skills
- develop new remote interfaces and virtual environments
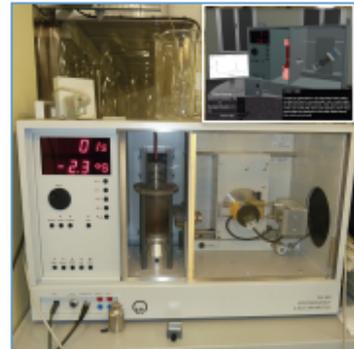
*PIXIE: real and virtual lab environments*
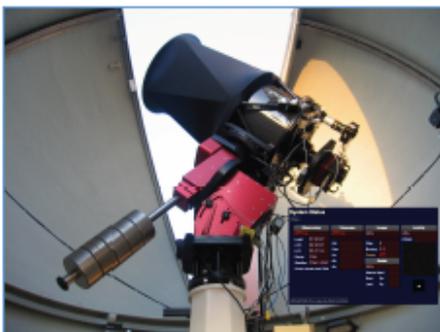
PIRATE: robotic telescope

Areas for investigation

- learning processes for practical work
- usage patterns with remote and virtual equipment
- the PIXIE Compton scattering experiment
- the PIRATE robotic telescope (pirate.open.ac.uk)
- communication with educators and other students
- perceptions and assessment of online practicals

Anticipated areas of impact

- online collaborative science learning
- improved public engagement with research
- mobile apps for crowd-sourced science
- massively open online *practical* courses
- effective interfaces for personalised learning
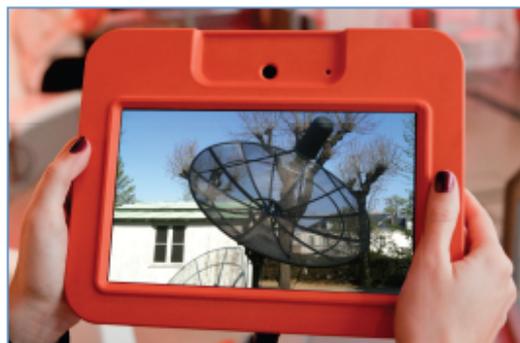
Public engagement with science from any location

Supervision Team: Prof Nicholas Braithwaite, Dr Ulrich Kolb & Dr Shailey Minocha

The OpenScience Laboratory
An initiative of The Open University and The Wolfson Foundation

Design and evaluation of Technology-Enhanced Learning for field trips within and across cultures

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Overview

This research will extend and deepen studies of technology for field trips to provide a conceptual base and toolkits that will inform research across a variety of cultures.

Aims:

- Evaluate how smart phone technology is being embraced within a fieldwork context in different cultures
- Take advantage of apps and online resources, such as the OpenScience Laboratory
- Create strategies to make the most out of existing technology

Building upon the Wolfson OpenScience Laboratory we aim to unlock the potential that the latest technology puts into the hands of students across cultural boundaries
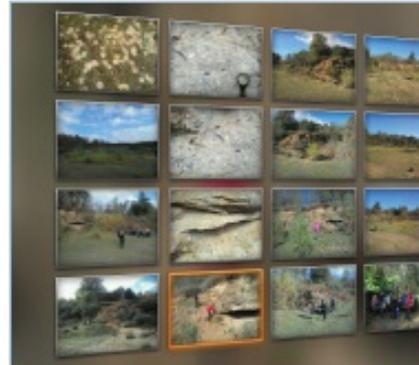
Smart phones give students access to new research tools

Adoption of new technology is often ahead of its utilisation

Methods

A combination of methods will be utilised to design and evaluate the current use of existing technology

- Qualitative analysis of the utilisation of technology in the field
- The quantitative analysis of statistics from official bodies
- Build upon existing research into cultural perspectives and models

Impact on Society

"*Practical science has been an under-developed area of online education – it is cost-effective and is a bold way of making the world of science accessible to many more people, particularly those in the least developed countries.*"
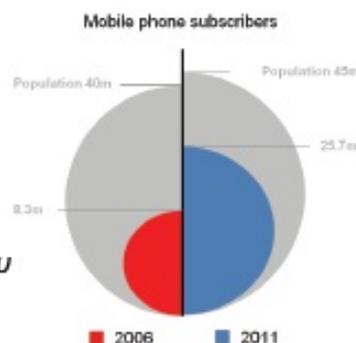- Prof Steve Swithenby

