CPD Scheme Application Form

This form must be submitted with your application at least two weeks in advance of the relevant CPD Panel meeting.

Title (Mr, Mrs, Dr etc.): **Professor**	**Surname (family name):** **Allan**		**Other name(s):** **Richard Philip**	
Please tick the UKPSF Descriptor at which you are applying for professional recognition:	D1	D2	D3	D4
Please give details (incl. dates) of your professional qualifications, e.g. BSc, PhD and/or prior attainment of professional recognition:	BSc Environmental Sciences (Hons), June 1995 PhD Meteorology, December 1998			
Department/School/Directorate: **Meteorology/MPS/Science**	**Job title: Professor of Climate Science**			
	Telephone: 0118 3785568			
	Email: r.p.allan@reading.ac.uk			
Key responsibilities in relation to teaching and learning/support of teaching (e.g. senior tutor, admissions tutor, technician etc.):	Module Convenor and co-convenor (MSc Climate Change, BSc The Science of Climate Change; Adult Education modules) MSc tutor Examinations scrutiny committee Peer observer and module supporter Science Outreach coordinator			
Signature of applicant:	 **Date: 1 September 2015**			
I confirm that the above named applicant has my support for professional recognition against the UKPSF. **Head of School/Department**	**Name: Professor Giles Harrison** **Head of Department (External Affairs)** **Signature:**  **Date: 13th August 2015**			
For office use only	**Date received:**	**Date of panel meeting:**	**Outcome:**	

PROFESSIONAL ACTIVITY TABLE

Professional Activity		Dimensions of the UK Professional Standards Framework (shaded = met)														
		Areas of Activity					Core Knowledge						Professional Values			
1	**Engagement in broad range of teaching practices within University and externally**	**A1**	**A2**	**A3**	**A4**	**A5**	**K1**	**K2**	**K3**	**K4**	**K5**	**K6**	**V1**	**V2**	**V3**	**V4**
	• Convene MSc module "Climate Change" • Developed/co-convene undergraduate module "The Science of Climate Change" • Contributing to development of new SAGES MSc programme in Past Climate Change and Ecodynamics 2013 • Contribute to wider departmental teaching (MSc team projects, Current Weather & Climate discussions, student presentations, tutoring) including supervision and exam setting/marking • Convened 2 adult education courses on Weather and Climate recently passed on to members of staff to whom I now act as mentor • Teach on external spring/summer schools and have examined 12 PhD students (7 as external examiner) • Attended and reflected upon continuing professional development training courses focussing on teaching and learning															
2	**Designed flexible active learning techniques and implemented these in teaching Climate Change to support learning across a range of ability levels** (see case study 1)	**A1**	**A2**	**A3**	**A4**	**A5**	**K1**	**K2**	**K3**	**K4**	**K5**	**K6**	**V1**	**V2**	**V3**	**V4**
	• Reflected on learning environment within module containing diverse student experience and learning needs • I designed active learning techniques to aid student learning of complex concepts • Implemented activities and adapted scope to suit range of student learning needs across contrasting teaching modules • Followed up small-group activities with assertive questioning to cement and appraise learning • Assessed effectiveness in meeting learning outcomes by (i) observing student-led discussion, (ii) assertive questioning of groups, (iii) feedback from students through Blackboard Survey, (iv) peer observation by colleagues • Monitored increased contributions to class discussion and reduced low-range final marks, indicating success of techniques • Some activities were employed by colleagues within teaching and learning across different modules															

3	**Redesigned formative and summative assessment and enhanced learning environment within MSc "Climate Change" module to better meet learning outcomes**	**A1**	**A2**	**A3**	**A4**	**A5**	**K1**	**K2**	**K3**	**K4**	**K5**	**K6**	**V1**	**V2**	**V3**	**V4**
	• Reflecting on student feedback I improved a formative assessment (single question to worksheet structure) providing scaffolding to meet needs of diverse learning community (range of nationalities and prior experience) • In-class assertive questioning and peer learning techniques (Denicolo et al. 1992) were applied to provide formative assessment and weaknesses in learning were identified and appraised through class discussion and recap • In response to module supporter feedback I improved summative assessment (Excel spreadsheet climate simulation) and marking schemes/instructions to better guide students, meet learning objectives and aid moderation • Improved feedback to students achieved by removing inexperienced marker and providing more detail for students reflection • Reflecting on student feedback I enhanced the learning environment by re-structuring the module from a multi-lecturer seminar-based model to a single-lecturer structure including two keynote seminars from guest speakers • Up to date research was incorporated into the core content along with further reading • Lesson plans were developed to incorporate learning outcomes and active learning; these were reflected upon following the lecture and modified where appropriate • Evaluation of modifications through student feedback and peer observations and ongoing feedback from module supporter and students are being considered to further enhance the assessments															
4	**Developed appropriate learning technology to deliver formative assessment and feedback within undergraduate teaching** (case study 2)	**A1**	**A2**	**A3**	**A4**	**A5**	**K1**	**K2**	**K3**	**K4**	**K5**	**K6**	**V1**	**V2**	**V3**	**V4**
	• Developed learning technology to provide formative assessment meeting University requirements for feedback to part 1 students in term 1 • Designed quiz and monitored participation through Blackboard; feedback was tailored to student responses, designed to provide learning pathways necessary for student to correctly answer the question • The quiz is suitable for use by the students in revising core concepts and in preparing for the summative assessment examination • Evaluation of student feedback and improved final assessment marks indicated the quiz positively impacted learning • Wider impact of adopting learning technology included its use by colleagues to develop their own teaching and learning activities															

5	**Promoted participation in higher education through development of teaching resources for Massive Open Online Course (MOOC) for use in undergraduate teaching** (case study 2)	**A1**	**A2**	**A3**	**A4**	**A5**	**K1**	**K2**	**K3**	**K4**	**K5**	**K6**	**V1**	**V2**	**V3**	**V4**
	• Promoted participation in higher education by developing teaching and learning material for the public that is adaptable for undergraduate teaching • Exploiting appropriate learning technologies to provide range of activities (video, article, online active learning content, structured questions, moderation of discussion groups, quiz assessment) for "Climate Change" MOOC that commenced in 2014 • Assessed/complimented student learning through active moderation on discussion groups • Content was modified to reflect feedback during and following debriefing after the MOOC • Active content using Scratch online programming software to develop an interactive energy balance model was exploited in undergraduate teaching															
6	**Led public engagement activities through schools and media outreach and applied techniques in teaching/learning practices**	**A1**	**A2**	**A3**	**A4**	**A5**	**K1**	**K2**	**K3**	**K4**	**K5**	**K6**	**V1**	**V2**	**V3**	**V4**
	• I led public engagement activities in my role as science outreach administrator for the Department of Meteorology, conducting a wide range of teaching in schools, adult education and public groups through teaching modules, providing lectures and media interviews • Steered departmental practice in developing media interaction and public engagement to meet wider University requirements and applied concepts such as reducing jargon and using analogies to enhance departmental teaching and learning practices • I developed resources for schools/public to aid learning of climate change concepts and used these resources to enhance undergraduate and postgraduate teaching and active learning; resources for active learning were improved following feedback from learners • Mentoring and training of staff in media and outreach techniques including active learning practices and using analogies to enhance communication were found to enhance departmental teaching and learning practices															

