



Teaching Development Grants
Project completion report

Project Details	
Project Title	Understanding and promoting student engagement via online interactive tutorials - development of an internationally relevant environmental chemistry and health context based learning activity
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Project Summary
<ul style="list-style-type: none">• Please provide a short summary (max 350 words) of your project, for dissemination through the HEA website.
<p>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:</p> <ul style="list-style-type: none">• Are there any specific issues found for the online teaching of international students compared to traditional teaching?• What are the levels of engagement and the experience of international students and how might we improve it?• What role can context based learning play? <p>The diverse range of students at the Open University provides a great opportunity to study these questions. Therefore this project surveyed students and academics within STEM subjects for student engagement with online courses, forums and tutorials, focussing on science students particularly in chemistry.</p> <p>International students attending an Open University Science residential school were interviewed to identify barriers and aids to their successful study. Possible areas of contention involve their level of English, confusion over aspects of assessment, differences in their educational and cultural background, difficulties in attending synchronous tutorials and feelings of isolation. Also during this course several academics were consulted over their experiences in teaching international students and problems with time differences and a reluctance to talk in tutorials was highlighted. The academic literature also recognises that student engagement and numbers falls more during online courses than traditional courses.</p> <p>Firstly an online international context based tutorial activity was developed focussing on trace metals in the diet and health. This was trialled in the Open University Level 3 course Metals and Life, with student and tutor feedback being obtained.</p>

Secondly, an online forum activity was prepared where the students studied research papers dealing with salt in the diet. This latter activity targeted transferable study skills such as skim reading, critical data analysis and introduced the students to the research literature. This was also trialled with the Metals and Life course with analysis of the student engagement with the forum and student feedback obtained. Interestingly, there were many students monitoring the forum but not posting on it. This teaching material will be made available on the RSC Learn Chemistry website.

Themes and Subthemes

- Please select any of the listed thematic areas that are covered by your project. You may also supply your own subthemes if desired.

Employability

Re-conceptualising employability	
Integrating work experience	
Addressing employer perspectives	
Making and evaluating resources	
Other (please specify):	

Internationalisation

Internationalising the curriculum	√
Integration of home and international students	
Promoting intercultural understanding	
Student and staff mobility	
Other (please specify):	

Project Report

- Please outline the milestones and deliverables that have been met against the timescale (**max 1000 words**).
- Please include:
 - activities that have been completed in the period covered by this report;
 - any changes or additions to the original activities/milestones outlined in the original project plan, including the reasons for these changes;
 - a summary of your aims and objectives, and whether they changed during the project;
 - a narrative of what you did and how you achieved it;
 - a discussion of the project methodology (technical implementation, how you went about your evaluation activities, and how you engaged your stakeholders);
 - a summary of what you have learned and would like to share with others.

Dr Catherine Halliwell worked as a researcher on this project. Catherine is an Open University (OU) Associate Lecturer with experience of online teaching across a wide range of STEM modules. During the grant Catherine was also able to attend the eSTEE annual teaching conference at the Open University in Milton Keynes.

Initial student feedback to inform teaching activity design

Although not in the original project plan, I interviewed international science students whilst tutoring at the OU Practising Science residential school (July 2012). This was valuable as opportunities to meet with students in distance learning courses are limited. These were open discussions to avoid influencing the student's responses and to better identify aspects of their learning that they identified as needing consideration. Additional feedback on the experiences of the online teaching international students was gained by discussions with several academic staff teaching on this course. These discussions inspired the future design of the following teaching activities and questionnaires for students and staff.

Feedback from interviews with international science students

Experiences of studying with a UK university

- Frequently students found the wording of questions in assessments was overly complicated. For example, long introductory paragraphs explaining the context of a question were often not considered beneficial.
- The rate of study and level of support from teaching staff was generally viewed as higher in the UK.
- Often combining work with distance learning courses was not an option in their home country and this coupled with the good reputation of UK degrees attracted students to the study in the UK.
- The students greatly valued the more up to date and applied content of UK courses.
- Mixed response from students about the high proportion of UK content as some students did not feel this was an issue while a few others did.
- Course fees were a concern for students but they were still keen for further study in-order to improve their employability.

