eSTEeM
exploring the frontiers of STEM education

The Open University

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Engaging with Open Research

A great deal has changed in recent years in relation to how academic researchers are expected to engage with publics, user communities and other stakeholders. The National Co-ordinating Centre for Public Engagement, based at the University of Bristol, in collaboration with six HEI-hosted Beacons located in the UK's nations and regions, has helped to crystallise theories and practices around a scholarship of engagement.

The National Co-ordinating Centre for Public Engagement (NCCPE) in Bristol. Picture: NCCPE website.

What is the agenda for budding scholars of engagement? If we can see beyond the widespread changes to our curriculum there is another elephant in the room: the REF. Forthcoming requirements to construct cases that demonstrate the impact of academic research are focusing attention on strategies for how we plan, enact and evaluate public engagement. These set considerable challenges for an area of scholarship that has often been a poor relation to teaching and research. But its prominence is changing, and for the better.

The Open University has secured RCUK funding for a three-year project designed to embed public engagement within the culture of research at the Open University. An overarching aim of the project is to promote 'an ecology of openness' in how we engage user communities, stakeholders and publics with Open University research. Led by Professor Tim Blackman, and supported by a Catalyst Champion for public engagement with research, this Research School-hosted, pan-OU project involves an interdisciplinary team drawing on expertise from the Faculty of Science (Richard Holliman), KMi (Trevor Collins), IET (Eileen Scanlon and Anne Adams), Social Sciences (Nick Mahony) and the Open Business School (Richard Holti).

The project draws on an NCCPE-produced methodology for cultural change called the 'Edge Tool'. This tool provides a framework for assessing how an institution's culture of public engagement develops in relation to its: purpose (leadership, mission, communication); processes (support, learning and recognition); and people (staff, students and publics).

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eSTEeM is contributing to the project through annual calls for engagement projects that will result in a series of supervised projects. A key aim of this work package will be to generate the types of evidence that can offer exemplars to other researchers.

eSTEeM's contribution will build on the recent eSTEeM call for engagement proposals. Three projects have recently launched as a result of that call, led by: Helen Donelan (MCT); Emma Rothero (Science); and Saskia van Manen (Science).

Please see http://www.open.ac.uk/media/fullstory.aspx?id=23266 for further details about the RCUK-funded project.

Written by Richard Holliman, Faculty of Science and CREET, The Open University.

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Flight of the Fritillary

THE Floodplain Meadows Partnership (FMP), hosted by the Open University, has been collecting data on the rare Snake's head fritillary at a National Nature Reserve (North Meadow, Cricklade, Wilts) since 1998. North Meadow is owned and managed by Natural England, and is home to 80% of the UK's remaining populations of this rare flower. Each April, Natural England manage many thousands of visitors who come and see the fritillaries in flower.

The FMP data collection has been done using volunteers through an annual fritillary counting day. Throughout this period, numbers of volunteers have been low, but recently are increasing as we put more effort into encouraging new volunteers to join us. The information collected has been entered into a database and trends of change noted. Management recommendations are fed back to the site manager to try to ensure that the site maintains its wildlife value, and over the years the numbers of plants has been steadily increasing.

During April each year, Natural England hold open days and the FMP provide information through posters, banners, guided walks and leaflets about the data we collect. This information is also available through the FMP website.

Recent Dutch research showed that their fritillaries are pollinated by bumblebees and the flowers have evolved a number of mechanisms to attract these pollinators to them (as they are only ready for pollination for a few days each year). We would like to observe bumblebee behaviour on several key sites to see whether they follow this pattern, and also set up a mechanism to count the bees themselves.

These pollinators are essential for the survival of fritillaries, and it is widely reported that they are declining in the wider countryside. Could this be an increasing problem for the survival of the UK populations of snake's head fritillary? What benefit may the early flowering fritillary have for bumblebee populations and thus for an important ecosystem service: crop pollination.

Volunteers collecting data. Picture: Emma Rothero.

Additionally there are a number of other sites in the UK where fritillaries are also found, and in some cases, counted. The counting methods are not the same as those we use, and in no other cases are the numbers of juveniles and non-flowering plants counted. Therefore, we have no knowledge about whether the trend for increasing fritillaries at North Meadow is due to management changes, the wider climate or other factors or in fact whether fritillaries are in fact decreasing elsewhere.

Our project aims to:

- Increase the numbers of volunteers at North Meadow through wider advertising improved engagement and better feedback of results.
- Establish two new sites where fritillaries are counted and establish two new volunteer groups to count fritillaries.
- Establish bumblebee survey transects on the three sites using volunteers to collect the data.
- Analyse the data collected and feedback findings to volunteers through feedback sessions, website and leaflets, alongside understanding why volunteers come, what they enjoy, what

Surveying fritillary. Picture: Emma Rothero.

they have learned and how they would like to be involved in the future, thereby increasing levels of engagement.

So far, we have established the two new sites, made contact with the Bumblebee Conservation Trust and run a Bee ID workshop for staff and volunteers. We have volunteers booked on to all three count days and a small number who have volunteered to undertake the more demanding bee surveys.

We have established a list of questions that we would like to ask the volunteers on the count days as part of a series of very informal interviews.

If you would like to get involved in the counts or take on a bumblebee survey, please do get in touch.
Email: Floodplain-Meadows-Project@open.ac.uk
Call: 01908 655645
Visit the website: www.floodplainmeadows.org.uk

Written by Emma Rothero, Faculty of Science, The Open University.

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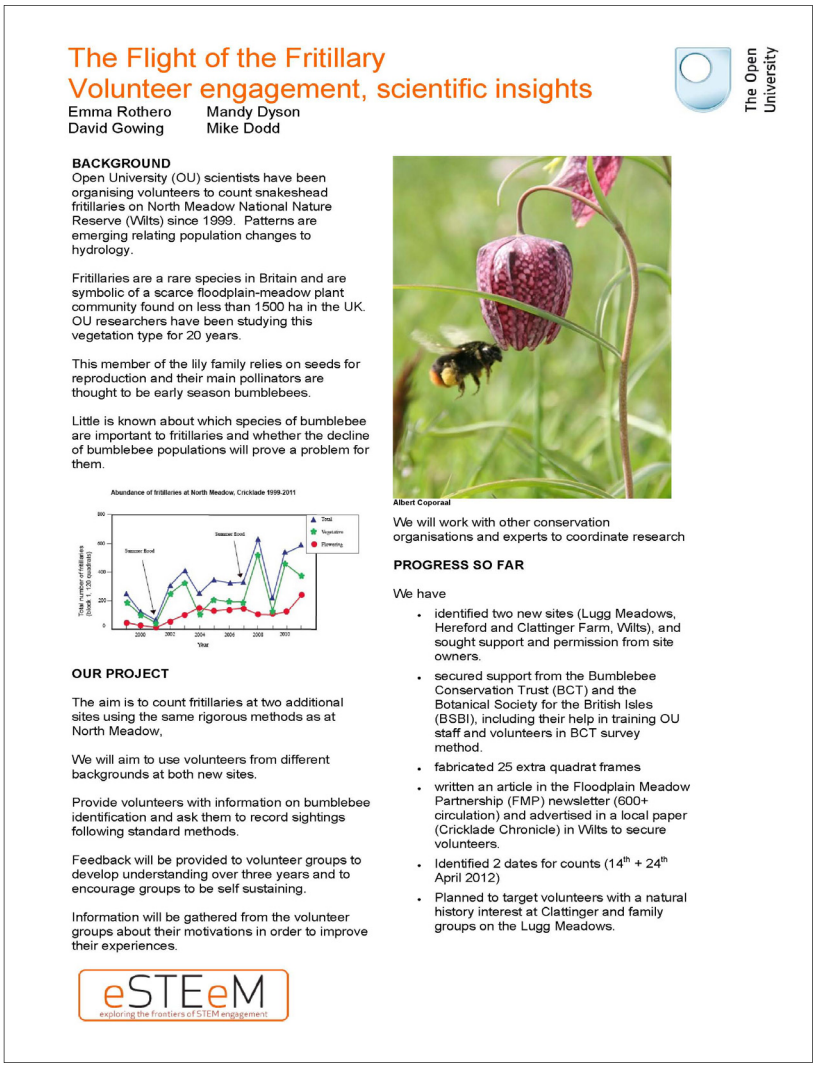


