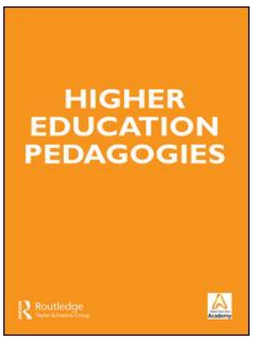

Routledge
Taylor & Francis Group

Higher Education Pedagogies

ISSN: (Print) 2375-2696 (Online) Journal homepage: https://www.tandfonline.com/loi/rhep20

The fall and rise of experiential construction and engineering education: decoupling and recoupling practice and theory

Alan Mark Forster, Nick Pilcher, Stuart Tennant, Mike Murray, Nigel Craig & Alex Copping

To cite this article: Alan Mark Forster, Nick Pilcher, Stuart Tennant, Mike Murray, Nigel Craig & Alex Copping (2017) The fall and rise of experiential construction and engineering education: decoupling and recoupling practice and theory, Higher Education Pedagogies, 2:1, 79-100, DOI: 10.1080/23752696.2017.1338530

To link to this article: https://doi.org/10.1080/23752696.2017.1338530

Published online: 12 Jul 2017.

HIGHER EDUCATION PEDAGOGIES, 2017
VOL. 2, NO. 1, 79–100
https://doi.org/10.1080/23752696.2017.1338530

The fall and rise of experiential construction and engineering education: decoupling and recoupling practice and theory

Alan Mark Forster[a], Nick Pilcher[b], Stuart Tennant[c], Mike Murray[d], Nigel Craig[e] and Alex Copping[f]

[a]Energy, Geoscience, Infrastructure & Society, Heriot-Watt University, Edinburgh, UK; [b]The Business School, Edinburgh Napier University, Edinburgh, UK; [c]School of Engineering and Computing, University of the West of Scotland, Paisley, UK; [d]Department of Civil and Environmental Engineering, University of Strathclyde, Glasgow, UK; [e]School of Engineering and the Built Environment, Glasgow Caledonian University, Glasgow, UK; [f]Department of Architecture and Civil Engineering, University of Bath, Bath, UK

ABSTRACT

From the mid-20th C., construction and engineering pedagogy and curricula have moved from long-held traditional experiential apprenticeship approaches to one ostensibly decoupling practice and theory. This paper traces this decoupling and explores modern-day opportunities and challenges for recoupling university education with industry practice. Within this context the UK Government funds Graduate Level Apprenticeships (GLA) and introduces the Teaching Excellence Framework (TEF), arguably signalling a desire to recouple. Nevertheless, many challenges from following previous UK Government policy prioritising research remain, particularly for post-1992 institutions. Arguably, Higher Education Institutions (HEI's) are at a pedagogical crossroads, considering whether to choose REF-ville, TEF-ville, and/or Apprentice Township. Do HEI's continue their increasingly decontextualized theoretical approach, or re-embrace construction and engineering education's experiential roots? We present and discuss opportunities and challenges currently facing HEI's, aiming to help inform decisions regarding recoupling theory and practice in construction and engineering teaching and learning, but potentially also other fields.

ARTICLE HISTORY
Received 1 December 2016
Revised 1 May 2017
Accepted 14 May 2017

KEYWORDS
Construction and engineering education; Research Excellence Framework; Teaching Excellence Framework; Graduate Level Apprenticeship

1. Introduction

Until relatively recently, the tradition of master craftsman ascending to complete project oversight (lead professional) was widely-accepted practice (Snell, 1996). The system of neophytes learning through experiential and ostensibly rigorous professional apprenticeship enabled continuity of key real-world competencies. Such competencies and schooling in construction and engineering were acquired onsite, without any summative assessment *per se*. Industry practitioners were considered 'competent' after sufficient time in practice (Thompson, 1968). Following 'apprenticeship', practitioners could gain professional body

CONTACT Alan Mark Forster a.m.forster@hw.ac.uk

chartership, and professional institutions had confidence they had 'served their time' and acquired prerequisite competencies and skills.