Studying at a distance as an international student

- Generally preferred face to face versus online tutorials but liked the flexibility provided by the recordings of online tutorials.
- Some students felt a duty to contribute to online forums.
- Generally students were not keen to talk in online tutorials, although this wasn't because they were worried about their level of English.
- Students prefer studying with other mature students.
- Studying abroad can be lonely.
- Time differences can cause some confusion.

Grouping all international students together may miss subtleties in their engagement and performance. As the students had a very diverse experience of and motivation for study. This agrees with the findings presented by Drs Kay and Hardy (Edinburgh Physics Education Group) at the ViCE-PHEC 2012 conference.

Teaching material and stakeholder engagement

Context based learning (CBL) activities were developed for the Metals & Life course. These were designed to be adaptable and applicable to other UK courses. As the teaching materials were trialled both students and tutors were actively engaged with for feedback to further improve the teaching activities. The tutor groups of Drs Collinson and Halliwell were organised to yield a mixed group of international and UK students to provide a focus group.

An International Context Based Learning online tutorial activity

1. Provided Powerpoint slides for tutors and pre-tutorial tasks for the

students.

2. Extracts provided from *Is the Western diet adequate in copper?* [1].
3. Students were asked to find (i) RDAs for transition metals in home country and (ii) typical values in foods. [5-9].

Reflections on the online tutorial group activity from questionnaire feedback and analysis of forum posts.

- Tutors used slides or merged with their own.
- Tutors more confident as discussing same material as others. Only one tutor was uncomfortable with using someone else's material.
- Liked the level of interactivity included and 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 so this inspired the next activity.

An International CBL forum activity on salt in diet

1. Targeted key skills and applying their knowledge.
2. *Salt in bread in Europe: potential benefit of reduction*, [2].
3. Students to skim read the paper whilst making notes, assess the abstract, conclusion and finally the full paper.
4. Critical evaluation of the paper.
5. Contrast the paper above with the weaker paper *Influence of exogenous iron, calcium, protein & common salt on the bioaccessibility of zinc from cereals*, [3].
6. Calculated salt from bread in their diet and values from data for another country.
7. Students to study and discuss sodium ions in ion channels on RCSB protein databank [4].

Reflections on the forum activity from questionnaire feedback and analysis of forum posts

- As it was optional only 8% of students posted but 44% of students lurked on forum.
- 39 student 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 initially critically evaluated the paper, which suggests a generic weakness of students. A second paper had to be added to enable the students to do this.

Engagement with stakeholders.

I attended the HEA induction event which was both informative and a good networking opportunity. I attended the ACS 2012 Biennial Conference on Chemical Education at Penn State. This was a great chance to discuss this project with experts.

Milestones: Three oral presentations and two posters of the findings were presented at different stages of this project at several UK meetings.

A remaining milestone is to submit the teaching material to the RSC Learn Chemistry website and will be undertaken in June 2013.

Similarly we plan to submit our research findings to either New Horizons or a similar journal.

Outputs

- What are the outputs that have already been achieved and can be shared across the sector? (**max 500 words**).
- Please include:
 - a summary of learning and teaching resource materials you have produced – for example, teaching materials, reports, publications, annotated or academic bibliographies, course outlines, websites/online resources (including URLs);
 - any cognate resources related to your work that you've found useful and might be equally useful for others.

Outputs achieved

- An introductory context based teaching activity:
 - Powerpoint slides for tutors and pre-tutorial tasks for the students.
 - Employing extracts from '*Is the Western diet adequate in copper?* J Trace Elem Med Biol, 2011, 25, 204.' [1]
 - Students asked to find (i) RDAs for transition metals in home country and (ii) typical values in foods. As needed students were directed to the UK's FSA and NHS, The European Commission's Health and consumer (Food), the USA's Office of dietary Supplements and Australian Eat for Health websites [5-9].
- A structured context based forum activity for students at the end of their degree and/or about to embark developing own research projects as part of their academic development:
 - Designed with an emphasis on study skills that were predicted to be particularly weak in international students. In particular critically analysing research papers [2,3] and possibly this should be embedded earlier in courses.
 - Students discussed selected sodium ion channels on the RCSB protein databank.
 - Linked to chemistry course content but adaptable to other courses in health or environmental science.
 - Used materials with an international focus, rather than a single-nation context and data. The students seemed to accept this without

comment.