The Flight of the Fritillary
Volunteer engagement, scientific insights

Emma Rothero David Gowing Mandy Dyson Mike Dodd

The Open University

BACKGROUND

Open University (OU) scientists have been organising volunteers to count snakeshead fritillaries on North Meadow National Nature Reserve (Wilts) since 1999. Patterns are emerging relating population changes to hydrology.

Fritillaries are a rare species in Britain and are symbolic of a scarce floodplain-meadow plant community found on less than 1500 ha in the UK. OU researchers have been studying this vegetation type for 20 years.

This member of the lily family relies on seeds for reproduction and their main pollinators are thought to be early season bumblebees.

Little is known about which species of bumblebee are important to fritillaries and whether the decline of bumblebee populations will prove a problem for them.

Abundance of fritillaries at North Meadow, Cricklade 1999-2011

Albert Coporaal

We will work with other conservation organisations and experts to coordinate research

OUR PROJECT

The aim is to count fritillaries at two additional sites using the same rigorous methods as at North Meadow,

We will aim to use volunteers from different backgrounds at both new sites.

Provide volunteers with information on bumblebee identification and ask them to record sightings following standard methods.

Feedback will be provided to volunteer groups to develop understanding over three years and to encourage groups to be self sustaining.

Information will be gathered from the volunteer groups about their motivations in order to improve their experiences.

PROGRESS SO FAR

We have

- identified two new sites (Lugg Meadows, Hereford and Clattinger Farm, Wilts), and sought support and permission from site owners.
- secured support from the Bumblebee Conservation Trust (BCT) and the Botanical Society for the British Isles (BSBI), including their help in training OU staff and volunteers in BCT survey method.
- fabricated 25 extra quadrat frames
- written an article in the Floodplain Meadow Partnership (FMP) newsletter (600+ circulation) and advertised in a local paper (Cricklade Chronicle) in Wilts to secure volunteers.
- Identified 2 dates for counts (14th + 24th April 2012)
- Planned to target volunteers with a natural history interest at Clattinger and family groups on the Lugg Meadows.

eSTEeM exploring the frontiers of STEM engagement

The Flight of the Fritillary project poster.

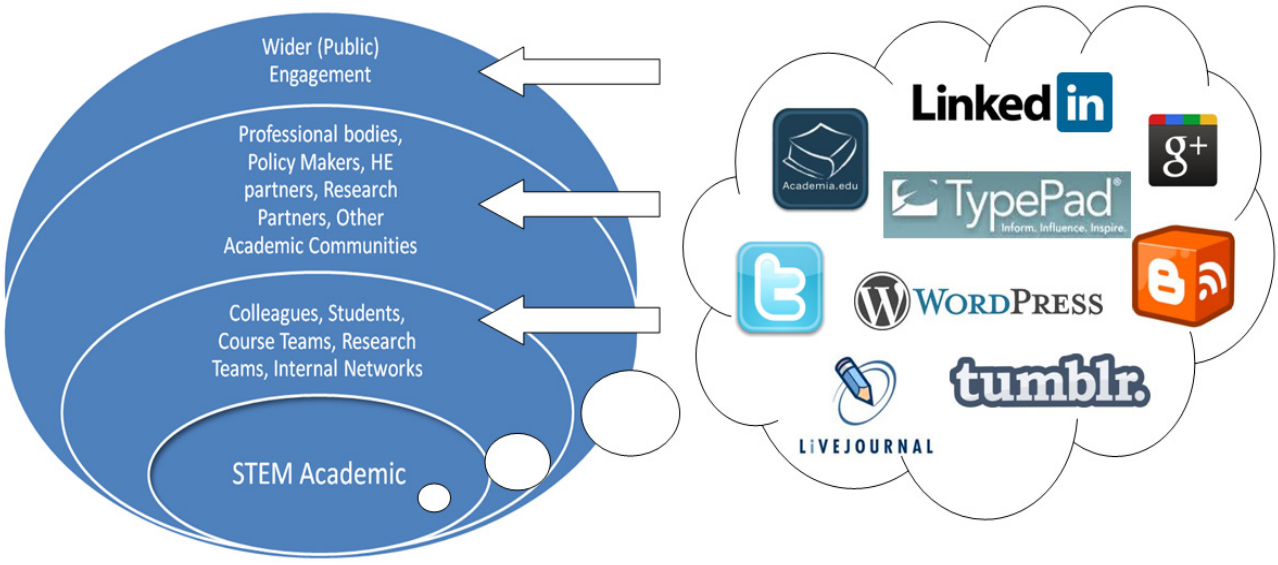
Enhancing Professional Networking and Engagement using Social Media

AS part of the eSTEeM theme of STEM engagement, which is concerned with our different user communities, the project 'Enhancing professional networking and engagement using social media' is interested in exploring the effects of the use of social media on these user communities and interactions.

The networking activities of STEM academics can be extensive and varied. Methods for maintaining links with this diverse network of people and organisations have changed over recent years with the increase in popularity of social media such as social networking sites and microblogging services. This project is interested in exploring how STEM academics are using social media to engage with their existing professional networks and establishing whether these tools enable broader engagement with other user communities.

We would like to understand the drivers for using social media. How are STEM academics currently using these tools to create and maintain an online professional identity and engage successfully with the wider community? What are the barriers against participating in such activities. What are people's fears and inhibitions about social media and wider engagement? In particular, with increasing workloads how can we ensure participation in such activities is efficient and effective?

With increasing pressure in the HE sector for professional identity management and the need to demonstrate engagement, as well as the current discussions surrounding digital scholarship, this project aims to provide a timely exploration into these activities and to identify useful practices. We are also interested in exploring other factors, such as gender and STEM discipline, that may have an effect on the levels of engagement and the approaches adopted.



The networking activities of STEM academics.

We are aiming to conduct a number of interviews to explore these issues. If you work in a STEM related discipline and do, or don't, use social media for professional networking and engagement and would be interested in discussing this with us please contact me.