Yet, after decades of Government intervention and shifts in public perception (Williams, 2013), the pedagogical and curricular link between construction and engineering industry theory and practice is becoming increasingly, and contestably (e.g. Royal Academy of Engineering, 2014) decoupled. Those acquiescent with decoupling theory from practice typically adopt a conceptual distinction between education (liberal perspective) and training (vocational perspective) (Williams, 2005). The liberal perspective values scientific theory's contribution in the pursuit of knowledge, articulating higher education (HE) learning experience's core aim as holistic study avoiding narrow specialisation (Carr, 2009). Here, Higher Education (HE) *educates* rather than *trains* students in specific technical disciplines, in an interpretation largely reflecting ancient universities' preference for liberal curricula and absence of science and technology (Roodhouse, 2007).

Vocational disciplines arguably require alternative pedagogies for employability (see Pegg, Waldock, Hendy-Isaac & Lawton, 2012). Construction (Tennant, Forster, Murray & Pilcher, 2015), and by extension engineering education, is context laden (MacLeod, 2010) and as The Engineering Council (2014, p. 3) advocates, 'all students deserve an engineering education that is world-class and that develops industry-relevant skills'. Indeed, increasingly, academics and industrialists oppose decoupling; the growing disquiet raised by Barr (2008) indicates wider anxiety, 'in due course, civil engineering degrees will be taught in many universities by a team of academics without much industrial experience, which may not prove good for the profession'. The growing popularity of research focused HE appointments has not gone unnoticed. As the Royal Academy of Engineering (RAE), (2014, p. 21) state; 'fewer lecturers in UK universities will have significant industrial experience.' This change contrasts starkly with the industry pioneers of vocational education where private industrial investment founded civic colleges pre-dating the establishment of vocationally oriented 'red brick universities'.

Although justifiably, both sets of ideals can coexist (Tennant et al., 2015), since 1945, and particularly over the past three decades, HEI's have become 'big business', driven by market forces and motivated by performance and enterprise (Fayolle & Redford, 2014). The focus on research excellence has arguably compounded the decoupling practice and theory. Yet, potentially challenging this is the recently published Teaching Excellence Framework (TEF) White Paper (BIS, 2016a), which arguably repositions teaching excellence centre stage and may present academia and industry stakeholders with opportunities to renegotiate and reinvigorate their prior co-determinist relationship. Although 'Teaching Excellence' is not new (See Enhanced Led Institutional Review ELIR (QAA, 2016)); its express measurement akin to the Research Excellence Framework (REF) is. Further, the introduction of Graduate Level Apprenticeships (GLA) creates a Triumvirate of HE, Industry and Professional Bodies (awarding accredited status). Although it is possible this simply represents a shift in policy focus, we argue that both TEF and GLA signal UK Government's recognition of a pedagogical need to recouple HE with industry, and that previous emphasis on research in many cases encouraged decoupling. Albeit many high profile reports (Dearing, 1997; Higher Education Funding Council for England, 2007; Confederation of British Industry and the National Union of Students, 2011; Wilson, 2012) have called for greater collaborative relations between academia-industry in aiding the student learning experience and subsequent transition to graduate employment.

Furthermore, 'research consistently shows that assessment drives student effort, learning and achievement' (Ball et al., 2012, p. 14) and there has been a growing call from students (Collins & Davies, 2009) for faculty to use real-world examples in their programme delivery. Through the provision of authentic and real-world learning assessment (Evans, Muijs, & Tomlinson, 2015) that 'mirror real-life situations' (Kreber, 2013, p. 19), faculty will be able to substantiate recent calls for high-impact pedagogies to enhance student achievement (Evans et al., 2015).