- The feedback we obtained will be developed into a general guide for tutors for creating similar online learning resources and structured activities. This will be made available via the eSTEEeM website of the Open University. This guide will also be incorporated into a publication on this project.
- The teaching materials that were prepared as well as being made available within the Open University will also be made available via the RSC Learn Chemistry website. This involves an initial external evaluation of the teaching material before it is added as a resource. We have discussed this activity with Rosalind Onions of the RSC and will submit the material once we have adapted it to be more in the format favoured by the RSC teaching resources.
- We also aim to write up the project, in particular the analysis of the student engagement with the activities and our recommendations for publication in *New Horizons* or a similar academic journal.

Impacts

- Please identify the immediate and expected impacts of the work on the student learning experience (**max 500 words**).
 - What difference has your project made to your own work, department and/or institution (for example, raised awareness, increased understanding or changes in practice and policy)?
 - How has your project changed the attitude of your stakeholders?
 - How has the wider community benefited from your project?
 - What evidence do you have for this?

Impacts on my own work

- This project has highlighted some student needs relating to general study skills that I am incorporating into the current rewriting of the level 2 Open University chemistry course and plan to include in the following rewrite of the level 3 chemistry course.
 - The project has provided my first experience of leading an educational research project.
 - It has highlighted several areas that I need to consider in the future such as the design of questionnaires and avoiding clashes with assessments on other courses.
 - Experience from this project will also feed into another educational research project that I am now involved in on 'Graduate skills in chemistry: online delivery, assessment and tracking.' This is funded by eSTEEeM at the Open University.

Impacts on the student learning experience

- Through the structured forum activity we identified that many students

are weak and/or lack confidence in critical analysis of journal articles. This has raised our awareness of this lack of confidence. Our evidence for this comes from the lack of participation/limited comments on this one part of the context based activity, compared to keen participation in other parts. This was also reinforced when we sought student feedback.

- We had presumed that we would see this outcome from students from a different educational culture but instead found that this was common to both UK students and international ones. This strongly suggests a future area for educational research.

- As part of this project we have encouraged the other tutors to include more interactive tasks for the students in their online tutorials and to move away from a traditional lecture style using PowerPoint slides with the students tending to adopt a passive role. This has been generally successful with most tutors engaging with the process and providing question sheets in advance of their tutorials. Even those tutors who do not like this process have been observed to be trying to stop and ask more questions of the students during their tutorials and praising the students for their active participation.

- The students have also commented on the student forum that they wish the level of support material was as high on other courses that they were studying.

- The students were inspired to find other relevant articles such as the New Scientist article at <http://www.newscientist.com/article/dn23054-mock-mars-mission-reveals-salty-surprise.html> possibly this should have been part of the activity to encourage more engagement.

- Although we have made several changes to the teaching this year, this project has been a major contribution and so must have positively influenced the observed increase in the student's overall mean mark for the module.

Impact on tutors

- The project has highlighted and provoked debate over the level of student engagement amongst the tutors for level 3 chemistry.

- Quoting one tutor (who works in industry) 'Equally, from someone that works with science graduates I would say that it has a knock-on effect. We have a huge issue in my day job with engagement of our junior scientific staff with other team members and with the science they are meant to be getting a grip on as part of project work.'

Impact on the wider community

These impacts are difficult to quantify;

- The material has been presented along with student feedback at a range

of meetings around the country.

- Our findings have been discussed with academics teaching in other science disciplines around the UK.
- In particular the discussion of student engagement in online teaching has been more widely discussed with reference to international students.
- The teaching material will be made open access via the RSC Learn Chemistry website.

Implications for the student learning experience

- What are the thematic or discipline implications of your work for professionals in the field, for students, or for the wider HE community and its stakeholders?
- What new development work could be undertaken to build on your work or carry it further?
- Provide information on the long-term management and sustainability of your project outputs – how can interested individuals access them and, if applicable, get involved with the area of work? How will your innovations continue now that the funding has ended? (**max 500 words**).