7	**Led whole year tutoring and supervision of MSc dissertation/projects and PhD thesis students**	**A1**	**A2**	**A3**	**A4**	**A5**	**K1**	**K2**	**K3**	**K4**	**K5**	**K6**	**V1**	**V2**	**V3**	**V4**
	• Teach and support learning through whole year tutoring of 2-3 MSc students per year • Activities were developed to compliment module-based learning (e.g. interpret basic hydrostatic equation using pressure sensors measurements) • Supported students in managing challenging learning requirements of MSc program • Led supervision of MSc student dissertation projects/mentored junior staff in joint supervision • Have also acted as BSc whole year tutor and BSc dissertation supervisor • Currently supervise 3 higher degree students and have led supervision of 2 PhD students to successful completion															
8	**Provide quality assurance and quality enhancement through peer observation of colleagues and moderating of module assessment**	**A1**	**A2**	**A3**	**A4**	**A5**	**K1**	**K2**	**K3**	**K4**	**K5**	**K6**	**V1**	**V2**	**V3**	**V4**
	• I act as module supporter for a range of modules (e.g. Atmospheric Physics, Tropical Weather systems, Remote Sensing); this involves appraising assessment structure and feedback, second marking, exam checking and wider module evaluation • I serve on the Meteorology department MSc examinations scrutiny committee and participate in examinations meetings • I serve on PhD monitoring committees (3-4 per year) • I contribute peer observations to colleagues (1/year) to whom I provide feedback and from which I reflect upon my own teaching practices															

Case Study 1 – Development of flexible active learning techniques and implementation within teaching across a diverse range of ability levels

Dimensions of the UK Professional Standards Framework														
Areas of Activity					Core Knowledge						Professional Values			
A1	A2	A3	A4	A5	K1	K2	K3	K4	K5	K6	V1	V2	V3	V4

In this case study I will demonstrate the development of evidence-informed methods using an appropriate learning environment (A1, A4) to facilitate active learning within a small group context (K2) and this is evidenced by examples of activities and evaluation of student and peer observer feedback (K5).

Background and Context

Motivated by a University recommendation for Meteorology to broaden its teaching scope, thereby increasing student numbers (V4), a new undergraduate module on "The Science of Climate Change" for non-meteorologists was developed with colleagues. This also contributes in tackling the wider national issue of a perceived declining public trust in climate science (Shuckburgh et al. 2012).

Developing this module presented two challenges:

1) Describing complex concepts to students without mathematical backgrounds;
2) Engaging with a diverse cohort.

It also presented an opportunity to develop new teaching resources, flexible enough to apply in other modules and appeal to a range of learners.

Initial approach

My initial approach in developing appropriate methods was guided by my teaching philosophy: I consider that learners must be fully motivated and actively engaged; a range of activities and methods are required to ensure inclusivity to cater for a diverse range of learning needs (V1). I consider that displaying enthusiasm for and demonstrating of broad knowledge of the core subject material is essential in engaging students (K1). Peer to peer interaction and active learning is necessary to foster collaboration and to build up a framework from which students are better able to generate a deeper understanding of the subject themselves.

To convey a large amount of core knowledge to the students, one option I considered was lecture-based content with worksheets to evaluate/consolidate learning. Reflecting on the diverse range of prior cohort experience I considered a more diverse and inclusive approach since learners experience teaching in contrasting ways, benefitting from a range of teaching styles and activities (V1, K3; Fry et al. 2009). In particular active learning (e.g. Denicolo et al. 1992) within a small group context can enable students with less experience and knowledge of science and mathematics to learn from their more experienced peers who themselves can benefit at a deeper level of understanding through their explanations (K2) and bring demotivated students up to the level of the motivated (Biggs, 2003).

Considering also prior CPD training including “Teaching for Active Learning” and “Small Group Teaching” (A5) I decided to develop a range of activities including peer to peer active learning interspersed with short lectures primed with assertive questioning (V3): here questions are designed to guide students towards the best answer, learning through reflection upon peer comments and feedback, while encouraging broad participation (Petty, 2009). I considered this strategy would facilitate greater engagement through whole-class interactive teaching, helping to cement knowledge through deeper understanding acquired within the activities, thereby improving attainment (e.g. Hattie, 2008; Freeman et al. 2014).

The range of activities (A1; Evidence 1.1) was designed to foster a continuous cycle of learning (Kolb, 1984): mini lectures introduce abstract conceptualisation; active experimentation and collaboration in small groups involve higher cognitive demand (Bloom et al. 1956) and providing concrete examples; follow-up assertive questioning and recap cements the key concepts (A2, V3). Aspects of these activities were first trialled in adult education teaching and schools outreach. For example, I initially demonstrated the infra-red thermometer activity (Activity 2, Evidence 1.1) but found including volunteers encouraged greater engagement and hence more active learning judged by student participation in assertive questioning and from positive student feedback (Evidence 1.2).

Reflection and Evaluation of Learning Activities

Evaluating active learning techniques by recording observations on my lesson plan, I noted that student engagement increased following active learning. The mix of mini lectures, activities and assertive questioning were designed to increase attention and promote deeper learning as shown by past studies (Fry et al. 2009; Petty, 2009; Freeman et al. 2014).

To evaluate the degree to which activities were challenging and met the learning outcomes, I designed a Blackboard survey of student perception (K5; Evidence 1.2). I found motivating students to participate in this survey was challenging (around 25% of students did not enter answers); incorporating the survey as part of a revision exercise may increase participation in the future. Based upon the survey results I judged that the degree of challenge was acceptable (only 7% found the activities unchallenging). However, I discovered 26% of students misunderstood learning outcomes, indicating greater reinforcement of conclusions following tasks is required. This was corroborated by peer observation (K6; Evidence 1.2) and will be tackled in the future.