Today, many HEI's, and especially post 1992 universities, find themselves at a pedagogical crossroads. Future strategic direction is influenced by three main parameters of modern academia; namely, the Research Excellence Framework (REF); the Teaching Excellence Framework (TEF); and the Graduate Level Apprenticeship (GLA). Decisions to recalibrate delivery of academic practice in one or any combination of these three areas could enable greater financial diversity and provide access to additional funding streams. Indeed, many institutions could (and do) aspire to simultaneously achieve success in REF, TEF and GLA. Yet, it is well recognised that certain institutions principally focus on REF (i.e. Russell Group institutions) whereas other HEI's, most notably post 1992 institutions clearly struggle to succeed. However, arguably, post 1992's can potentially attain competitive advantage by focusing on TEF and GLA's given their strong traditions of contextualised teaching and learning, and their relatively high proportion of industrially experienced academic staff base. A danger is though, that redirecting resources towards any combination or all three 'funding stream' represents a potential 'opportunity cost' due to the nature of academic appointments (i.e. Teaching; Senior; or Professorial Fellow with significant industrial experience versus research active Assistant; Associate; and full Professors (formerly Lecturer; Senior Lecturer; Reader, and Professor)) and their notional best fit for academic duties. Whilst in this paper the focus is on construction and engineering education, such challenges and considerations arguably apply in other professional fields such as Medicine, Accountancy and Law where HEI's need to decide how and to what extent they can or should follow UK government policy.

This polemic paper charts the fall and rise of construction and engineering education through a vocational lens, exploring the challenges and opportunities currently facing the HE sector. Following this introduction, the historical background to construction and engineering education is outlined. Thereafter, key staging posts impacting upon the fragmentation of theory from practice are charted. The value of recoupling theory with practice is examined in section four. Section five outlines and discusses current UK government initiatives designed to recouple theory and practice, focusing on challenges and opportunities currently facing HEI's. In conclusion, the value of reinvigorating theory informed construction and engineering practice is reinforced and validated as a unique 'selling point' enabling competitive advantage in an increasingly commercial, crowded and competitive higher education sector.

2. Background

Whilst the eminence of the artisan builder (Bowyer, 1993, pp. 221–222), or 'builder-in-chief' pivotal to the design and delivery of a project has arguably been lost in antiquity, their traditional abilities, competencies and education were firmly rooted in craft training and reflected a profound knowledge of organisation, process, materials and technologies.

Significantly, the process of becoming educated and competent in the abilities expected of a 'Builder in chief' has an extremely long history. Indeed, the Roman author, Vitruvius cited in Morgan (1960, p. 5) highlighted that:

> the 'Builder in Chief' should be equipped with knowledge and understanding of many different branches of learning, because he is required to judge the quality of artistic work. Those … who have a thorough knowledge of both practice and theory are in a position to obtain and wield authority…….. knowledge is the child of practice and theory.

Such philosophical deliberations arguably enlightened the educational system for construction and engineering education, and continued until the formal development of architect and other recognised professions. The fundamental principle that knowledge was 'the child of practice and theory' was rarely questioned. Indeed, few 17th and eighteenth century architects received any formal training, the majority derived from artisan backgrounds, and the transition from apprentice to 'builder in chief' was uncomplicated as competency in the required craft skills and technical abilities was achievable through a 'straightforward' experiential route (Bowyer, 1993).

In engineering, similar practices and norms prevailed. British engineering education was similarly practice-based with experience in the field a priority, and that 'the system of training by apprenticeship had become strongly established, and the pupillage fees provided a powerful vested interest against change……. There seemed little reason to change what had become a demonstrably successful form of organisation and training' (Buchanan, 1985, p. 222). Yet, significantly, nascent interplay between the practical and the theoretical was recognised, as 'British engineers were not entirely lacking in theoretical knowledge before 1850. Close relationships had existed between many leading engineers and the natural philosophers of the eighteenth century' (ibid, p. 219).

Despite emerging links between practice and theory, the time honoured Vitruvian traditions remained the 'pedagogical' custom right up until the mid-nineteenth century, in what could be regarded as an unsupported, individual and somewhat informal 'voluntary dual system'. Snell (1996, p. 318) describes this as the 'system in which industry was responsible for practical training… and colleges and institutes ran more formal academic courses, designed in theory to supplement this'. Whilst it is clearly evident that construction and engineering education should not return to these roots, it is important to acknowledge and reflect upon the traditions of construction and engineering education to inform and advance contemporary interpretation of teaching and learning frameworks.

