'To believe is to be able'

A study of developing self-efficacy in undergraduate biologists at the University of Hull

"Dominic has been nominated for Excellence in Teaching as he demonstrates an exceptional commitment to student learning and support. He has been responsible for designing innovative modules that really challenge and inspire students."

"…going above and beyond what is expected of him… he should be proud and recognised for introducing such a student centred and research-led approach to teaching."

University of Hull 2017 Teaching Excellence Award Nomination.

Background

I believe that Higher Education is an important opportunity for people to have experiences that encourage self-belief. These experiences should provide evidence of one's ability to overcome a wide range of barriers and succeed in their personal aspirations (Bartimote-Aufflick et al., 2016). My teaching attempts to replicate authentic professional challenges that students might face in 'the real world'. Students are helped to overcome challenges through the application of taught, transferable skills. My commitment to authenticity and level-appropriate challenge won me the first UoH Teaching Excellence Employability Award in 2017. This case study details my efforts as a Programme Director of BSc Zoology to develop a curriculum that emphasises the development of student self-efficacy.

*"**Self**-belief does not necessarily ensure success, but **self**-disbelief assuredly spawns failure." **Albert Bandura - Social Foundations of Thought and Action.***

Reason for Implementing Approach

My research suggests that our students do not recognise and so cannot articulate the whole of their development; especially in less well-defined, transferable skills such as autonomy (Henri et al., 2017). In order to address students' poor self-efficacy development, I have devised a simple learning-cycle framework that highlights key barriers and how I have addressed them (Figure 1). The framework draws from my research and the sources of self-efficacy identified by Bandura (2013). Although

individual innovations occur at the module-level, in this case study they are discussed from the viewpoint of a Programme Director as part of a multi-stage process.

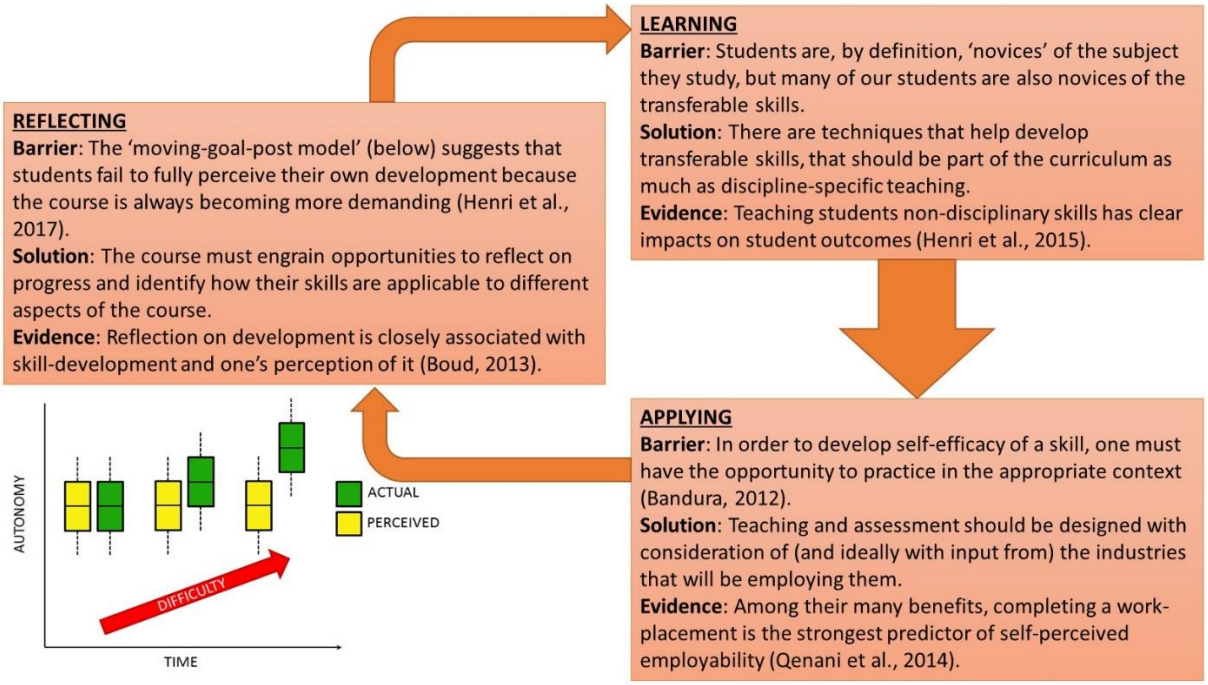

Figure 1: Learning cycle of self-efficacy, including the 'Moving goal-post model' visualisation from Henri, et al. (2017).

