

**Higher Education Bioscience Teacher of the Year Award 2015**  
**Case Study: Enhancing higher education in biosciences through co-creation**  
**Dr Mark Clements, University of Westminster**

**Background**

This case study describes how co-creation has been used to enhance student learning within the biosciences. This approach is grounded in 'co-creation of knowledge & understanding' rather than students being passive recipients of knowledge. Higher education is facing many challenges including the need to respond to the changing way students learn and the increasing interdisciplinary nature of science. Students entering higher education are described as 'digital natives' (Jones and Shao, 2011). During primary and secondary education pupils are exposed to a wide range of technology enhanced learning methods and are increasingly learning through social collaboration both inside and outside the classroom. Higher education needs to respond to this change as well as to the increasing interdisciplinary nature of the biosciences. This is necessary if we are to engage students and to produce graduates who are agile, flexible and have the necessary skill sets required to address current as well as future global challenges. The wider adoption of co-creation approaches within bioscience higher education has the potential to meet these demands.

The applicant has a track record in adopting innovative student co-creation approaches within the curriculum developed through both internally and externally funded pedagogic research projects. Research was built upon established theoretical pedagogic frameworks as well as being inspired by discussions with fellow practitioners at educational forums such as JISC and ALT-C. This case study highlights some of the key findings from this work including the development of mobile learning solutions and an interdisciplinary learning model for art/science collaboration to support co-creation within the curriculum.

**Reasons for introducing this teaching method**

New teaching practices were developed by the applicant in recognition that the traditional didactic lecture format places the lecturer in charge of the learning process so that students are followers rather than fully pro-active. The new practice was developed based on the applicants' observation that learning was often more effective during informal extra-curricula research projects at the University of Westminster such as the iGEM competition (an international synthetic biology competition) and Broad Vision (an art/science collaboration project). These activities enabled students to learn through a process of co-creation providing an opportunity for them to actively engage with their own learning through an experiential process that is both collaborative and constructivist (Lee & Smagorinsky, 2000; Moon, 2004). Through a series of research projects the applicant has developed ways of embedding similar co-creation opportunities within a standard module curriculum to enhance student's engagement with learning process and improve their overall experience. Such inquiry-based approaches support the development of key graduate attributes sought by employers (both scientific and non-scientific) including

originality in application of knowledge, ability to critically assess complex issues and creativity (Gartland and Wood, 2008).

### **Lecturer's perspective**

There is increasing recognition that tablet devices are a highly effective mobile learning tool that can be used to facilitate co-creation of knowledge and understanding (Belshaw, 2009). The applicant obtained funding (JISC Westminster+ Project and internal sources) to explore how Nexus 7 tablet devices could be used to enhance learning. Students taking two modules were each provided with a tablet device allowing learning to be focused on carefully designed enquiry-based learning activities. These activities encouraged students to critically explore a wide range of online bioscience resources both inside and outside the classroom. The applicants' role became that of a facilitator, guiding students in the identification of appropriate online resources, discrimination of high quality materials and critical evaluation of the information retrieved, allowing students to construct their own knowledge and understanding. Students shared the collaboratively authored resources they developed (using Google Docs and Wikis) which then formed the basis of in-class discussions as well as being the major coursework element for the module. Wikis and Google Docs record the individual contribution of each student to the task so that an individual mark for the group coursework can be awarded thus overcoming a major issue with assessed group work tasks. The collaborative authoring tools also allow the progress of students to be monitored providing a mechanism by which formative feedback can be provided in real-time during the module. This builds student confidence in the work they are producing and allows the module team to intervene early if additional guidance is required.

This approach was very successful as evidenced through student feedback (see student perspective below) encouraging other colleagues in our Faculty to adopt similar approaches using a bank of mobile devices. This informed a decision by the Faculty to provide all second and third year students with a tablet device in the next academic year establishing a model for mobile learning across the University based on the principles of active collaborative learning and co-creation (Delaitre and Clements, 2015). Gunter Saunders, the (Associate-Director of Information Services at the University of Westminster) said:

*'Mark has pioneered the use of tablet devices within his department, using them successfully to create thriving active learning environments for his students. He has influenced his colleagues and the wider University with his work, influencing and informing the provision of similar approaches across the Law School (from 2013) and now across the entire Faculty within which his department is located. Feedback from students has been very positive about the approach he has taken. I consider Mark to be leading the way in this area, serving as a 'change agent' for the University in relation to flipped classroom approaches.'*

In 2010, the applicant was the Bioscience lead on an extracurricular student co-creation project called 'Broad Vision' led by Heather Barnett (Media, Arts & Design). Broad Vision (<http://broad-vision.info/about/>) has become a highly successful

programme provides an opportunity for students to engage in art/science collaborative research and interdisciplinary learning. In 2012, the Broad Vision team co-designed a 15 credit Undergraduate module that embedded the principles of art/science collaboration and co-creation into the curriculum. This project was supported by the University's Interdisciplinary Learning Fund and brought together students from bioscience and the art based courses.