3. The rise of construction and engineering professional bodies: Decoupling academic theory

Introducing any new order inevitably meets resistance (Machiavelli, 1532), and it is essential to first ensure its value be perceived or championed (cf. Russell & Russell, 2006). The mid-nineteenth century saw 'substantial evidence of an increasingly prominent scientific dimension to British engineering practices…but… an uneasy sense that the development of academic engineering posed a threat to traditional methods of instruction' (Buchanan, 1985, p. 221). Yet, 'perceptions' shifted arguably due to the rise of the Professional Institutions championing requirements for enhanced understanding of theory, and simultaneous endorsement of Professional Bodies by influential individuals.

The newly established Professional Institutions' cited aim was promoting an increasingly structured, classified and codified pedagogical framework to guarantee individuals gaining chartership would possess a solid scientific level of knowledge. The educational route to membership for three professional bodies, The Smeatonian Society of Civil engineers (established 1771), the 'Institution of Civil Engineers' (established 1818) and the 'Chartered Institution of Civil Engineers' (established 1828) was one whereby 'virtually all 'professional' engineers had acquired their skill-set by a process of pupillage in the office of an existing engineer' (Buchanan 1985, pp. 218–219). For example, the 'Smeatonian Society of Civil engineers' aimed for 'the general advancement of mechanical science and more particularly for promoting the acquisition of that species of knowledge which constitutes the profession of a civil engineer' (ICE, 1828). Thus, under the emerging Professional Institutions, chartership remained embedded in time-honoured Vitruvian traditions.

As Engineering Institutions grew in number, so did those in construction, architecture and surveying. The 'Builders Society' (established 1834) became the 'Institute of Builders' in 1884. In Architecture, the Institute of British Architects (established 1834) subsequently attained Royal Chartership in 1837 to become the 'Royal Institute of British Architects' (RIBA). In surveying, the Surveyors club (established 1792) became the 'Institution of Surveyors' in 1868 and attained Royal Chartership in 1881 to become the 'Royal Institution of Chartered Surveyors' (RICS). Although unique in discipline, these institutions had many parallels in curricular and pedagogical underpinnings of the professionalisation concept. For example, 'the RICS structure and rules were modelled on Civil engineers' (Thompson, 1968, p. 174). Furthermore, full membership criteria often reflected similar institutional rules to those established for members of Civil Engineers Institutions.

Corresponding with the rise of Professional Institutions, prominent construction and engineering practitioners championed scientific theoretical knowledge. For example, Sir John Fowler in the 1860s and 1870s championed theory given 'an anxious perception of the new demands being made on the engineering profession, requiring ever-greater specialist expertise and theoretical competence' (Buchanan, 1985, p. 224). Yet, coupling practice with theory was still considered key. Colburn, editor of 'The Engineer' believed 'the knowledge which the youth, intended for an engineer, should acquire, would, we may believe be best imparted by an engineer' (ibid.). Indeed, the *zeitgeist* was to maintain the *status quo*: 'it is not the custom in England to consider theoretical knowledge as absolutely essential' (ibid.). Yet, with ever-greater levels of professionalism emerging, the industry relationship between industrial practice and scientific theory was wavering.

One highly influential individual was William John Macquorn Rankine (1820–1872). Rankine's worldview was that 'our defect is the want of a good knowledge of the theories affecting our practice' (cited in Buchanan, 1985, p. 226) and campaigned vigorously and ultimately successfully to have engineering studies recognised as a full university degree (Buchanan, 1985). Significantly, another prominent individual, William Allen Sturge (1850–1919) adjusted his stance to recognise the importance of theory. This adjustment was a result of many key individuals and scientific engineers arguing that, 'however valuable practical experience may be, it was desirable to back it up with some theoretical competence' (Buchanan, 1985, p. 225). Thus, there emerged a wider industrial and societal acceptance of the pivotal role of theory in supporting practice. This need was catalysed by public perceptions of 'unscrupulous' engineers (Bowyer, 1993) and catastrophic engineering failures

such as the collapse of Robert Stephenson's Dee Bridge in 1847 (Buchanan, 1985) and Tay Rail Bridge in 1879 (Ferguson & Chrimes, 2011).