A particular challenge I found was engaging the diverse cohort early in the module. Many were new to higher education and few were familiar with their peers. My experience suggested many were therefore reluctant to contribute ideas to the whole class, appearing demotivated. Springer et al. (1999) found small group teaching can positively influence learning and self-esteem but impact on motivation was less noticeable. Reflecting upon these findings and peer observation recommendations that introducing activities at an earlier stage would be beneficial (K6; Evidence 1.2), I decided to introduce active learning and assertive questioning techniques as early as practicable within my section of the module (A4). I asked students to reflect upon the introductory lecture delivered by my colleague the previous week and to write down ideas guided by prompting questions. I found this helped motivate students by acquainting the diverse group; subsequent discussion using assertive questioning reinforced prior learning (V2). I also introduced an early demonstration of forcing

and feedback loops (Evidence 1.1): I involved the back row, judged to be the least engaged, and observed improved group cohesion and participation.

I also discovered that due to the diverse cohort some students did not engage in the activities, wishing to work alone. Consequently I decided to explain beforehand why active learning and participation is vital in fully understanding key concepts which will be assessed. Observing my students following this modification, I found participation and engagement with the activities overall improved.

On reflection, I consider that reducing lecture-based content further in this initial lecture could help to further engage the least motivated students. I plan to introduce more pyramiding techniques (Jaques, 2000) designed to increase confidence and active participation by less motivated and lower confidence students: here silent reflection upon questions/ideas are recorded individually for discussion in buzz groups and subsequent class discussion through assertive questioning.

Impact on teaching and learning practices

In addition to enhanced student participation, engagement and attainment on the module through the introduction and evaluation of active learning techniques, there was a wider impact upon my teaching and colleagues' practices across other modules. Since activities were designed for use in teaching scientific material to non-scientists, their focus upon key concepts, rather than mathematical technique, make them flexible with respect to wider teaching and learning practices.

I have adapted these activities for public engagement and student tutorials, finding them successful in meeting learning outcomes across a range of modules from adult education to Masters-level with only small modifications required. Activity 4 (dealing with natural climate variability) is relatively simple to use yet incorporates current research data to increase engagement and interest; this activity has been adapted by colleagues in undergraduate teaching as has Activity 2 (on the greenhouse effect) by colleagues in school careers events, of importance in University recruitment (V4).

In conclusion, I have designed and developed a range of active learning tasks combined with assertive questioning techniques to promote deeper learning and improve motivation, engagement and attainment. Evaluation of these techniques, through direct observation, peer observation and student feedback has demonstrated improved engagement. The methodologies positively impacted teaching across my modules and colleagues have adopted some activities. Ongoing improvement through critical evaluation of these activities is necessary, with particular emphasis on how well learning outcomes are met and ensuring whole-class participation, which remains a challenge.

References

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Bloom, B., Englehart, M. Furst, E., Hill, W., & Krathwohl, D. (Eds.) (1956). Taxonomy of educational objectives: The classification of educational goals. Handbook I: Cognitive domain. New York, Toronto: Longmans, Green

Denicolo, P., N. Entwistle and D. Hounsell (1992) What is active learning? Effective Learning and Teaching in Higher Education. Module 1, parts 1 & 2. CVCP, Sheffield.

Freeman S., S. L. Eddy, M. McDonough, M. K. Smith, N. Okoroafor, H. Jordt, and M. P. Wenderoth, Active learning increases student performance in science, engineering, and mathematics, PNAS, 111, 8410-8415, doi:10.1073/pnas.1319030111

Fry, H., S. Ketteridge and S. Marshall (2009). A handbook for teaching and Learning in Higher Education. 3rd Edition. Kogan Page, London, pp 526.

Hattie, J. (2008) Visible Learning: A Synthesis of over 800 Meta-Analyses Relating to Achievement, London, Routledge.

Jaques, D. (2000). Learning in Groups: A Handbook for Improving Group Work, 3rd ed. London: Kogan Page.

Petty, G. (2009) Teaching Today: A Practical Guide, 4th Edition, Nelson Thornes, UK, pp 614.

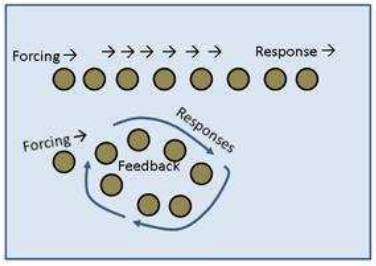
Shuckburgh, E, Robison, R and Pidgeon, N (2012). Climate Science, the Public and the News Media. Living With Environmental Change, available from www.lwec.org.uk

Springer et al. (1999) Effects of Small-Group Learning on Undergraduates in Science, Mathematics, Engineering, and Technology: A Meta-Analysis, Review of Educational Research, 69(1), pp. 21-5.

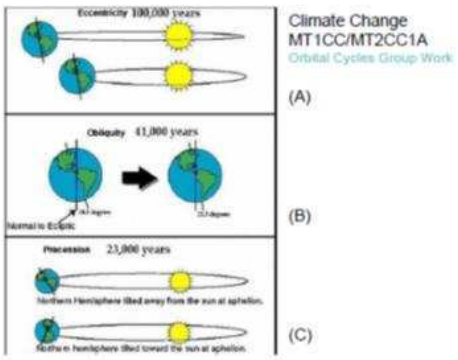
Evidence 1.1: Examples of Active Learning Activities

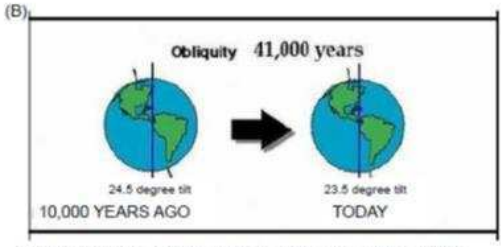
Activity	Learning Outcomes	Details	
1) Forcing and Feedback	Define what are forcings, feedbacks and responses in the climate system	Student “volunteers” (about 10) come to the front of the class and are arranged to perform examples of forcing, response and feedback	
2) Infra-red thermometer	Describe the greenhouse effect Recall that warmer objects emit more infrared radiative energy	Student volunteers (2) demonstrate, using an infra-red thermometer, that warmer objects emit more infrared radiative energy and the influence of windows to illustrate the greenhouse effect	
3) Glacial Cycles Worksheet	Describe the factors leading to the timing of glacial cycles	A worksheet guides small groups of students (3-4) to investigate the effects of changes in Earth’s orbit around the sun on the initiation of glacial cycles. This is followed by a class discussion.	
4) Ranked global average temperature	Discuss the factors that cause unforced variation of climate	A worksheet presenting Earth’s annual average temperature ranked from the warmest to the coolest year is provided (and updated each year). The students discuss how natural factors can influence the ranking and a class discussion consolidates this.	