Written by Helen Donelan, Faculty of Mathematics, Computing and Technology, The Open University.

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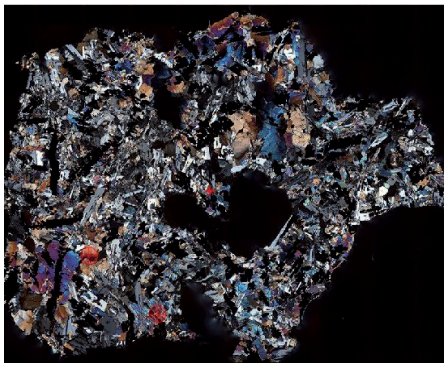
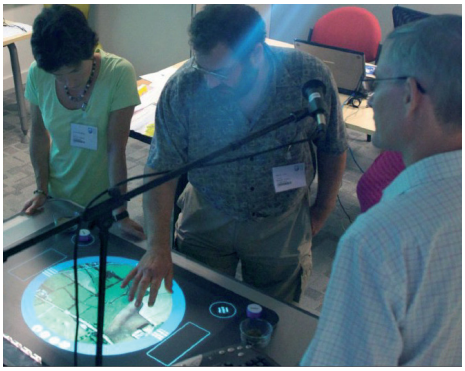
The Wolfson OpenScience Laboratory



An early example of a (petrological) virtual microscope slide.



A 'table top' surface used in the 'Out There In Here' project.

A £1million grant from the Wolfson Foundation has launched an Open University initiative to transform the teaching of practical science. The initiative was developed by and will be run by eSTEeM.

Practical science is undergoing rapid and fundamental change. The internet is making it possible to work together globally, sharing data and sharing facilities. Networked facilities, instruments and sensors are becoming available with which we can explore the early Universe, the micro-world of cells and biomolecules, and the nano-world of particles and atoms. Social networking is altering our ability to collaborate remotely and is changing society's expectation for engagement in science. So far, teaching of practical science, conducted in laboratories, field stations and observatories, has been resistant to these trends.

Our vision is that the Wolfson OpenScience Laboratory will transform the teaching of practical science**.** It will enable cutting-edge science experiments to be accessed through the screen. Students will be able to run labs, make observations, receive and analyse data, and talk to other scientists at any time and place. OU students will visit and work within the Lab throughout their studies of science. All modules will be to include practical work as and when it is needed. However, the users may be students of other universities or schools across the globe. The Lab will also be open to the public, empowering all citizens to become involved in practical science.

The Laboratory will be a global centre for practical science teaching, built in collaboration with university and professional body partners in the UK and overseas. Although operating entirely online, users will be able to access data from real physical instruments and equipment, enabling them to carry out authentic and rigorous science investigations. The OpenScience experience will be a huge advance on oversimplified simulations.

Science graduates are desperately needed in every country but a lack of lab facilities and resources makes it difficult to expand capacity. Online education is cost-effective: it is a bold way of making the world of science accessible to many more people, particularly those in the less developed countries. We are working closely with a consortium of mixed mode universities in Nigeria to ensure that the Wolfson Lab and its resources are suitable for inclusion in their distance learning programmes. Up to now, science has not featured in such programmes significantly because of practical constraints, even though STEM education is a national priority.

Approximately 25,000 students (OU and partners) and many more members of the public are expected to use the experiments in the first three years. 20% of the material will be made freely available under open source software and the initiative will operate internationally, enabling students and teachers from across the globe to share knowledge and discuss experiments.

The Wolfson OpenScience Laboratory will help to satisfy the demand for experienced science graduates. It will be designed so that colleagues across the sector and globe can adopt it for use in their own teaching. It will offer:

- Remote access to laboratories and observatories, involving students operating real physical equipment, controlled remotely.
- Virtual laboratories and instruments which provide interfaces to real data and emulate real physical equipment.
- Online field investigations which involve electronic access to a conventional field trip, or virtual experiences using satellite-borne and remotely operated sensors.

- Citizen Science which involves the public gathering and interpreting data on contemporary science issues.

Existing major software platforms will be integrated into the Lab. iSpot, which orchestrates the collection and identification of photos of flora and fauna, will be redeveloped for international use. nQuire, a system that supports inquiry based learning, will allow us to introduce new pedagogical approaches. Underpinning the whole development will be rigorous educational research supported by learning analytics. We are now recruiting postgraduate students to assist in this work.

In the first phase of the initiative (April 2012 to July 2013), we will establish a software platform that is robust and extensible and link it to the educational systems needed for structured learning. Existing software will be incorporated, as well as striking examples of new approaches (an immersive 3d virtual reality field trip, a remote radio-telescope, a pilot of Treezilla (a nationwide tree map), etc.) Partners, including Obafemi Awolowo University in Ife, will contribute applications. The resources will be evaluated by the OU and partners. A long term design vision and system specification will be created.

The Open University's remotely accessed PIRATE telescope.

Virtual field trip screenshots.

The further development of the Laboratory is dependent on funding and both OU and partner priorities. Over the next 3 years the OU will be committing ~£3M to the Lab - it will be a core part of OU teaching. We are seeking further external funding to broaden the scope and impact of the initiative. Future Science priorities, subject to funding, are;

- Open Science Investigations – the Lab will offer; mass participation experiments, supported access to professional science databases, and mentoring in scientific inquiry proposed by students and the public.
- Extension to mobile platforms which will assist access in less developed countries. A student in Sub Saharan Africa controlling a radio telescope via their mobile phone is entirely feasible.
- Wider incorporation of immersive 3d virtual reality. The issue is to use the technology to assist authenticity whilst not generating irrelevant overheads.
- Introduction of haptic and tactile technologies that are relevant in practical work involving manipulation and dexterity.
- Broadening of the partnership with the aim of sector wide change.

This initiative is focused on science but its rationale is equally applicable to engineering, design or any discipline in which practice plays a significant part. It is early days yet but we are discussing sister projects in which the core Wolfson platform is re-used to create analogous online practice environments.
The Wolfson OpenScience Lab was conceived by and involves a large number of people from across the Open University. There are several external partners, including professional bodies. If you are interested in keeping in touch with this initiative, please get in touch with us at esteem@open.ac.uk.

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Capacity Building for Distance Learning in Nigeria

NIGERIA is the most populous country in Africa, with approximately 167 million citizens and a rapidly growing economy, but the expansion of the university sector cannot keep pace with the aspirations of its school leavers for university education. At the start of the academic year in 2011, an estimated 1.25 million applicants with university entrance qualifications were unable to access the 350,000 places at the country's federal, state and private universities.

Nigeria. Picture: wikitravel.org

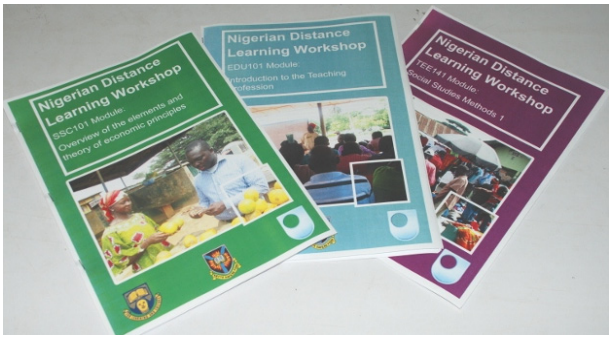
For the past three years, Professor Steve Swithenby, eSTEeM Co-director from The Open University UK, has been assisting the National Universities Commission (NUC) Nigeria to develop proposals for a step-change in access to higher education through the expansion of high-quality distance learning.