Accordingly, education institutions were founded to provide supplementary theoretical knowledge and greater collective professional recognition. Kealey (2008) notes that between the 1820s and 1840s in Britain, workers were trained as apprentices on the job or in the 700 or so private mechanics institutes. This continued in the last third of the nineteenth century where both London and the larger UK cities developed university courses to help deliver theoretical knowledge. For a considerable time, universities and professional bodies complemented each other and were in relative equilibrium. Both acknowledged the importance of scientific theory and aspired to achieve it whilst remaining coupled with the highly contextualized nature of the workplace. The rise of the 'indentured' apprentice complementing the status of the professions corresponded with increasing requirements to support experiential learning with formalised qualifications. Qualifications achieved were associated with the attainment of a minimum of 5 years study in architect offices or engineering practice (Bowyer, 1993) and thus reflected strong pedagogical coupling between theory and practice. Early examples, and now distinguished HE establishments that facilitated this, include; the School of Arts of Edinburgh (established 1821) [now Heriot-Watt University], and the Royal College of Science and Technology, Glasgow (established 1887) [now The University of Strathclyde].

Regarding individuals teaching at universities, many appointments exhibited considerable professional practice, meaning teaching and learning remained connected to the real-world, and kept 'theoretical knowledge closely tuned to the practical requirements of engineering' (Buchanan, 1985, p. 230) and surveying (Thompson, 1968). Educational links with construction and engineering practice also included funding. As Kealey (2008) notes, it was ultimately industry that met the costs, as the fees or loans artisans received to fund their study resulted in higher wages. Thus, the perceived equilibrium of experience and theory still endured: supplementary theory was integrated with the voluntary dual system (Snell, 1996), and the notion that university education may shorten pupillage, 'but not replace it' (Buchanan, 1985, p. 229) remained the norm. Thus, pedagogical and curricular approaches to theory and practice remained tightly coupled throughout the first half of the twentieth century (Ferguson, 1992).

However, a shift in parity between UK HEI's and professional bodies arguably materialised from the 1950s onwards. Three primary routes to engineering professionalism subsequently evolved, each regarded equivalent: (i) university vocational degree, (ii) full-time tuition at a recognised school of instruction, (iii) approved practical training coupled with evening classes or postal tuition (Thompson, 1968, p. 222). Whilst this educational framework, symbiotic of the 1950's, transpired to be short-lived, it signalled the start of significant transformation in UK HE, and the crossing of the Rubicon regarding decoupling theory and practice.

In 1963, the Robbins report (Robbins, 1963) recommended significant changes to the UK HE system including widening access and greater diversification among the student group. In response, in the 1960s and 1970s, technical colleges and Polytechnics (now in many cases post 1992 universities) vastly expanded surveying courses which 'were accredited by a joint validation and accreditation exercise of the Council for National Academic Awards (CNAA validation) and the RICS (accreditation)' (Plimmer, 2003, p. 3). In the UK, HEI's could independently of industry, undertake the initiative in preparing graduates for industry.

Thus, there was no requirement or incentive for undergraduates to gain competencies experientially pre-graduation. The curricula were so constituted that theoretical content and composition was accredited by the Professional Institutions. The rise of the graduate construction and engineering professional in the 1950's and 1960's increasingly decoupled theory from practice, and undermined the traditional dual voluntary apprenticeship. Construction and engineering theory could now be taught and studied independently from practice, and instruction was increasingly delivered by a new 'class' of lecturer; namely, the Career Academic. The Career Academic may be described as 'a research-active university staff member with very limited professional or practical experience of working in the industry in which they are a scholar' (Tennant et al., 2015, p. 7). Such individuals came with the promise of being able to publish high impact journal papers and win research grants. Over the past three decades, UK government focus on the REF (formerly RAE in 1986) catalysed their recruitment in a world of teaching and learning where theory is decoupled from practice.