Mobile phone subscribers

Technology adoption in Tanzania
Source: Tanzanian Government, ITU

Population 40m

Population 45m

25.7m

0.3m

- 2006
- 2011

Supervision team: Prof Mike Sharples, Prof Stefan Rueger & Dr Sarah Davies

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The Open University

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OU CAMPUS MAP

eSTEeM Conference
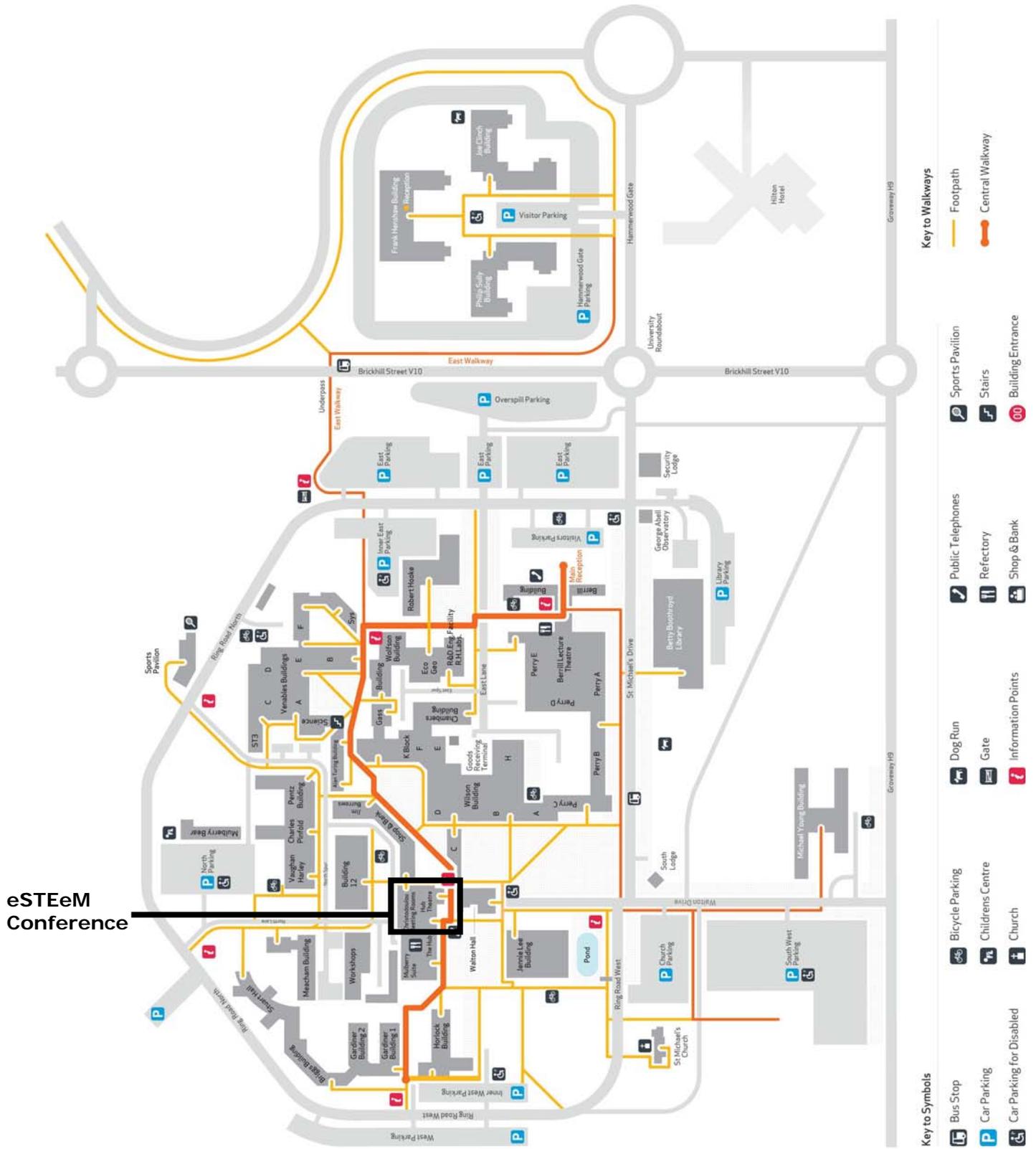
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