In February 2012, as part of a rapidly advancing programme of institutional collaboration, Professor Swithenby led a team of seven academics from three OUUK Faculties (Science, Health and Social Care, and Maths, Computing and Technology) in intensive capacity-building workshops in Nigeria in distance learning design and pedagogy. The two-week workshops, supported by funding from the British Council in Abuja, were held at three locations to enable participation by over 30 Nigerian academics from university distance learning centres in Lagos, Ile-Ife, Ibadan, Abuja, Yola, Maiduguri, and the from National Open University of Nigeria (NOUN).

Professor Steve Swithenby (3rd from left) with distance learning workshop participants from the Universities of Abuja, Maiduguri and Modibbo Adama University of Technology, Yola, OU mentors Dr Suresh Nesaratnam and Dr Basiro Davey and ITC experts from SchulPortals.

The immediate practical outcome of the workshops was the production of 30 interactive study units contributing to ten undergraduate modules in a range of subject areas, including teacher education, computer science, accountancy and economics, management, Islamic law, social studies, and peace and conflict resolution.

More importantly, the Nigerian participants received intensive mentoring in the design, drafting, illustration and editing of distance learning resources with embedded self-assessments for students, using the template from the HEAT (Health Education and Training) programme in Ethiopia (www.open.ac.uk/africa/heat).



Three of the study units produced in the workshops.

These resources were primarily designed for print-based production due to current shortfalls in internet connectivity and computer access, but all participants also experienced the development and use of online assets such as wikis, e-glossaries, computer-marked assignments, video screen capture, podcasts and online tutorials and discussion forums.

The next stage in this ambitious programme is the development of a Memorandum of Understanding between the OUUK and the Nigerian NUC, and further work to support a shared appreciation of the context, aims and distance learning culture in Nigeria, build capacity in methods of effective distance learning pedagogy and student support, and foster ongoing academic relationships and research collaborations. The intention is also to progress the establishment of a Nigerian Distance Learning Academy, which will serve as the focus for academic staff development in distance learning pedagogy in the Nigerian university system.

Some participants from Obafemi Awolowo University hard at work in the distance learning workshop in Ile-Ife with OU mentors Ali Wyllie and Dr Janet Haresnape. Academics from the University of Ibadan also attended.

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Workshop participants from the University of Lagos and the National Open University of Nigeria with OU mentors Dr Kerry Murphy and Dr Daphne Chang.

Exploring one of Chile's Volcanoes

IN March I undertook a reconnaissance research trip to a little known volcano in southern Chile, at the invitation of a colleague working at the University of Chile. The aims were twofold: first to gain a better understanding of the hazards posed by future eruptions from this volcano; and secondly to evaluate the potential of this volcano to help us understand more about interactions between Andean volcanoes and ice during past glacial periods, and in doing so to contribute to the climate change debate.

I mostly do my fieldwork in Iceland, where I am accustomed to a combination of driving chunky 4x4s and long footslogs to get to the interesting mountains. This time was a first for me because it was a combination of horseback and long footslogs. Of course I had ridden horses before in Iceland (for fun), but Icelandic horses have the reassuring characteristic of being so small that if one gets into trouble one simply slips feet from the stirrups and plants them on the ground which is a few inches below. When I first met the Chilean horses they looked big, and mean. I said I'd not been on a horse this big for 34 years and needed the most sedate and gentle of horses, to which I was told 'OK, you must have Tornado '.

Dave McGarvie with ‘Tornado.’

After brief reminders of what to pull and push and what side to get on, off we went on the 30 km trek to the intended camp at Laguna Azul (the blue lake) nestled within the Quetrupillán volcano, the subject of our research. Once Tornado and I had firmly established who was boss (him), we got along fine. I was mightily impressed at how sure-footed the horses were, and how effortless my tent, rucksack, and food were heading upwards.

Confidence grew as I realised that Tornado was going to allow me to stay on his back, so I got out the borrowed OU video camera and took some footage that made me sea-sick watching it afterwards. It was rather magical riding upwards through the forest of lichen-draped Araucaria trees (Monkey Puzzle), with glimpses of the snow-capped summit of Quetrupillán above.

The summit disappeared as the clouds rolled in and we rode across the upper flanks of the summit getting soaked and in low visibility. After descending to Laguna Azul there was also an opportunity to get the feet thoroughly soaked as the horses had to wade through chest-deep water where a young lava flow had dammed the lake. It was real cowboy camping, with a campfire using dead wood and with every morsel of food and drink tasting of wood smoke.

Laguna Azul with the summit of Quetrupillán behind. Picture: Dave McGarvie.

Back to the science. Building upon the work of my Chilean colleague we were able to establish that there had been some large eruptions from this volcano during the present ice-free period (interglacial) that started about 9,000 years ago, and although the most recent sizeable eruption was c.1240 years ago, there had been periods when the volcano had been particularly active. So this is a volcano that has long periods of inactivity followed by short periods of intense eruptive activity, and is currently in an inactive period. However very few of the people who live nearby appreciate that Quetrupillán is an active volcano and that it has erupted pyroclastic flows that lie in the soil beneath their houses. I know this because I gave two ad-hoc talks in Pucon at which locals were astonished that Quetrupillán could erupt again.

This is because all the attention is on its attractive ice-capped neighbour called Villarrica which has

the classic volcano shape that children draw, and which has a permanent lava lake within its summit crater from which a plume of escaping as constantly streams. Villarrica produces small but dramatic eruptions every few decades or so and is the one everyone considers to be dangerous because the bustling tourist town of Pucon sits beneath it. In fact Pucon is built on mudflow deposits from past eruptions of Villarrica produced when eruptions melted summit ice and snow.

Whilst I was in Pucon the eruption warning siren sounded and I legged it down the stairs heading for the safe haven of the nearby rocky peninsula by the time the siren stopped and I realised that it was just a test.

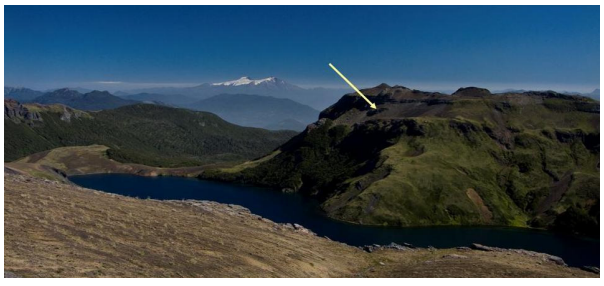
Villarrica from Quetrupillán. Note the plume rising from Villarrica's summit crater. Picture: Dave McGarvie.

Lanín from Quetrupillán, with young lava flows from Quetrupillán damming the lake. Picture: Dave McGarvie.