4. Considerations for recoupling

We stress here our argument is for progressive and meaningful recoupling, not simply returning to the traditions and pedagogy of the artisan builder and a curricula based wholly on practice, nor neglecting the relevance of scientific theory. Rather, we stress the need for a real-world teaching and learning agenda embracing parity of theory and practice to directly address the educational aspirations and needs of both students and industry. Regarding criticisms of the decoupled status quo, one is that today graduates are leaving with research and development skill-sets more suited to university rather than industry careers (Pons, 2016). Such arguments have been made for some time, Aparicio and Ruiz-Teran (2007, p. 343) noted that in UK HE, Career Academics, given their research focus, would 'instruct their students as though they were to become academics, or scientists, rather than engineers.' Concomitantly, it is also arguable that purely *practical* experience is pedagogically insufficient to instil the competencies and education required of twenty-first century design practices or technologies (Tennant et al., 2015). Operatives solely educated via site practice could be criticised for their narrow perspective and inability to contextualise influences, impacts and consequences beyond the confines of the construction and engineering process that formed their education (Tennant et al., 2015; Craig, Tennant, Murray, Forster & Pilcher, 2016). A decoupled system only educates individuals in either theory or practice, whereas both are needed to support a real-world teaching and learning agenda fit for purpose in the twenty-first century. The concept of recoupling theory with practice and 'bringing the outside world in' (Evans et al., 2015) is arguably something that would apply across other professions.

Further, it is arguable that today professional competencies are established in both core and mandatory practice areas (see Engineering Professors' Council, 2016; RICS, 2014; CIOB, 2016; ICE, 2015). These competencies are formed through combining the 'hard' and 'soft' skill-sets required for effective practice. The competent chartered construction professional must clearly be capable of demonstrating accurate reasoned advice to clients. Current chartership schemes exhibit a certain degree of commonality. Most conform to a system of evidence-based criteria addressing; i) Knowledge and understanding ii) Application of knowledge and understanding, iii) Reasoned advice and depth of knowledge and, (iv)

Professional commitment. The current full time HE system, in principle equips learners with level 1 knowledge (RICS, 2014; CIOB, 2016). The extent to which this knowledge and understanding is contextualised or has 'real-world' meaning, notwithstanding the requirement for curriculum design relevant beyond HE (Evans et al., 2015), will vary dependent upon curricular content and academics delivering the subject (Tennant et al., 2015; Pilcher, Forster, Tennant, Murray & Craig., 2017).

Clearly, the argument exists that industry, not university, is the appropriate place to contextualise this learning. Nevertheless, universities wish to recruit research 'ready' academics well placed to publish journal papers and write research grants, yet all too often have difficulty contextualising teaching and learning (Tennant et al., 2015). Arguably, such contextualisation can only come from individuals with a solid grounding in theory *and* who have access to practical experience and meaningful learning gained from the workplace. Given the growing number of generic construction and engineering programmes now available, the extent of disconnect between HEI's and industry may be more acute than previously thought. Bolden, Connor, Duquemin, Hirsh and Petrov (2009) proposed a pictorial model to describe a three stream (teaching, research, business engagement) approach to HE-employer engagement and argued that each stream should have equal value. In addition to explicit knowledge, Bolden et al. (2009) noted the importance of character attributes such as passion, trust, and value alignment as key contributors to successful collaboration. Regarding the benefits of recoupling, it should be remembered that construction (Tennant et al., 2015) and engineering is context laden (MacLeod, 2010), and for the student experience to be meaningful, multiple opportunities to engage with industry are paramount and precious.

The pedagogical benefits of a real-world agenda are twofold; students build cognitive bridges between theory and practice, the engineering faculties and departments build relational bridges between academia and industry. Building academic–industry bridges is however, not straightforward. It requires considerable leadership, project management, personal commitment, organizational dexterity and indomitable spirit (with no guarantee of successful outcomes). It also requires a common language and disposition to help forge trusting relations. These are increasingly rare skill-sets. Today, many engineering faculties do not have this in-house proficiency and this 'loss' is arguably the result of the employment of Career Academics who do not have the connections with industry (Tennant et al., 2015). The employment of those with industry experience will, however, be a key benefit and essential aspect to recoupling the system. Such individuals can arguably advance academic-industry collaboration and contextualise teaching for students, reflecting the needs of construction and engineering practice. They may also bring highly valued programme legitimacy, credibility and external visibility due to their well-established profile within the professional communities. Indeed, Durning (2004) has argued even without such industry experience, academics and practitioners should become one community of practice, rather than two tribes. Although key questions here would be who leads pedagogical direction, and how communication and collaboration is forged.