Broad Vision is grounded in the theory of the generative curriculum (Gibbs, 1998) and thus has no prescribed curriculum. Each year it takes its inspiration from a different theme; for example last year's theme was 'Future Human'. Within this module students become teachers working in partnership with academics on a range of emergent student-led interdisciplinary art/science projects. These projects evolve from a series of creative conversations providing an opportunity for collaborative sharing of their disciplinary knowledge. Students are located on different campuses across London so collaboration outside of the classroom is supported through a dynamic social networking platform 'Ning'. Designing an assessment model that had sufficient flexibility to accommodate a generative curriculum model was challenging. However, this was achieved by focusing on student reflection around the 'process' of interdisciplinary collaboration and co-creation rather than specific research outputs produced during the module.

Heather Barnett (Broad Vision lead (Media Arts & Design and National Teaching Fellow) said:

*'Mark has been instrumental in leading this exciting interdisciplinary field, whose disciplinary expertise and pedagogic principles have paved the way for innovative learning strategies to evolve. His contribution has been great: working directly with students as co-producers of knowledge, in contributing to the exchange and expansion of pedagogic practices between the teaching staff, and in taking learning gained back to his disciplinary context and inspiring others within his field.'*

### **Student perspective**

The integration of mobile learning devices within teaching transformed the way students learnt creating an active dynamic enquiry based learning experience leading to student co-creation of knowledge and understanding. The impact of this was evidenced through an improvement in the overall module evaluation scores for the module. The overall average satisfaction score for the module increased from 3.6/5 (prior to the introduction of Nexus device) to 4.7/5. When asked what they liked most about the module, the students responded *'the case studies and group work during every lecture were very interesting, every lecture was exciting'*, *'the nexus device and teaching technique'* and *'the nexus device was used to enhance understanding, but please do not take it back, addicted to it!'*. The tablet devices also enhanced the communication between the applicant and students with students commenting that they liked *'the ease of interaction between the lecturer and the students'*. The approach was also commended by two external examiners who also praised the quality of student work produced providing further evidence of how the

integration of tablet devices and social collaborative learning within modules can transform the student learning experience.

Co-creation within the art/science collaboration project also had a positive impact on the student learning experience and the applicant's contribution was recognised through the Student Union Staff Appreciation Awards. One student said *'Mark has definitely gone above and beyond this year. Namely in his involvement with the Broad Vision project..... He's come to extra-curricular events outside of work hours, and been an all around star. His passion and enthusiasm for the project was infectious, and he definitely deserves to be recognised for his efforts'*.

Students were given an opportunity to continue their project work at the end of the art/science collaboration module leading to the co-production of a series of public engagement activities. Last year this included a three-week exhibition and symposium at the GV Art Gallery (<http://www.gvart.co.uk/wp-content/uploads/2012/03/GV-Art-and-Broad-Vision-Future-Human-Press-Release.pdf>) funded through a Wellcome Trust People's Award and also included the co-production of a series of school workshops to engage the next generation of scientists.

The impact that Broad Vision has had on students can be illustrated by three examples. Mell was an illustration student who was considering dropping out of University when she joined Broad Vision. The module re-ignited her passion for her subject leading to the creation of a series of living microbial sculptures ([www.mellissafisher.com](http://www.mellissafisher.com)). This led to a commission by the Eden Project to develop her microbial portrait work as part of an upcoming Wellcome Trust 'Microbiome' exhibition. Benjamin (Human & Medical Science) and Robbie (Illustration) collaborated on a project entitled vibronacci (<http://rcadoescience.tumblr.com/>). Benjamin now works for the Royal Society in area of public engagement and his experience on Broad Vision was instrumental in securing this position. Robbie has continued his design and illustration work inspired by marine biodiversity leading to several awards (<http://www.radstudio.info/#!about/c10fk>). These examples highlight the value of providing interdisciplinary collaboration opportunities within the curriculum.