Learning

In my experience, students do not underperform on our courses because of insufficient understanding of the material. In their annual reflections, my tutees almost always highlight the need to develop their non-discipline specific skills, which highlights low self-efficacy. From a graduate-perspective, the top-four most requested skills by employers are team-work, communication, independence and critical-thinking (CBI, 2009). It is my belief that Higher Education degrees should directly teach proven methods to promote skills development, a belief that I have implemented within our curriculum with evidenced success.

"It is surprising how little of our students' education is aimed at supporting them in acquiring this skill [time-management]… The development of an evidence-based tutorial training system for self-regulation would be a fantastic outcome with clear potential for significant impact."

Prof Frank van Veen reference (University of Exeter) *SRHE grant aimed at developing understanding of student barriers to effective time-management.*

As part of my role as Director of Student Experience, it has been my job to design Academic Support Tutor materials for biology students. I created an initial series based on widely-available time-management guides, focusing on applicability to students (Kruse, 2015). Student feedback has highlighted that these techniques had not been taught anywhere else and actively encouraged learning ownership. The materials are available to other subject areas to support tutors across the institution.

"Just started using your organisation spreadsheet and its incredibly useful thank you"

Student after my time-management lecture for foundation year bioscientists.

"I think this is really good and useful for our students. I'll certainly try it out in my first AST session."

Dr Mossy Kelly Director of Student Experience for the School of Maths and Physical Sciences UoH.

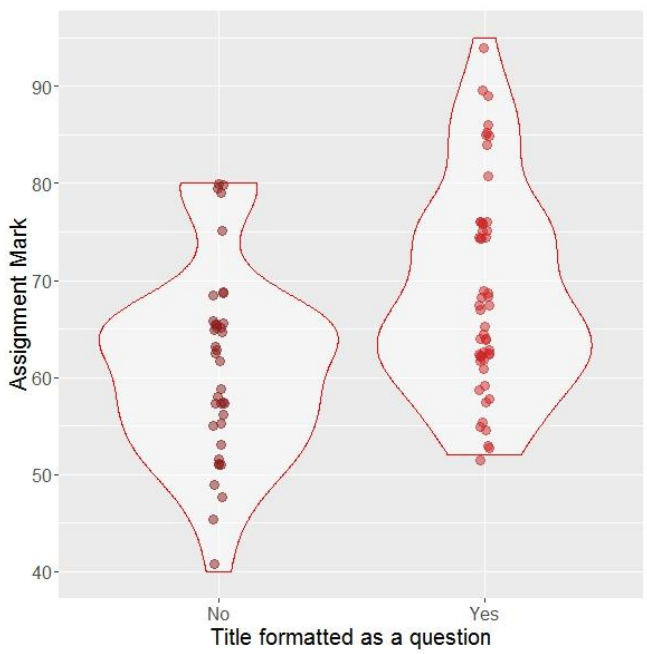

Figure 2: Violin plot of assignment grades for students who did and did not use the 'inquisitive approach', indicated by the presence of a question in the title. Data are from two cohorts in 2015 and 2016 and solidify the findings of the original paper.

Only ~2/3 of UK graduates (lower than the global average) were capable of exhibiting criticality during the most recent literacy skills survey (OECD, 2013). Suggesting that higher education may not be developing graduate criticality as effectively as it can. I designed 'inquisitive-approach' tutorials for my Behavioural Ecology students, training them to frame the assignment as a question that needs answering. Students who used the approach were more likely to obtain a 1st, which requires the exhibition of critical thinking (44% vs. 22%) (Figure 2), and scored an average of 7% higher than those who did not use the technique ($X^2_1 = 4.62$, P= 0.03) (Henri et al., 2015).