Summary of general feedback from science students on distance learning

1. Often found wording of questions was overly complicated. In particular, long introductions to assessment were thought to be distracting from what was actually been assessed.
2. Time differences can be an issue with synchronous teaching, for example the switch between summer and winter time is confusing.
3. General reluctance to talk online unless encouraged specifically to engage.
4. Rate of study and level of staff support is higher in UK.
5. UK courses have more applied and up to date content which is valued.
6. Students felt a duty to contribute to online forums. However clearly many choose to just monitor what is being discussed.

Student feedback on context based learning

1. Only positive comments mainly focussing on seeing the relevance of the course material to their everyday life.
2. Students noted it was a strong motivation for their studies.
3. A significant 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.'

Student feedback on evaluating research papers

1. Positive feedback on the use of skim reading as an approach to analysing a paper.

2. Students find it difficult to be critical of the research of others. Providing a second paper that the students were told seemed weaker encouraged them to be critical.

3. There is a lack of awareness of how peer review works and how the quality of a journal is rated.

Further details and e-mail addresses for contact are available at <http://www.open.ac.uk/about/teaching-and-learning/esteem/projects/themes/externally-funded-projects/activities-improve-the-engagement-international-students->

Continuing Educational Research

- Clearly there is scope to build on the topics we introduced in this project, such as discussion of metals in the diet. The students also seemed to really engage with the activity using the RCSB protein databank to study ion channels beyond the textbook. This could be adapted to several other topics.

- Analysing research papers seems to be an area students need practise and support with. It was interesting to note that students who didn't engage with this optional activity then struggled at the end of the course with two research papers needed for their examination. This became apparent from their forum posts prior to the exam.

- Dr Collinson is now involved in an educational project entitled 'Graduate skills in chemistry: online delivery, assessment and tracking.' This is funded by eSTeEM at the Open University and will continue to develop the key skills aspects that we identified in both UK and international students during this project. The findings of this project will be disseminated in due course.

Dissemination

- Please give details of any dissemination activities that have occurred during the reporting period or are still to be undertaken (**max 500 words**).

Poster Presentations (presenters underlined)

SR Collinson, C Halliwell, Activities to improve the engagement of international students in online teaching, eSTeEM annual conference, The Open University, March 2013.

SR Collinson, C Halliwell, Activities to improve the engagement of international students in online teaching, HEA annual STEM conference, The University of Birmingham, April 2013.

Oral Presentations by Dr Collinson

Analysing and improving the engagement of international students in online teaching, Variety in Chemical Education and the Physics Higher education conference, Edinburgh, August, 2012. The initial findings of this project were well received and resulted in several useful discussions and suggestions. In particular, with Dr Alison Kay and Dr Judy Hardy of the Physics Education Group at Edinburgh.

Developing international context based learning activities, RSC Teacher Fellow Network meeting, London, February 2013.

Can context based learning improve the engagement of international students in

online distance teaching? HEA annual STEM conference, The University of Birmingham, April 2013.

Internet

<http://www.open.ac.uk/about/teaching-and-learning/esteem/projects/themes/externally-funded-projects/activities-improve-the-engagement-international-students>- eSTEEem website outlining the project, providing the poster form the eSTEEem annual conference and e-mail addresses for contact.

The teaching materials that we have prepared as well as being made available within the Open University will also be made available via the RSC's Learn Chemistry website. This involves an initial external evaluation of the teaching material before it is added as a resource. We have discussed this activity with Rosalind Onions of the RSC and will submit the material once we have adapted it to be more in the format favoured by the RSC's teaching resources.

Publication

We plan to publish the project, in particular the analysis of the student engagement with the activities and our recommendations for engaging international students, in New Horizons or a similar academic journal.

Due to our limited student feedback we may run the forum based activity in 2014 as the material has already been produced this year and this would help the publication of our research by providing more feedback to analyse. This would also benefit the inclusion of key skills in the course rewrite that starts in August 2013. Also the 2012-13 student cohort was not typical in terms of student numbers, level of study and hours of study because of transitional funding arrangements and so 2014 may be more representative.

Budget

- Please report on how you have spent the funds awarded by the HEA.
 - Please include details of any divergence from the original budget plan and the reasons for this.

The original budget submitted with the proposal has been closely adhered to.