Quetrupillán is the middle of three active volcanoes that form a distinct line in southern Chile. Villarrica is at one end and Lanín at the other. Both Villarrica and Lanín are beautiful ice-capped cones, whilst Quetrupillán looks like it had a cone but has lost it. The indigenous people (Mapuche) have a legend that explains this. Lanín was a man who admired the attractive Villarrica, but could not see enough of her because Quetrupillán was between them. So Lanín removed Quetrupillán's head so he could gaze constantly upon Villarrica. Quetrupillán means 'the headless one' in Mapuche, but does this legend tells of an eyewitness account of the eruption that destroyed Quetrupillán's cone? This is something we may discover in the future if we can establish the date of the eruption.

But the science that really interests me is that involving volcano-ice interactions, and Quetrupillán did not disappoint. In fact there are spectacular examples of lava flows that managed to weave their way through networks of tunnels melted into the ice, and of lava flows that spilled from the heights into ice-filled valleys. But why is this interesting? Well for a start we don't have a clue how about thick the ice was during past glaciations simply because the ice has disappeared. So a lava flow that has features indicating contact with the surrounding ice provides information on the minimum thickness of ice at a particular location at a particular time in the past. This is valuable information, especially for linking the how past variations in temperature have affected the rate of ice accumulation on land.

Spectacular example of a lava that has chilled within an ice tunnel. The small columns are oriented at right angles to the ice walls.



Lava (indicated by yellow arrow) that flowed into an ice tunnel melted high into the flank of a glacier that once filled this valley

This reconnaissance trip was a success. It proved that this volcano is suitable for further study and so we are currently putting together the framework of a grant proposal to do further work on the volcano-ice interactions. Some footage was also taken using an OU video camera that may end up as a short official OU YouTube clip.

Written by Dave McGarvie, Faculty of Science, The Open University.

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OVER 1400 international delegates from administrators to VCs, from Afghnistan to Zambia gathered in London on the 13-15 March 2012 to hear about developments in education at Going Global, the annual conference organised by The British Council.

Going Global is a series of international educational conferences hosted by the British Council which offers an open forum for policy makers and practitioners from around the world to discuss issues facing the international education community.

This year's programme included more than 50 conference sessions over the two-day event, one of which, 'Bridging the divide: visions of education futures through technology' saw the OU's Vice-Chancellor enchant the audience with his enthusiasm for the topic.

The OU had a shared stand, a collaboration between the Business Development Unit, eSTEeM and the International Development Office to showcase our projects. Members of the OU team were able to answer questions from the delegates during the breaks in conference.

The Open University's stand at Going Global 2012. Picture: Babette Oliver.

Members of the OU eSTEeM team were on hand to talk about their project posters:

- *Meeting the Challenge of global STEM education* – Steve Swithenby and Keith Williams
- *Developing capacity in the WASH sector* – Pam Furniss (OU), Richard Cater (WaterAid) and Jen Smith
- *Role of three-dimensional virtual environments in the globalisation of Science education* – Shailey Minocha
- *Delivering masters globally: medicinal chemistry online* – Yao Xu, Peter Taylor and Simone Pitman.

The event was an interesting blend of academic conference and trade show. International education is now a major business sector. For OU staff it was interesting to hear how face to face institutions are increasingly using blended learning techniques and technologies in their delivery of international programmes. One of the most interesting sessions was a World Café discussion on the impact of technologies on delivery of HE. The session Chair, Ben Wildavsky has since blogged on his reflections on the contrast between the Indian proposals for technology enabled expansion to the perceived threat to the US HE status quo through what he describes as the edupunk movement http://chronicle.com/blogs/worldwise/the-promise-and-peril-of-ed-tech-democratization/29413.

I took part in two of the Indian led discussions, their challenge is both an expansion of participation from 10% to 15% (population >1Billion and at the 2001 census 41% below 18) and a need to bridge the gap between the premier league IIT and IIS institutions and the rest of the HE sector. The solution is a national educational distribution network including remote laboratory facilities and simulation. Whilst the government sponsored Aakash low cost ($35) tablet remains controversial http://iitbombay.org/news/Current/aakash-tablet-project-goes-to-iit-bombay India seems set for a major expansion of technology enabled STEM teaching.

In the Digital Divide session Umar Saif of Pakistan described his work on use of a suite of "poorman's broadband" and SMS peer to peer tools to enable distributed learning in low capacity internet and cell-phone dominated environments http://people.csail.mit.edu/umar/research.html. Tailoring delivery to suit the technology students have access mirrors our own policies in use of domestic media.

This event once again showed that the OU is at the forefront of online distance learning, but that we must continue to showcase our products in this increasing market.

All four posters can be viewed under the *'Resources'* tab of the eSTEeM website.

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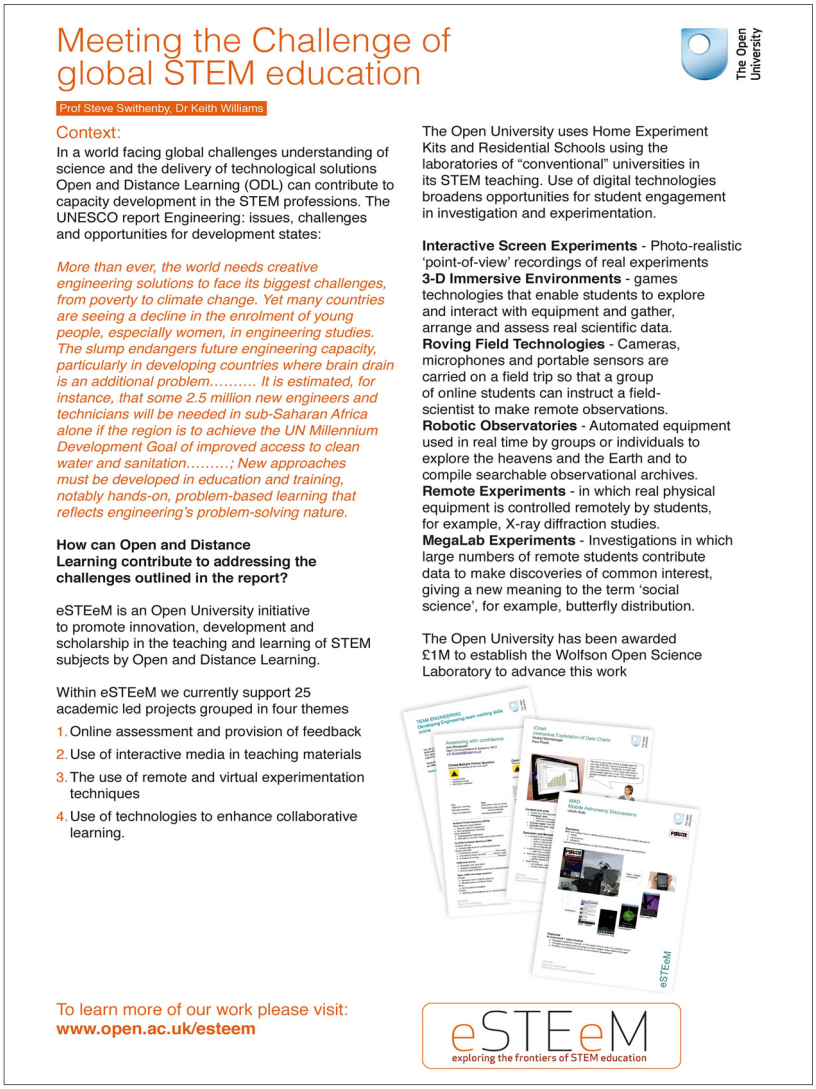