These innovations highlight the spare capacity for improving transferable skills within the degree. They also lend credence to the idea that skills should not be separated from disciplinary content.

Applying

Learning for self-efficacy must be authentic and challenging, but not overcome the student's capability (Bandura, 2012). My teaching starts with the key barrier to the learning outcome, which informs what support is required for students to feel capable of overcoming that barrier themselves. For students transitioning into HE, a core barrier to engagement is self-identification as a university student (Briggs et al., 2012). Our biosciences foundation year (level 3) students feel their lack of scientific background keenly. I have redesigned a core biology foundation module where groups undertake an independent biological research project; a task that for many institutions is not undertaken until the final UG year. The module carefully introduces the student-led aspects of the research project and each stage is paired with a tutorial in which groups work with a research mentor. This careful scaffolding ensures students are not overwhelmed (Figure 3), develops their identity as scientists, and promotes self-efficacy in the skills needed for their UG degree. The group-aspect of the module provides important academic support at early stages, and ensures a collective self-efficacy that is less likely to be overwhelmed (Figure 3).

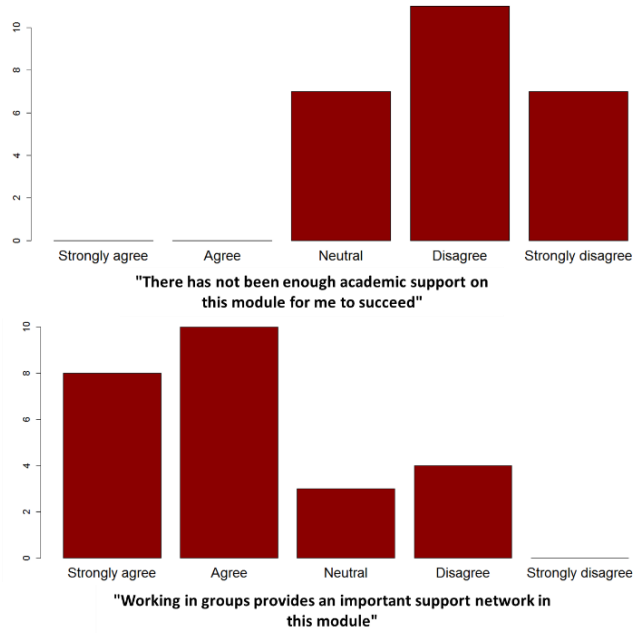

Figure 3: Responses of 27 students who completed the Group Research Project module in 2017 to two questions about the support and group work on the module.

> "It was good that we had free reign of the whole project, which again allowed the development of vital skills for my degree"
>
> *"Has made me feel more confident about first year… I've made friends"*
>
> ***Students 2017***

Final year undergraduates need experiences that will develop their self-efficacy for the next stage of their careers, employment. While work-placements traditionally fill this role, they are difficult to organise and integrate with disciplinary content (Crebert et al., 2004). In my 'Practical Conservation' module, I designed a capstone experience that requires students to organise their own volunteering. Importantly, students are introduced to potential organisations during a series of fieldtrips earlier in

the year (or they can proceed with a contact they have developed themselves). The module ends with a presentation to their chosen organisation, role-playing as a consultant providing recommendations for the future. 100% of the students surveyed in the last two years have agreed that the module provides opportunities to develop key employability skills found nowhere else in the programme. Industry partners highlight how beneficial module authenticity is for future employability.

"Innovative, real-world assessment strategy including a blog and paired presentation, with students able to pursue their own interests. High academic achievement indicative of very good engagement."

2016 Biology and Zoology BSc External Examiner

"This was my favourite module. The practical experience gained was invaluable and enjoyable. This introduced me to conservation work that I will more than likely continue for pleasure.

2017 Student

"The competitive nature of conservation means applicants without voluntary, hands on experience simply won't make it to interview… if this experience can be offered during teaching-time it will be invaluable to those students in the future."