Activity 4 – Ranked Global Temperature Activity



Activity 1 – Forcing/Feedback Demonstration



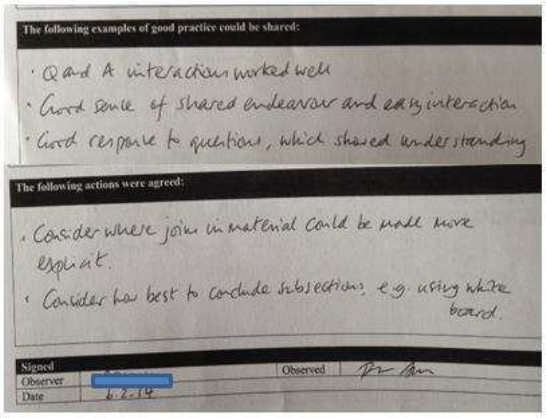


10,000 years ago the tilt of the Earth's axis relative to its orbit around the sun (obliquity) was more extreme.

How would this affect the solar radiation absorbed over the planet's surface?

How would this affect the seasons?

Activity 3 – Glacial Cycles worksheet



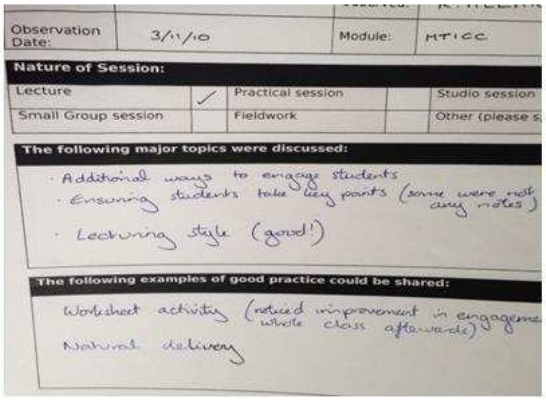
The following examples of good practice could be shared:

- Q and A interaction worked well
- Good sense of shared endeavour and easy interaction
- Good response to questions, which showed understanding

The following actions were agreed:

- Consider where joins in material could be made more explicit.
- Consider how best to conclude subsections, e.g. using white board.

Signed
Observer
Date 6.2.14
Observed



Observation Date: 3/11/10 Module: MT1CC

Nature of Session:

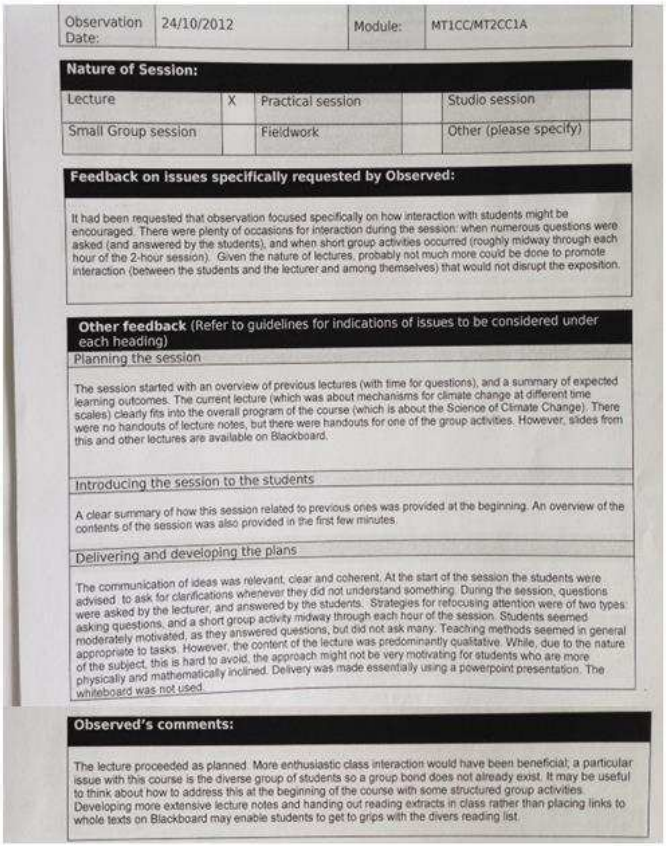
Lecture	✓	Practical session		Studio session	
Small Group session		Fieldwork		Other (please s	

The following major topics were discussed:

- Additional ways to engage students
- Ensuring students take key points (some were not using notes)
- Lecturing style (good!)

The following examples of good practice could be shared:

Worksheet activity (noticed improvement in engagement whole class afterwards)
Natural delivery



Observation Date:	24/10/2012	Module:	MT1CC/MT2CC1A

Nature of Session:

Lecture	X	Practical session		Studio session	
Small Group session		Fieldwork		Other (please specify)	

Feedback on issues specifically requested by Observed:

It had been requested that observation focused specifically on how interaction with students might be encouraged. There were plenty of occasions for interaction during the session: when numerous questions were asked (and answered by the students), and when short group activities occurred (roughly midway through each hour of the 2-hour session). Given the nature of lectures, probably not much more could be done to promote interaction (between the students and the lecturer and among themselves) that would not disrupt the exposition.

Other feedback (Refer to guidelines for indications of issues to be considered under each heading)

Planning the session

The session started with an overview of previous lectures (with time for questions), and a summary of expected learning outcomes. The current lecture (which was about mechanisms for climate change at different time scales) clearly fits into the overall program of the course (which is about the Science of Climate Change). There were no handouts of lecture notes, but there were handouts for one of the group activities. However, slides from this and other lectures are available on Blackboard.

Introducing the session to the students

A clear summary of how this session related to previous ones was provided at the beginning. An overview of the contents of the session was also provided in the first few minutes.

Delivering and developing the plans

The communication of ideas was relevant, clear and coherent. At the start of the session the students were advised to ask for clarifications whenever they did not understand something. During the session, questions were asked by the lecturer, and answered by the students. Strategies for refocusing attention were of two types: asking questions, and a short group activity midway through each hour of the session. Students seemed moderately motivated, as they answered questions, but did not ask many. Teaching methods seemed in general appropriate to tasks. However, the content of the lecture was predominantly qualitative. While, due to the nature of the subject, this is hard to avoid, the approach might not be very motivating for students who are more physically and mathematically inclined. Delivery was made essentially using a powerpoint presentation. The whiteboard was not used.