Another recoupling benefit is that by gaining both theoretical and practical attributes and knowledge, students gain core transferable skills sought by industry employers, and closely aligned with professional institution core competencies. Further, broader graduate attributes align with mandatory competencies such as communication, presentation and computer literacy and should permit greater transferability. How effectively these skills are delivered at university level is critical in complementing employee training organised by

the company. The concept of the industry ready graduate, articulate in the language of the profession, technically competent and skilled in progressive areas of practice (i.e Building Information Modelling (BIM) and Low carbon design) is anticipated by professions and arguably considered an educational baseline given Professional Institutions accredit programmes. Recoupling theory and practice will help ensure students have employability attributes and are industry ready. Many criticisms of the current decoupled system can be made, and many reasons for recoupling theory and practice found. Understandably, an awareness of this is evidenced in recent UK government policy both by introducing a Teaching Excellence Framework (TEF), and also Graduate Level Apprenticeships (GLA).

5. Navigating the Pedagogical Crossroad: REF, TEF and Graduate Level Apprenticeships (GLA)

As previously stated, HEI's currently find themselves at a pedagogical crossroads. Neoliberal economic thought, now at the heart of contemporary HE leadership and management thinking, has at this point in time facilitated an exceptional level of competitiveness (Peel, 2006) and homogeneity among HEI's in the UK, and arguably creates heightened anxieties for universities regarding strategic direction, funding, student recruitment and institutional branding (Williams, 2013). Over the past four decades, university research activity and the research assessment model (RAE and REF) has ostensibly dominated academic deliberation (Hénard & Roseveare, 2012; Russell & Russell, 2006). The reach and impact of research performance is considerable. Less prestigious universities and most notably post-1992 HE establishments, notwithstanding their academic origin, rich heritage and custom being firmly embedded in teaching construction and engineering theory and practice have sought to become 'pale imitations of Russell Group Universities' (McNay, 2014). However, recent UK Government interventions are arguably beginning to challenge the primacy of research outcomes in HE. Navigating the twenty-first century HE pedagogical crossroad presents alternative markets and new opportunities to recouple construction and engineering theory with practice, see Figure 1: Pedagogical Crossroads.

To explore and make sense of the immediate and imminent pedagogical and curricular implications of the challenges facing HEI's, this section draws upon three vignettes of potential HE decision-making; first, the Research Excellence Framework (REF) and its dominant position within HE policy and executive decision-making; second, the introduction of the Teaching Excellence Framework (TEF) and its potential impact on current HE strategy and; third, the Graduate Level Apprenticeship (GLA) and increasing opportunities for widening participation, increasing student participation and diversity and enabling social mobility.

A constant thread running through these vignettes is the prospect and challenge of recoupling theory with practice in construction and engineering education and their implications for teaching and learning. Whilst it is convenient to draw upon the metaphor of a pedagogical crossroad for ease and clarity, the reality of HEI decision-making and future strategic trajectory is undoubtedly complex and layered. However, anecdotal evidence is beginning to emerge that many HEI's will assess, review and respond to fluid market conditions (Teece, 2016) and may attempt to reposition their corporate income, image, reputation and overall 'commercialization' strategy around a distinctive REF/TEF or an alternatively GLA delivery model. This will undoubtedly have notable consequences for recruitment policies within the HE sector.

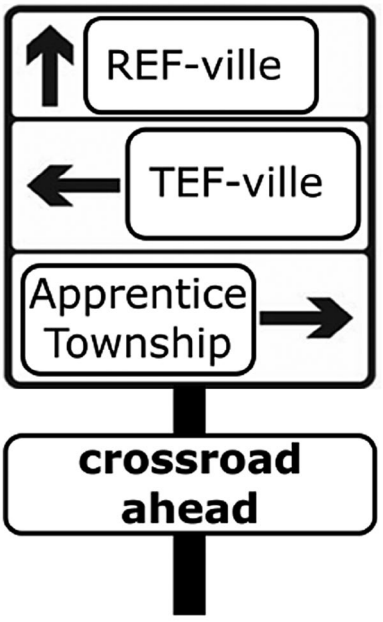

Figure 1. Pedagogical crossroads.