Regional Manager of Yorkshire Wildlife Trust

Reflecting

Reflection is a core aspect of learning, and particularly so for skills development (Boud et al., 2013). However, in my experience compulsory reflections often result in reduced student satisfaction. Formative assessment provides an important opportunity to reflect, but engagement is limited if students do not perceive its benefit or do not use the feedback (Boud & Falchikov, 2007). In my Current Biology module, I designed formative draft submissions that focus on specific aspects of a final assignment (so they do not increase student or staff assessment burden). Drafts are paired with summative self-reflections on skills development and how to improve. Student reviews of the module rarely complain about the reflections, which are instead seen as an integral aspect of 'doing better'. 94% of students surveyed in the last two module cohorts agreed that they had opportunities for personal development and that feedback was useful.

"Innovative assessment strategy that requires compulsory formative coursework to be completed prior to related summative tasks as well as submission of written reflections on feedback received

and how this is used. Detailed track-changes style formative feedback is provided by staff, with the written reflections helping to ensure that this feedback is read and used. The effectiveness of the approach is indicated by the 2-21% increase in marks between the formative and first summative assessment tasks. "

2016 Biology and Zoology BSc External Examiner

Wider impact

Many academics limit engagement with contemporary teaching methods because they lack pedagogic self-efficacy (Brownell & Tanner, 2012). In August 2017, I started the 'Assessment Therapy' programme to support lecturers in their teaching-development. Seven of the 8 bioscience lecturers that I supported through the assessment therapy sessions redesigned their modules. As a result over-assessment has been reduced (which had been highlighted by both external examiners), academics spent less time marking (~80hrs), and a whole cohort of students were the beneficiaries of change (207 students across 11 separate modules). The most common positive comment from participants was that they felt reassured in my support of their solutions, which benefitted their self-efficacy.

"Dom has been extremely helpful and instructive in helping me formulate my new module, bringing valuable experience and insight on module structure, practical design and assessment strategies."

Dr James Gilbert – Lecturer in Behavioural Ecology

"Dr Henri was extremely helpful in identifying which components of assessments could be dropped from my second year module, with the aim to improve student performance, learning and experience, as well as saving staff time and reducing workload."

Dr Isabella Capellini – Senior Lecturer in Evolutionary Biology

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Reflections

Variation in student self-efficacy makes it difficult to ensure that everyone is sufficiently challenged and that no-one is over-whelmed. This issue drives my current pedagogic research, as I attempt to understand how self-efficacy alters response to student-led teaching methodologies. For example, low self-efficacy students are more likely to only engage with formative assignments when there is a clear link to improving their own grade (manuscript in development). It is my hope to find keystone

learning experiences that optimally evidence one's self-belief. This understanding will help students develop resilience through positive self-efficacy without negatively impacting their wellbeing.

"Dominic Henri is an excellent teacher. His practice is grounded in educational theory, personal experience and an innate understanding of the needs of his students (and colleagues). He genuinely cares not just that his students become successful biologists, but that they understand that they are successful biologists and have the confidence to say so."

Professor Graham Scott, Associate Dean (Education) University of Hull.

Dissemination

Published papers

Henri, D.C., Morrell, L.J., & Scott, G.W. (2017) Student perceptions of their autonomy at University. **Higher Education**

Henri, D., Morrell, L., & Scott, G. (2015). Ask a clearer question, get a better answer. **F1000Research**, 4.

Conference presentations

Enhancing Student Learning Through Innovative Scholarship (July 2017) Transitioning pre-certificate students to autonomous learning: Independence through group work [15 min talk]

Society of Experimental Biology Enhancing Biology Education (July, 2017) Student Perceptions of their autonomy at University and other stories [30 min talk]

Society of Experimental Biology Enhancing Biology Education (July, 2016) Ask a Clearer Question, Get a Better Answer: Critical Thinking & Inquisitiveness AND The role of Higher education in developing student autonomy [two posters].

Higher Education Academy 'Inspire to succeed: Transforming teaching and learning in STEM' (Jan, 2016). Student perceptions of learner autonomy in a school of biological sciences [30 min talk] AND Ask a Clearer Question, Get a Better Answer: Critical Thinking & Inquisitiveness [poster].

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Henri, D., Morrell, L. & Scott, G. (2015) Ask a clearer question, get a better answer. *F1000Research*, 4.

Henri, D., Morrell, L. & Scott, G. (2017) Student perceptions of their autonomy at University. *Higher Education*, 1-10.

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