Meeting the Challenge of global STEM education

The Open University

Prof Steve Swithenby, Dr Keith Williams

Context:

In a world facing global challenges understanding of science and the delivery of technological solutions Open and Distance Learning (ODL) can contribute to capacity development in the STEM professions. The UNESCO report Engineering: issues, challenges and opportunities for development states:

More than ever, the world needs creative engineering solutions to face its biggest challenges, from poverty to climate change. Yet many countries are seeing a decline in the enrolment of young people, especially women, in engineering studies. The slump endangers future engineering capacity, particularly in developing countries where brain drain is an additional problem..... It is estimated, for instance, that some 2.5 million new engineers and technicians will be needed in sub-Saharan Africa alone if the region is to achieve the UN Millennium Development Goal of improved access to clean water and sanitation.....; New approaches must be developed in education and training, notably hands-on, problem-based learning that reflects engineering's problem-solving nature.

How can Open and Distance Learning contribute to addressing the challenges outlined in the report?

eSTEeM is an Open University initiative to promote innovation, development and scholarship in the teaching and learning of STEM subjects by Open and Distance Learning.

Within eSTEeM we currently support 25 academic led projects grouped in four themes

1. Online assessment and provision of feedback
2. Use of interactive media in teaching materials
3. The use of remote and virtual experimentation techniques
4. Use of technologies to enhance collaborative learning.

The Open University uses Home Experiment Kits and Residential Schools using the laboratories of "conventional" universities in its STEM teaching. Use of digital technologies broadens opportunities for student engagement in investigation and experimentation.

Interactive Screen Experiments - Photo-realistic 'point-of-view' recordings of real experiments
3-D Immersive Environments - games technologies that enable students to explore and interact with equipment and gather, arrange and assess real scientific data.
Roving Field Technologies - Cameras, microphones and portable sensors are carried on a field trip so that a group of online students can instruct a field-scientist to make remote observations.
Robotic Observatories - Automated equipment used in real time by groups or individuals to explore the heavens and the Earth and to compile searchable observational archives.
Remote Experiments - in which real physical equipment is controlled remotely by students, for example, X-ray diffraction studies.
MegaLab Experiments - Investigations in which large numbers of remote students contribute data to make discoveries of common interest, giving a new meaning to the term 'social science', for example, butterfly distribution.

The Open University has been awarded £1M to establish the Wolfson Open Science Laboratory to advance this work

To learn more of our work please visit:
www.open.ac.uk/esteem

eSTEeM
exploring the frontiers of STEM education

Meeting the Challenge of global STEM education - Steve Swithenby and Keith Williams.

eSTEeM: Annual Conference: STEM Futures: From Plan to Practice

THIS summary of feedback from the 1st eSTEeM Annual Conference, which was held on 6th March 2012, is not intended to be fully evaluative. However, the feedback received from our recent conference was over-whelmingly positive and we were astonished to see just how representative the comments that follow actually are.

From the 89 delegates that registered, less than half were involved directly with eSTEeM, highlighting the ex-tent of our wider community. 29 of the delegates completed a feedback questionnaire and a selection of quotes from this feedback is listed below.

Wordle cloud summarising delegates feedback from the conference.

Overall conference experience

"I particularly valued seeing/hearing what colleagues (esp in Science) are doing."
"I really enjoyed learning how other academics were developing their teaching."
"Stimulating and enthusing."
"Very informative and stimulating."
"Reinvigorating."
"A very stimulating experience which has given me lots of ideas to follow up and learn more about."
"Inspiring and informing for developing practice in Wales."
"Stimulating and inspiring."

Top elements of the conference

"Hearing about how eAssessment makes a real difference to students."
"Meeting colleagues who are doing interesting things with educational technology & evaluating the impact."
"Networking with other academics."
"Positive tone of all presentations"
"Key note lectures that provided vision, ambition and excitement"
"Seeing what other faculties do in their pedagogy"
"Meeting enthusiastic people"
"Publicising work I am doing and making new contacts through presenting my own work"
"Keeps one up to date on the initiatives being taken within the university"
"Allows for the initiation of collaborative projects"

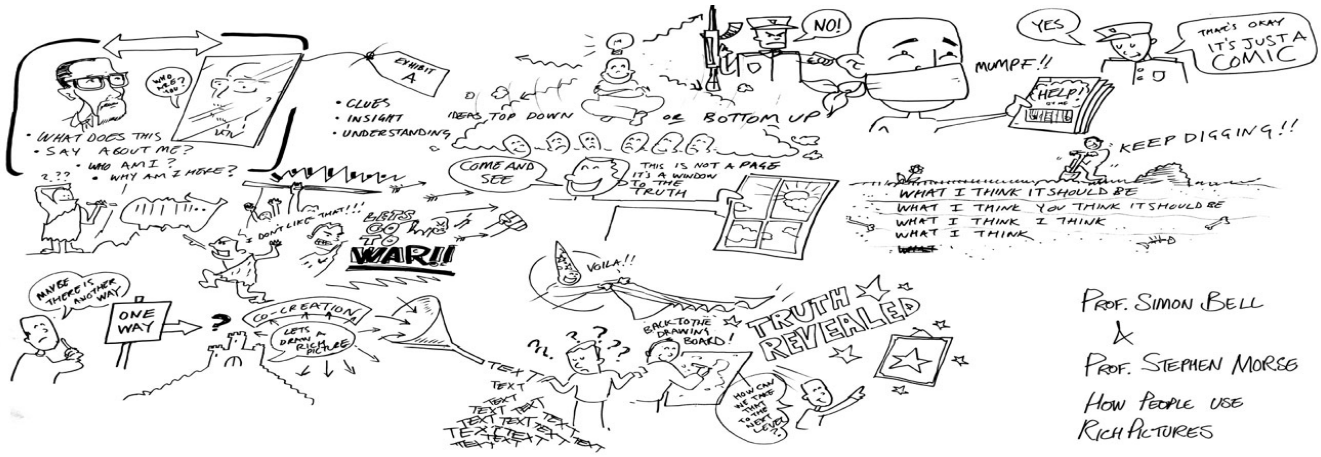
"Publicising work I am doing and making new contacts through presenting my own work"
"Seeing what interesting research projects are being carried out- both small and large scale."
"Thought provoking and informative"
"Keeps one up to date on the initiatives being taken within the university"
"Allows for the initiation of collaborative projects"
"Sense of learning community"
"Social interactions between presentations are very satisfactorily utilized"
"Reinforced sense of eSTEeM community"

OU staff can view a replay of the keynote presentations by visiting the *'Videos'* section under the *'Resources'* tab of the eSTEeM website.

Delegates networking during the poster presentation session. Picture: Diane Ford.