## **Issues**

Co-creation encourages active student engagement with their learning. This requires carefully designed learning activities and a shift away from the traditional didactic lecture format. Technology can facilitate this process but this requires infrastructure investment as well as staff development in order to bring about change (Belshaw, 2010). Students increasingly own mobile devices but this can create inequality and exclusion of some students. The provision of learning devices to all students can overcome these issues providing a level platform for learners as well as enabling staff to adopt new innovative approaches to learning.

The generative curriculum model provides an exciting approach for interdisciplinary collaboration and co-creation. However, such a model is resource intensive

requiring greater academic support compared to traditional teaching methods. This can be partially mitigated through the use of 'student interns' but is still resource intensive. Due to this it is unlikely that such models will become the norm for all modules, however, offering at least one opportunity for a student to engage with interdisciplinary collaborative research during a course is feasible and would dramatically enhance the student learning experience. Such experiences also facilitate the development of essential graduate attributes desired by future employers.

### **Benefits**

Co-creation within higher education has the potential to actively engage students in their learning allowing them to take ownership of this process. Technology is a powerful enabling tool facilitating student collaboration both inside and outside the classroom whilst also enhancing student digital literacy skills that are increasingly desired by employers. The way students learn can also be transformed by embedding interdisciplinary co-creation opportunities within the curriculum enabling graduates to gain the experience and skills required to solve current and future global challenges.

### **Reflections**

Co-creation has the potential to transform learning within higher education. This will require significant institutional investment both in terms of infrastructure and staff development to be realised fully. The applicants' experience of adopting such approaches has been transformative, leading to a radical change in his teaching practice and also the leadership of widening student co-creation opportunities across the University. Students have benefited from these co-creation opportunities enabling them to develop a broader set of graduate attributes. However, the wider adoption of such approaches requires both staff and students to move outside of their disciplinary/teaching comfort zones in order to explore new frontiers of knowledge.

### **Dissemination/publications.**

The Broad Vision team held a HEA funded workshop on 'Learning across disciplinary divides: integrating art and science through emergent curriculum design' held in November 2013. This event led to an article in the Times Higher Education (<http://www.timeshighereducation.co.uk/news/westminster-programme-integrates-arts-and-science/2009322.article>).

Broad Vision was featured in the Guardian (<http://www.theguardian.com/education/2013/mar/19/art-students-find-beauty-in-science>).

A three-week exhibition and a symposium (co-produced by students) at GV Art Gallery (<http://www.gvart.co.uk/broad-vision-future-human-5-june-28-june-2014.html>) funded by a Wellcome Trust People's Award (Barnett, Clements, Gardner, Allen and Fry (2014))

A university business case 'Provision of flexible mobile learning to Faculty of Science & Technology students for student success and a model for realising the full potential of Learning Futures' was awarded Jan 2015 (Deloitte & Clements, 2015).

A report on 'Students as co-creators' was co-authored by Clements and Oradani in December 2015 commissioned by the University of Westminster as part of an institution wide 'Transforming Learning & Teaching' project.

Work from this case study was presented at the University of Westminster Learning & Teaching symposium in 2011, 2012 and 2013.

## References

Belshaw, D. (2010). Mobile and Wireless Technologies Review. [online] JISC Infonet. Available from: <http://www.mmiweb.org.uk/mtl/downloads/jisc-mobile-review.pdf>

Gartland, K.M.A. and Wood, E.J. (2008) Research-Teaching Linkages: enhancing graduate attributes: Life Sciences. [online] Quality Assurance Agency for Higher Education. Available from: <http://www.enhancementthemes.ac.uk/docs/publications/enhancing-graduate-attributes-life-sciences.pdf?sfvrsn=16>

Gibbs, G. (1998) Teaching in higher education: theory and evidence. Milton Keynes, England: Open University.

Jones, C & Shao, B (2011). The Net Generation and Digital Natives. Implications for Higher Education. A literature Review commissioned by the Higher Education Academy. [www.heacademy.ac.uk/sites/default/files/next-generation-and-digital-natives.pdf](http://www.heacademy.ac.uk/sites/default/files/next-generation-and-digital-natives.pdf)

Lee, C.D. and Smagorinsky, P. (Eds.).(2000). Vygotskian perspectives on literacy research: Constructing meaning through collaborative inquiry. Cambridge, England: Cambridge University Press.

Moon, J. (2004). A Handbook of Reflective and Experiential Learning: Theory and Practice. London: Routledge Falmer.