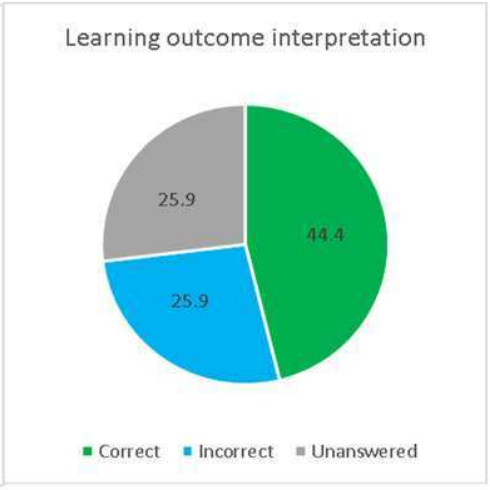
Observed's comments:

The lecture proceeded as planned. More enthusiastic class interaction would have been beneficial; a particular issue with this course is the diverse group of students so a group bond does not already exist. It may be useful to think about how to address this at the beginning of the course with some structured group activities. Developing more extensive lecture notes and handing out reading extracts in class rather than placing links to whole texts on Blackboard may enable students to get to grips with the divers reading list.

Dr. Allan,
(cc Prof. Arnell)

Thanks a lot for your answer, giving me a deep breath.
I was just confused by how to count the acadmic week...

Although I don't have any background in meteorology and have some difficulty in understanding academic terms in English, I am really enjoying this class so far, thanks to every lecturer's explanation with eagerness.



Evidence 1.2: Examples of peer observation, student feedback and evaluation of active learning. This demonstrates the success of assertive questioning, reflection on class diversity, positioning of active learning sessions and degree to which learning outcomes are met.

Case Study 2 – Use of technology in promoting active learning of complex scientific concepts and providing formative feedback to students

Dimensions of the UK Professional Standards Framework														
Areas of Activity					Core Knowledge						Professional Values			
A1	A2	A3	A4	A5	K1	K2	K3	K4	K5	K6	V1	V2	V3	V4

In this case study I will demonstrate the development of appropriate learning technology to meet University quality assurance requirements for formative assessment (K4, K6). Evidence is provided of Blackboard-based assessment and feedback (A3), an interactive energy balance diagram for use in a Massive Open Online Course (MOOC) and undergraduate teaching and student interaction and feedback.

Background and Context

I consider that appropriate learning technologies are powerful tools in providing active learning opportunities and delivering targeted feedback for large groups. Active learning has been demonstrated to enhance student attainment (Freeman et al. 2014) and is central to my teaching philosophy (case study 1). I recognise benefits of incorporating aspects of online learning within my teaching activities for student learning. Considering the wider context, Redecker et al. (2010) state that universities will change significantly with respect to pedagogical strategies involving appropriate learning technologies and also involving collaboration with schools (V4).

Further motivations for developing specific learning technology were based on University quality assurance requirements (K6): “All Schools must ensure that for every Part 1 module taught in the Autumn Term, a minimum of one piece of formative or summative feedback on an assignment is provided to students before the winter vacation…” (University of Reading, 2014). Additional University requirements involved development of MOOCs, in part to enhance student recruitment potential, promote participation in higher education (V2) and develop undergraduate teaching resources and distance learning (V4). The development of interactive online content is particularly suited to MOOCs in combination with more standard resources (videos and articles), recognising benefits of active learning and a diversity of learning styles (K3; Fry et al. 2009).

Development and evaluation of an online formative assessment and feedback tool

Reflecting on University quality assurance policy, the benefits of evaluating student learning and the effectiveness of my teaching at an early stage in the module one option I considered was an in-class quiz. I found this to be well suited to adult education teaching. However, I discovered that providing individual feedback to students was time consuming and repetitive and considered it would be beneficial for students to receive more timely feedback on their answers. Therefore I decided an online quiz would be an effective method of providing feedback on performance to enhance learning (A3; Sadler, 1998; JISC, 2010).

I designed a set of multiple choice questions in Blackboard; feedback was provided following completion (Evidence 2.1). I decided to tailor feedback to the student response so learning pathways could build understanding necessary for students to answer correctly (A1, A3). The learner is provided with information as to why answers were incorrect but the correct

answer was not provided. I thought that this would aid the cycle of learning, making the student think more deeply about the key concepts and enable students to self-regulate their learning (K3; Nicol and Milligan, 2006). Correct answers were met with additional information to enhance learning.

I evaluated participation using Blackboard “Course Evaluation” tools and found acceptable participation (>80%). Since the assessment was formative, some students may have decided that the activity was not compulsory. I therefore tried emphasising the importance of receiving feedback at this stage in the course and that the exercise was beneficial for tackling the final assessment question, some of which were also multiple choice.

I initially went over quiz answers in the following class. However, I decided this may also encourage non-participation since students would receive the answers. Therefore I decided to discuss only questions students appeared to have difficulty with, based upon the Blackboard Course Evaluation results. Further evaluation of student feedback and improved final assessment marks indicated that the quiz positively impacted attainment (K5).

Development and Evaluation of an interactive energy balance model for use in teaching

I was involved in scoping a University Climate Change MOOC, designing 4 tasks. I discussed approaches with colleagues and we initially decided that a mix of video lectures, articles and guided activities combined with an interactive comments board would meet the learning requirements of the target audience (including A-level students and parents of potential students). Based upon my teaching philosophy I considered that a mix of visual and verbal content combined with active participatory activities would maximise learning (K3). This is supported by studies showing learning retention after 3 days is just 10% following reading, increasing to 50-65% for verbal and visual material and 70-90% for participatory activities (Dale 1969; Pike, 1989).

I therefore designed a simple energy balance climate simulation which students could interact with (A1; Evidence 2.2). This was written in Scratch programming software aimed at children so that interested participants could adapt this software if required. The learners were able to alter the amount of sunlight, the reflection of the planet and its greenhouse effect and understand the influence of their actions on the Earth’s temperature (K4). One difficulty I encountered was a requirement for all content to be accessible on tablets and mobile devices. Since Scratch uses Flash software it was incompatible with these devices. Considering recommendations by colleagues, I decided to create a Screencast using free software: this involved recording myself demonstrating the energy balance model; the students could view and listen to this video. I also included prompting questions in the activity to provide scaffolding for the students to guide their learning (A2) and evaluated the success of this activity through an interactive comments board (Evidence 2.2).

I discovered that the interactive comments board also encouraged student participation, instructor feedback and peer to peer learning (A2, Evidence 2.2). This “online socialisation” (Salmon, 2002) generated a vibrant community and I observed an enhancement in motivation and confidence during my interaction, further evidenced by positive student comments about this aspect of the module, in particular educator engagement (A4, K5; Evidence 2.2).

Following student feedback from the comments board we discovered that the use of unfamiliar scientific terms was impeding student learning (K5). Hence we tried implementing a glossary of terms to mitigate the problems with scientific jargon. Based upon student feedback I found that this was a valuable addition; we are currently updating content to address additional student feedback (Evidence 2.2).