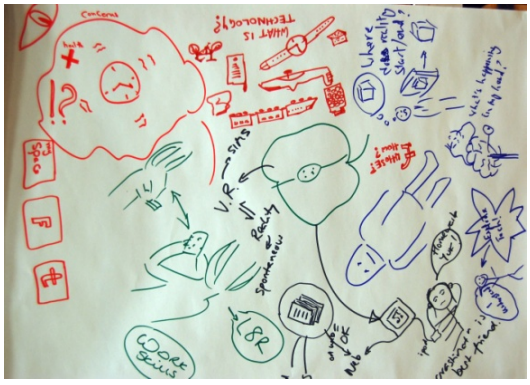
THE Diagramming Colloquium held at Walton Hall on the 7th March had the explicit task of providing insights in 'Pictures to help people think and act' and so it proved.

The agenda for the day was packed with a combination of papers (seven in all), workshops (two) and a talk-back session, where members of the audience were selected to give a sense of their reflections on the day. The papers were captured in diagrammatic form by the resident artists for the day the Livescribes. Practicing what we preach, each paper had three focal points – the speaker, the inevitable PowerPoint presentation and the live scribes cartoon. For example, here is the picture drawn of the paper provided by Simon Bell and Stephen Morse



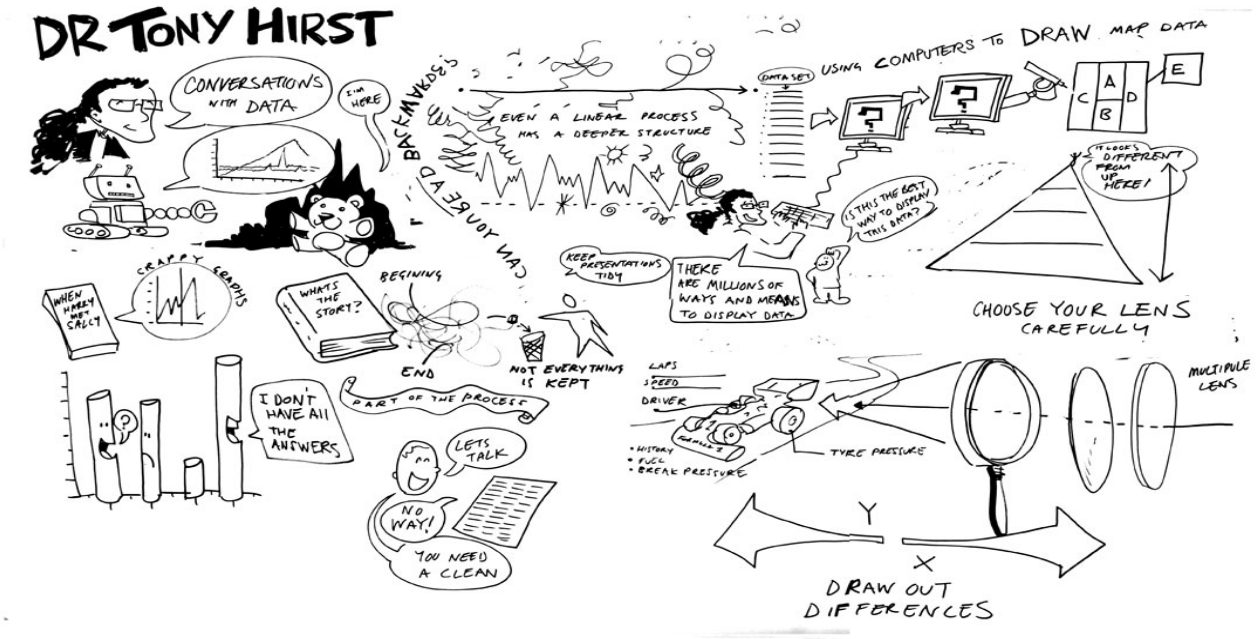
Livescribes illustration: Simon Bell and Stephen Morse.

The bulk of the morning papers by Simon Bell, Stephen Morse, Andy Lane and Tess Berg dealt with hand drawn diagrams to assist learning and problem solving. These papers were complemented by the first workshop, where Tessa Berg from Herriot Watt provided all those present with the opportunity to draw their own picture… two of the resulting pictures are shown here.



Livescribes illustrations: Tessa Berg.

In the afternoon, the papers by Vicky Eves, Pete Thomas and Peter Lloyd related more to the ways in which OpenMark/Moodle can be used in assessing diagrams, how diagrams can help learning happen and how diagrams can be represented, discussed and assessed by use of the CompendiumDS software.
Following this, Tony Hirst gave a hugely enjoyable 'romp' through some of the ideas which allow data to 'speak' .. these visual conversations are rich but are sadly often missed.



Livescribes illustration: Tony Hirst

Finally, to round off the day, the talk back session provided a lively opportunity for those who had listened to the papers to feedback and give their own overview of the event.

The day was filmed and the resulting video is available to view on the eSTEeM website, please see the *'Videos'* section under the *'Resources'* tab of the eSTEeM website. All articles will be published later in the year in a Special Edition in the Journal Systemic Practice and Action Research.

Written by Simon Bell, Faculty of Mathematics, Computing and Technology, The Open University.

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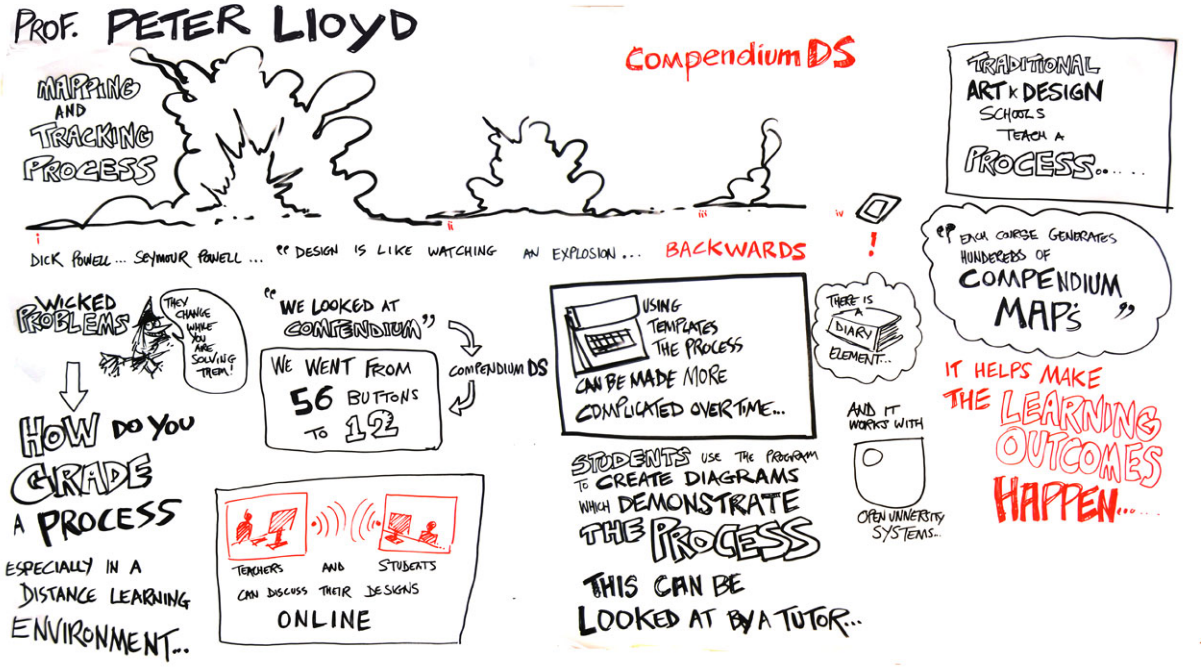
Livescribes at work. Picture: Stefan Reuger.