In summary the funds were used to:-

- Appoint Dr Catherine Halliwell as a researcher on the project.
- To cover some of Dr Collinson's research time on this project.
- Dr Collinson to present at the RSC Teacher Fellow Network meeting in London and the HEA annual STEM conference in Birmingham.

Departmental funds were used for Dr Collinson to attend the HEA induction event at York and to present at the Variety in Chemical Education and the Physics Higher education conference in Edinburgh.

Lessons learned

- Please report on any issues or problems that have impacted on the development and implementation of the project, how you have addressed or overcome them, and any advice you would give to others (**max 500 words**).

A major challenge with performing educational research at a distance is obtaining feedback from the students on their experiences. This seems to be compounded by the fact that the students are studying part-time and so are very strategic about how they spend their time. We tried obtaining feedback via e-mails and online surveys. The clearest feedback was obtained from tutors via posting on the dedicated tutor forum.

Perhaps clear sign-posting of how optional activities will benefit subsequent assessment activities may provide motivation for students. This was included but perhaps not clearly enough. Monitoring student posts on the forum and the number and frequency of students lurkers was seen as an alternative method to gain data on student engagement.

We hope to re-run the forum activity next year to gather more data and provide an opportunity to improve the material to better engage more students.

References

- If appropriate, please provide a list of relevant bibliographic references, compiled in your preferred referencing style.

References used in the teaching material

1. Leslie M. Klevay, Is the Western diet adequate in copper? *Journal of Trace Elements in Medicine and Biology*, 2011, 25, 204-212.
2. Joan Quilez and Jordi Salas-Salvado, Salt in bread in Europe: potential benefit of reduction, *Nutr Rev*, 2012, 70, 666-678.

3. Sreeramaiah Hemalatha, Smita Gautam, Kalpana Platel, Krishnapura Srinivasan, Influence of exogenous iron, calcium, protein & common salt on the bioaccessibility of zinc from cereals, *Journal of Trace Elements in Medicine and Biology*, 2009, 23, 75- 83.

4. RCSB protein databank available at <http://www.rcsb.org/pdb/home/home.do>

Recommended daily Amounts of nutrients (RDAs)

5. UK, Food Standards Agency

<http://www.food.gov.uk/multimedia/faq/gettingenoughironfaq/>

6. NHS Choices

<http://www.nhs.uk/Conditions/vitamins-minerals/Pages/Iron.aspx>

7. European Commission, Health and Consumers, Food,

http://ec.europa.eu/food/food/labellingnutrition/supplements/index_en.htm

8. USA, Office of Dietary Supplements, National Institutes of Health

<http://ods.od.nih.gov/factsheets/Iron-HealthProfessional/>

9. Australia, eatforhealth.gov.au, Daily nutrient requirements calculator

<https://www.eatforhealth.gov.au/node/add/calculator-nutrients>

References used in designing this project

Norman Reid, Oct. 2006, Getting Started in Pedagogical Research in the Physical Sciences, A Physical Sciences Practice Guide, HEA, available at http://www.heacademy.ac.uk/assets/ps/documents/practice_guides/practice_guides/getting_started_ped_research.pdf

Jenny Preece, Blair Nonnecke, Dorine Andrews, The top five reasons for lurking: improving community experiences for everyone, *Computers in Human Behavior* 20, 2004, 201-223.

Rebecca Ferguson, Peer interaction: the experience of distance students at university level, *Journal of Computer Assisted Learning*, 2010, 26, 574–584.

Tony Luxon, Moira Peelo, Internationalisation: its implications for curriculum design and course development in UK higher education, *Innovations in Education and Teaching International*, 2009, 46, 51–60.

Betsy J. Banner, Motivating and Assisting Adult, Online Chemistry Students: A Review of the Literature, *Journal of Science Education and Technology*, 2010, 19:215–236.

Tina L. Overton, John S. Bradley, Internationalisation of the chemistry curriculum: two problem-based learning activities for undergraduate chemists, *Chemistry Education Research and Practise*, 2010, 11, 124–128.

Harry E Pence and Barbara Losoff, Going beyond the textbook: The need to integrate open access primary literature into the Chemistry curriculum, *Chemistry Central Journal*, 2011, 5, 18.