Wider impacts and implications of learning technology

The development of two examples of appropriate learning technology were found to be effective in delivering formative assessment and feedback and encouraging active learning. Both also had wider impacts upon my teaching and the practices of colleagues.

I found the Blackboard quiz suitable for use by students in revising the core concepts and in preparing for summative assessment. I discovered it was readily applicable to other climate change modules with minor modifications. Following peer observation, my colleague decided to implement similar learning technology within their module (K6).

Active learning technology developed as part of a Climate Change MOOC was found to be suitable for undergraduate teaching. I tried using the energy balance simulation in teaching the greenhouse effect and supplied this as an optional activity on Blackboard (Evidence 2.2). Monitoring participation using Blackboard Course Evaluation showed that some students participated but I consider that a more structured approach, using some of the guiding questions developed in the MOOC, would be beneficial in increasing participation and enhancing the learning opportunities in future. Reflecting upon the success of the MOOC comments board, based upon student feedback, I am considering this type of interactive learning in future undergraduate teaching. However, I think that the contrasting learning needs will necessitate further evaluation and design of such activities for use in this contrasting learning environment.

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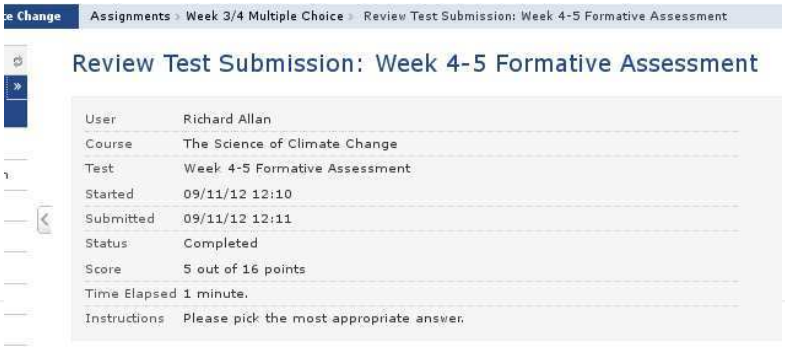


ce Change | Assignments › Week 3/4 Multiple Choice › Review Test Submission: Week 4-5 Formative Assessment

Review Test Submission: Week 4-5 Formative Assessment

User	Richard Allan
Course	The Science of Climate Change
Test	Week 4-5 Formative Assessment
Started	09/11/12 12:10
Submitted	09/11/12 12:11
Status	Completed
Score	5 out of 16 points
Time Elapsed	1 minute.
Instructions	Please pick the most appropriate answer.

Evidence 2.1 – Examples of questions and formative feedback from online Blackboard formative assessment.

Question 1 — **1 out of 1 points**

The Earth's albedo is defined as

Selected Answer: ☑ the fraction of incoming sunlight that is reflected back to space.

Response Feedback: Yes, it is the reflected shortwave radiation divided by the incoming shortwave radiation and can be defined at the top of the atmosphere or at the surface. If the top of atmosphere albedo is 0.6 (e.g. thick clouds) then 60% of incoming sunlight is refelected. If the surface albedo is 0.1 (dark cloud-free oceans) then 90% of the incoming sunlight is absorbed by the surface.

Question 2 — **0 out of 1 points**

Which of the following is a negative cloud feedback:

Selected Answer: ✗ Aerosol emissions from industry cause cloud droplets to become smaller and more numerous resulting in more reflective clouds.

Response Feedback: A negative feedback involves a response to a warming or cooling which acts to reduce this warming or cooling.

Question 3 — **1 out of 1 points**

The Earth cools to space by

Selected Answer: ☑ emission of longwave radiation.

Response Feedback: Yes, the only way the Earth can cool to space is through the emission of long wavelength (or thermal/infra-red) radiation.

Question 4 — **1 out of 1 points**

Greenhouse gases

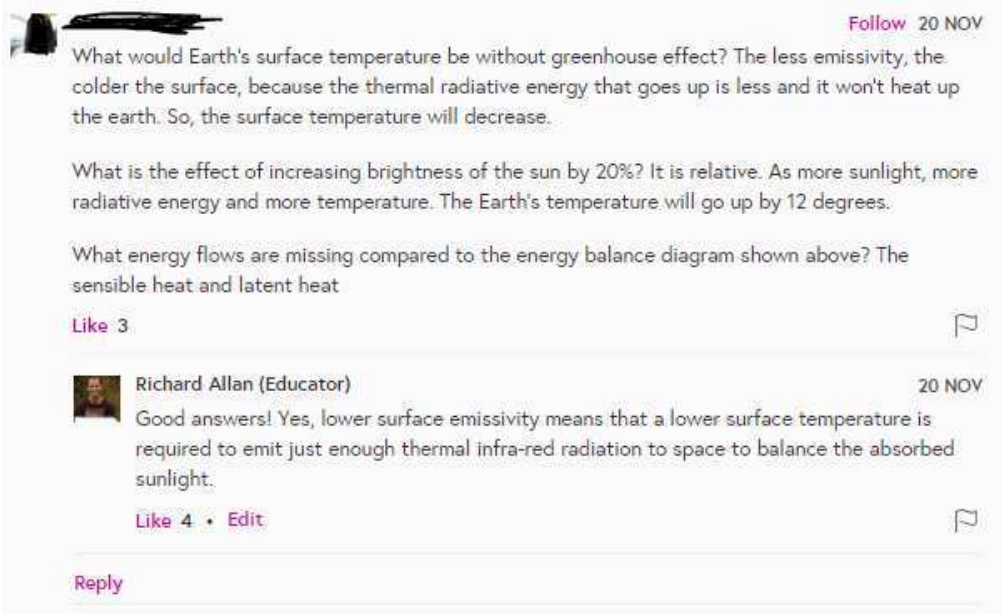
Evidence 2.2 – Example of interactive energy balance model as part of Climate Change MOOC (top; evidence of large number of views: 1808) screen capture of online content introducing the interactive energy balance activity (right) and an example of interactive student participation and educator feedback through comments pages (bottom, part of the 487 online comments associated with this section). Evidence of evaluation of MOOC activities and initial use in undergraduate teaching are provided on the following page.

If your browser supports Flash you can go to the interactive energy balance activity (or see Scratch Project Page) and try changing the energy of the brightness of the Sun, the Earth's reflectivity (albedo) and the atmospheric greenhouse effect (emissivity) to see what happens to the Earth's energy balance. If, however, your browser doesn't support Flash, you can view this screencast of the activity.