Livescribes illustration: Andy Lane

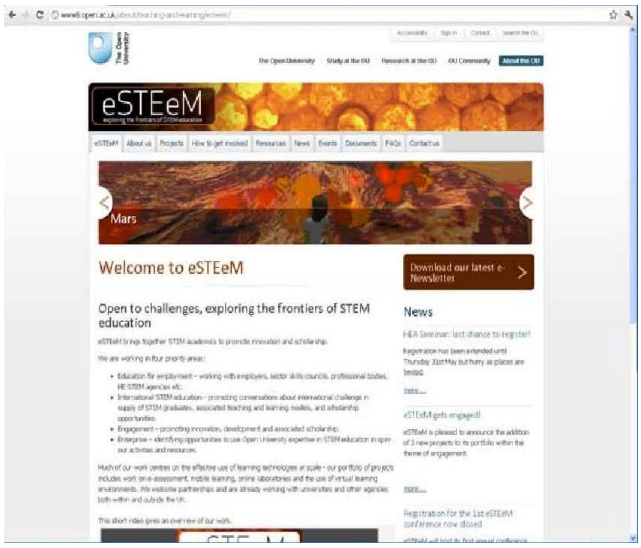


Livescribes illustration: Peter Lloyd

Further Livescribes from the Colloquium can be found under the *'Resources'* tab of the eSTEeM website.

eSTEeM News...

eSTEeM has recently enhanced its presence by launching its brand new website. The site contains a host of information and resources including latest news and events and relevant links to the STEM higher education teaching community. If you have a news item, resource or event that you would like us to promote then please email us at esteem@open.ac.uk.



The new look eSTEeM website

eSTEeM will be contributing to the 2.1m Euros Juxtalearn project recently funded by the EU. The project aims to improve learning of threshold concepts by juxtaposing video performances. Led by Anne Adams (IET), eSTEeM's e-assessment insights will be a part of the approach used.

Simon Collinson (Faculty of Science) has recently been awarded an Individual Teaching Development Grant from the Higher Education Academy. Entitled 'Understanding and promoting student engagement via online interactive tutorials - development of an internationally relevant environmental chemistry and health context based learning activity' there are two strands to the project. Firstly, the analysis of international student engagement in online STEM teaching to produce guidelines for staff. Secondly, to promote a more interactive and collaborative use of online tutorials leading to the development of a series of interactive CBL activities including online tutorials suitable for Natural Sciences students studying the OU course *Metals and life* (S347). The aim will be to make these internationally relevant by using an internationally relevant health and environmental context which could easily be adapted to other courses. If you would like to discuss/collaborate on this project then please contact Simon.Collinson@open.ac.uk.

Over the past 6 months, Liz Whitelegg, Sam Smidt and Nick Adams (Faculty of Science) have been working on a project 'Unclear about Nuclear' to develop a short online unit about nuclear energy accompanied by an 'App' (for iPhones/iPads and Android phones). The £32K of funding for the unit and the App was provided by the National HE STEM Project, and it was a condition of the funding that all outputs from the project had to be made freely available to other HEIs.

The unit and App are aimed at young people, aged 18 to 25 years, to encourage them to engage with learning about nuclear energy and to provide them with a start on a learning journey that could move them towards a career in the nuclear energy industry.
The App is designed to appeal to young people in particular by using a gaming approach to investigating their personal energy usage, guided by a robot from the future called N.E.I.L. (Nuclear Engineered Intelligent Lifeform).

eSTEeM News...

The 20-hour unit has re-used existing module and study skills material from a number of OU sources plus BBC Horizon and 'Bang Goes the Theory' video extracts. These resources have been re-versioned and re-edited them to make it suitable for NVQ level 3 learners with no previous science, technology, engineering or maths background beyond GCSE. Both the unit and the App are being trialled by young people during June before being launched.

In order for the unit to be freely available to other HEIs it had to be presented on an open source platform so it will run from the Learning Space on OpenLearn.

The project has met the funder's aim by delivering study materials that will feed into the skills pipeline by offering those interested in exploring employment in the nuclear industry, further learning and skills to support more advanced training programmes. For the OU it has given the staff involved experience of developing a short package of learning out of existing resources in a very short timescale and with minimum staff. We have been pleased also to work with LTS Corporate to produce the unit and App and it has provided an opportunity for staff in this area to further their skills in developing mobile technologies for learning.

And finally…

eSTEeM will shortly be launching a new call for scholarship projects linked to major strategic developments. Keep an eye on our website for further details alternatively join our mailing list to be kept up to date on the latest developments. Email esteem@open.ac.uk with 'Mailing list' in the subject header.

Want to contribute to the next edition?

Are you currently, or have recently, been engaged in developing new and innovative approaches to teaching and learning within the STEM disciplines?

Do you have a particular viewpoint on the issues for STEM education in regards to eSTEeM's four priority areas of education for employment, international STEM education, public engagement and enterprise?

Then eSTEeM would love to hear from you.

Please send your article of no more then 300 words to the Editor at esteem@open.ac.uk by the 14th September 2012.

The next edition will be October 2012.

Forthcoming Events...

eLearning Community Event: Inquiry to Innovation. Approaches to Teaching STEM Practice at a Distance
27th June 2012, The Open University
eSTEeM workshop based on the development of STEM practice and implications for both systems and pedagogy.

eSTEeM Community Event: Presenting your Research
5th July 2012, The Open University
Presenting your research effectively is a big problem. What this session will give you here is a quick, simple intro to finding the 'wow' in your research and how to present that.

Contact esteem@open.ac.uk for further information on these events. Remember to keep an eye on the *'Events'* section of our website for further details of upcoming events.

The eSTEeM stand at the Learn About Fair 2012. Picture: Kat Garrow.

Follow us now on Twitter @eSTEeM_OU

All about eSTEeM...

eSTEeM brings together STEM academics to promote innovation and scholarship. We are working in four priority areas:

- Education for employment – working with employers, sector skills councils, professional bodies, HE STEM agencies etc.

- International STEM education – promoting conversations about international challenge in supply of STEM graduates , associated teaching and learning models, and scholarship opportunities.

- Engagement – promoting innovation, development and associated scholarship.

- Enterprise – identifying opportunities to use OU expertise in STEM education
In spin-out activities and resources.

Much of our work centres on the effective use of learning technologies at scale - our portfolio of projects includes work on e-assessment, mobile learning, online laboratories and the use of virtual learning environments. We welcome partnerships and are already working with universities and other agencies both within and outside the UK.

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