You may like to consider the following questions:

- What would Earth's surface temperature be without greenhouse effect?
- What is the effect of increasing brightness of the sun by 20%?
- What energy flows are missing compared to the energy balance diagram shown above?

The simple energy balance activity is useful in understanding the link between Earth's energy balance and global average temperature. However, it does not include the complexity of the climate system. For example, it is likely that if temperatures warmed, Earth's albedo would change which would also influence the temperatures in a "vicious cycle", termed feedback. In the next step we will discuss the importance of these feedback processes for climate change.



Week 1

	Comments	Likes
Course is interesting or enjoyable	6	27
Course has a lot of scientific terms or commenter struggling to understand more technical aspects or suggested including a glossary	10	41
Time suggested to complete course is too short	4	9
Would have liked more information on prehistorical climate	2	5
Suggested MPs should take this course	2	4

Based on the post-course survey (400 people)

- 75% - clear structure
- 90% - educators engaging
- 75% - level right
- 45% - no previous knowledge
- 65% - visit the course a few times a week
- 80% - spent between 30min to 2 hours
- 80% - time required about right
- 75% - length about right
- 45% - excellent experience / 40% good
- 7% - would pursue a degree on subject

Lecture 2: The Climate System

Enabled: Statistics Tracking

Attached Files: MTxCC_02_Greenhouse_2014.pdf (1.737 MB)

Copies of Week 2 lecture slides above.

Suggested reading:

IPCC WG1 5th assessment report (2013): Section 1.2.2 in Chapter 1

IPCC WG1 4th assessment assessment report (2007)
What determines climate? FAQ 1.1, p.96-97
The Greenhouse Effect: Section 1.4.1 p.103-106 and FAQ 1.3 p.115-116
These are available here:
http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch1.html
http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter1.pdf

Further Suggested Reading:
Lacis et al. (2010) Science (available online on campus network)

Pittock, Chapter 1.

Optional Activity:

Sratch energy balance activity (requires Flash player, not possible using ipad/iphone)

Evidence 2.2 continued.

Continuing Professional Development Log - Richard Allan

Learning Event	Start Date	End Date	Completed
SMALL GROUP TEACHING	1/16/2006	1/16/2006	Yes
Active learning techniques and Setting Learning Outcomes	6/1/2006		Yes
Brain Friendly Teaching and Learning Seminar	6/30/2009		Yes
LEARNING OUTCOMES AND COURSE DESIGN	11/11/2009	11/11/2009	Yes
INTRODUCTION TO PROGRAMME AND QUALITY ISSUES IN HE	1/20/2010	1/20/2010	Yes
EVALUATING YOUR TEACHING	2/10/2010	2/10/2010	Yes
INTRODUCTION TO LEARNING TECHNOLOGIES	2/24/2010	2/24/2010	Yes
RESEARCH - TEACHING SYNERGIES	3/10/2010	3/10/2010	Yes
PORTFOLIOS AND PROJECTS	4/13/2010	4/13/2010	Yes
TEACHING FOR ACTIVE LEARNING	4/13/2010	4/13/2010	Yes
LEARNING AND TEACHING FOR LARGE GROUPS	4/14/2010	4/14/2010	Yes
RUNNING TUTORIALS AND SEMINARS	4/14/2010	4/14/2010	Yes
EXAMINING AND ASSESSING	4/15/2010	4/15/2010	Yes
GIVING FEEDBACK TO STUDENTS	4/15/2010	4/15/2010	Yes
PERSONAL TUTOR SYSTEM	4/28/2010	4/28/2010	Yes
NEW LECTURERS' STAKEHOLDERS LUNCH AND MEETING	6/2/2010	6/2/2010	Yes
SUPERVISING RESEARCH STUDENTS	6/2/2010	6/2/2010	Yes
PRESENTATION PRACTICE AND FEEDBACK	12/8/2010	12/8/2010	Yes
VOICE SKILLS FOR PRESENTATIONS	2/16/2011	2/16/2011	Yes
COMMUNICATION SKILLS FOR PERSONAL TUTORS	5/25/2011	5/25/2011	Yes
NEW LECTURERS' STAKEHOLDERS LUNCH AND MEETING	6/29/2011	6/29/2011	Yes
RESEARCH STAFF MENTORS TRAINING (SCHOOL-BASED)	6/19/2013	6/19/2013	Yes
PGCAP PORTFOLIO WRITERS WORKSHOP	2/11/2014	2/11/2014	Yes
Media Training (mediafirst.co.uk)	3/19/2014	3/19/2014	Yes
UNCONSCIOUS BIAS IN DECISION MAKING (SCHOOL-BASED)	10/2/2014	10/2/2014	Yes
FLAIR CPD SCHEME - BRIEFING EVENT	1/12/2015	1/12/2015	Yes
Internal Meteorology staff meeting on module development	6/16/2015	6/16/201	Yes
E-assessment	6/25/2015	6/25/2015	Yes
Assembling and displaying images through i-Globe system	7/13/2015	7/13/2015	Yes
FLAIR CPD WRITING RETREAT: FOLLOW UP (ALL TIERS)	7/15/2015	7/15/2015	Yes
Meteorology T&L module development from student experience perspective	7/23/2015	7/23/2015	Yes
FLAIR CPD WRITING RETREAT: FOLLOW UP (ALL TIERS)	8/4/2015	8/4/2015	Yes

Reference to support an application for Fellow

Your name	Dr Thomas Hesselberg
Job title	Director of Studies for Biological Sciences and Environmental Conservation
Institution	Oxford University Department for Continuing Education
Email address	thomas.hesselberg@conted.ox.ac.uk
Candidate's name	Prof Richard Allan.

Please confirm if you are located within, or external to, the candidate's Faculty: **External**

In what capacity are you able to comment on the candidate's professional practice?

Director of Studies for the climate and weather modules taught by Richard for the Oxford University Department for Continuing Education

Please state if you have Fellowship of the HEA, and if so, at what tier: **Fellow (D2)**

- I confirm that I have read the candidate's application for Fellowship of the Higher Education Academy X *(please tick)*
- I am aware of the requirements for Fellowship at Descriptor 2 of the UK Professional Standards Framework and am confident that this application meets the requirements in full X *(please tick)*

Please provide a minimum of 3 examples of the candidate's experience and achievements in learning and teaching (e.g. innovative practice, contribution to developments in learning and teaching within their discipline/area) and how these map to the UK Professional Standards Framework. *Please expand the space below as necessary. The indicative word count for references is 500 words.*

Teaching and Supporting Learning

Richard is a very experienced and effective teacher and his enthusiasm for his subject area shines through. The combination of these factors and his very interactive teaching style in the form of asking thought provoking questions and including small practical and group discussion sessions works particular well in an adult educational setting, where students come into the class room with a very broad range of previous knowledge and expectations. It is obvious that Richard successfully takes these factors into consideration when planning and designing his sessions. Both of the modules, Richard regularly taught for the Oxford University Department for Continuing Education (OUDCE) 'Climate Change: Past, Present and Future' and 'The Climate and Weather' were popular and very well received. Student feedback was always consistently high with positive comments on Richard's enthusiasm, teaching style and level of interaction. Richard is now no longer teaching

actively for OUDCE, but he continues supporting these modules by mentoring the replacement tutors that have been hired in his place.

These aspects of Richard's work map to the UKPSF at: A1, A2, A3, A4, A5, K1, K2, K3, K4, V1, V2, V3.

Innovative Practice

Richard has a very clear focus on increasing student participation and promoting active learning in his modules. In order to further these goals he used a number of innovative practices in the modules he taught at OUDCE including:

- Developing a weather predicting game that ran throughout the length of his module (complete with scores and rankings), where students were asked to predict the weather at a given European destination based on weekly up-to-date weather maps.

- The use of interactive group activities simulating the function of simple weather predicting computer models by asking students to perform simple calculations in sequential order.

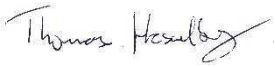
These aspects of Richard's work map to the UKPSF at: A2, A4, A5, K1, K2, K3, K4, V1, V2, V3.

Module Development

The modules that Richard taught and designed for OUDCE were very well structured and clearly designed with a broad and varied audience in mind by beginning the courses as jargon free and simple as possible and then building up complexity slowly as students gained in knowledge and confidence. The individual sessions clearly linked to both course-wide and session-specific learning outcomes. All sessions were designed so that passive learning activities (i.e. lecturing) included frequent questions and small class discussions and were structured around active learning activities (i.e. group discussions and practical activities) catering for a range of learning styles. Throughout his teaching for OUDCE, it was clear that Richard reflected on his teaching and modified the sessions in response to student and departmental feedback. His focus on active learning and inclusion of different learner types were also evident from his assessment which, in contrast to the usual departmental end-of-course essay, consisted of a portfolio of worksheets and multiple-choice quizzes. Finally it is a credit to his course design that subsequent tutors on these modules have retained a large part of the material developed by Richard including the innovative weather predicting game.

These aspects of Richard's work map to the UKPSF at: A1, A2, A3, A4, K1, K2, K3, V1, V2, V3.

For overseas references only: *Please can referees confirm that the candidate is working at a level equivalent to Higher Education in the UK.*

Referee signature:  **Thomas Hesselberg** **Date: 24th of August 2015**

Reference to support an application for Fellow

Your name	Prof Ellie Highwood
Job title	Professor of Climate Physics, Dean of Diversity and INclusion
Institution	University of Reading
Email address	e.j.highwood@reading.ac.uk
Candidate's name	Prof. Richard Allan

Please confirm if you are located within, or external to, the candidate's Faculty: Within

In what capacity are you able to comment on the candidate's professional practice?
Head of Department for Academic staff for Meteorology. I have also been peer observer for Richard on some occasions

Please state if you have Fellowship of the HEA, and if so, at what tier: Senior Fellow (Tier 3)

- I confirm that I have read the candidate's application for Fellowship of the Higher Education Academy X *(please tick)*

- I am aware of the requirements for Fellowship at Descriptor 2 of the UK Professional Standards Framework and am confident that this application meets the requirements in full X *(please tick)*

Please provide a minimum of 3 examples of the candidate's experience and achievements in learning and teaching (e.g. innovative practice, contribution to developments in learning and teaching within their discipline/area) and how these map to the UK Professional Standards Framework. *Please expand the space below as necessary. The indicative word count for references is 500 words.*

Designing modules for and supporting students from diverse learning communities (UKPSF areas A1,A2, A4, K1,K2, K3, K4, V1, V2)

Richard's subject area, climate change, provides opportunities for teaching across a broad range of learning communities both internal and external to the University, and online. Richard has embraced this challenge with the full realisation that his teaching methods and module content need to be tailored to each cohort of learners. As examples, in his multi-ability, multi-background and multi-national MSC module he has employed scaffolding techniques in the course materials to account for differences in prior background, in his undergraduate module he has made extension use of active learning techniques to improve engagement, in his MOOC contribution he designed and wrote an online activity as well as contributed fully to the online discussions with participants, recognising the value of peer to peer and peer to expert informal discussion. I have observed many of his public lectures and seminars on climate change, and the success of Richard's delivery style and planning of sessions is evident in the

sophistication of the questions asked at the end, and the enthusiasm of the audience. I have also had occasion to deliver a lecture for Richard when he was unexpectedly unavailable, and the level of development of the materials meant that this was straightforward for both me and the students concerned.

Richard is in fact developing as a mentor in this aspect as he has passed on Continuing Education courses to other members of staff whom he supports and as such is starting to show D3 potential.

Developing innovative teaching activities (UKPSF A1, A5, K3, K4, K5, V3)
Richard has developed a number of new teaching and learning activities. Often these are developed for one specific module, and then on reflection Richard realises they can be modified to use in another environment – for example the greenhouse effect model written for the climate change MOOC has been trialled for use in his university modules and Richard continues to reflect on how this could be used. Of particular note with this initiative is that Richard chose to write the model in a programming language used by schools and children to facilitate participants altering the code themselves, thereby extending the learning opportunities on offer. This is something we should consider more widely. The second development of note is the level of consideration that Richard has given to the use of on-line quizzes. The justification for not providing the correct answers automatically, rewarding correct answers with opportunities for further learning and the usefulness of this approach is clearly reflected in the fact that 80% of the class completed this formative assessment and the link to final performance in the module.

Enhancing assessment and feedback (UKPSF A2, A3, A4, K4, K5, K6, V4)
A diversity of learners with very different aims and requirements necessitates a strong concentration on ensuring assessment and feedback methods are suitable and effective. Richard has paid keen attention to this through redesigning the formative and summative assessment in the MSc module including removing an inexperienced marker, using learning technology to provide immediate feedback in on-line quizzes and via discussion boards across all modules. He also gives feedback to MSC students via tutorials and to research students throughout their dissertations. Richard has observed my classes and learning activities (including the MOOC) before, and I find his feedback constructive but challenging as indeed it should be.

For overseas references only: *Please can referees confirm that the candidate is working at a level equivalent to Higher Education in the UK.*

Referee signature: Eleanor J. Highwood **Date: 26/8/15**