5.1. Vignette 1: REF-ville: the Research Excellence Framework

Since the introduction of the Research Assessment Exercise (RAE) in 1986 (Peel, 2006) and its most recent incarnation, the Research Excellence Framework (REF), research activity and performance has attained a dominant position and built an enduring prestige. Whilst the impact on a liberal orientated curriculum, which forms the mainstay of many elite, research intensive universities may be slight, the same cannot be assumed for vocational courses such as the engineering disciplines and construction education. At the heart of HEI policy and driving decision-making is the ongoing commercialisation of the HE sector. Williams (2013) defines university commercialism as a commercialism that can be on the one hand profit-focused, but on the other hand, focused on gaining income to supplement another part of the institution. Over the past three decades, participation in RAE and REF has provided universities with potential access to a parallel income stream; namely, teaching and research funding (Macfarlane, 2011). Consequently, access to the block research grant thought to exceed £1 billion per year (Matthews, 2016) looms large over the vast majority of UK HEI's policy-making.

The financial (block grant funding) and non-financial (prestige) rewards associated with research performance is significant (HEPI, 2016). Potentially lucrative outcomes have resulted in disproportionately passionate academic discussions and sizeable investment in institutional research strategy. HEI's, especially research intensive universities, typically members of the Russell Group remain unlikely to dismantle the organizational structures that support a significant income stream. Creating context, approximately 80% of all Research Council funding is attained by 20% of universities; 'predominantly' UK Russell group institutions (Guardian, 2014). Indeed, universities successful in attracting research block funding via REF are also frequently consulted on proposed design changes

and viewpoints aimed at refining the burgeoning REF administrative system (HEPI, 2016). It would be folly to suggest HEI's with a successful track record in securing REF funding will review the subject matter with an empty head. Given that all HEI's currently find themselves at a pedagogical crossroad, successful institutions when invited to comment and recommend adjustment in implementation and performance metrics are unlikely to change tact. Conversely, any suggested amendments to 'participation rules' are in all likelihood designed to reinforce their current status and mitigate any external threat to their dominant position within an increasingly global and competitive HEI marketplace.

Yet, 'participation rules' are only one barrier to enhanced research performance. The direct and indirect cost of institutional infrastructure necessary for promoting and enhancing research performance should not be underestimated. The increasing direct cost in terms of staffing, developing expertise and overseeing organizational management in the REF exercise has recently been acknowledged in the Government Green paper (2015), prompting widespread calls for it to 'be made less burdensome and bureaucratic' (HEPI, 2016, p. 34). Whilst the increasing direct cost is both obvious and measurable, the indirect cost is less evident. It is not inconceivable that improved performance in research activity is characteristically offset by a diminution in the quality of teaching: 'as more effort is put into research it is not surprising that teaching has suffered' (HEPI, 2016). However, the research stakes remain disproportionately high and the income and prestige that has been developed and nurtured over many decades is unlikely to be side-lined by the occasional or even recurrent report of poor teaching.

Indeed, early commentaries in the Times Higher Education (THE) hinted at the possibility of elite research universities not participating in TEF (Havergal, 2016), although recent anecdotal evidence suggests most will. Despite uncertainty regarding TEF, the ongoing debate is arguably publicising a commonly held view within HE that 'excellence in research attracts prestige, but excellence in teaching does not' (Blackmore, Blackwell & Edmondsen, 2016, p. 4). Indeed, research excellence impacts on lucrative international student numbers (Graham, 2015) whereas teaching does not and institutional reputation built upon research excellence is unlikely to be eroded in the short to medium-term by non-participation or poor performance in TEF (Blackmore, et al., 2016). In other words, for universities continuing to seek financial rewards and prestige associated with REF and accompanying league tables, decoupling theory from practice, despite its implications for 'real-world' pedagogy and curricula, is a trend that is likely to continue unabated.

For less prestigious universities not necessarily excelling in research activity, the seductiveness of research block grant and enhanced status and prestige is almost omnipresent: 'even teaching-led institutions are strongly influenced by a cultural bias within higher education to value research more highly' (HEPI, 2016, p. 10). Such behaviour hints at the institutionalised and embedded character of REF. For many HEI's, there is arguably an organizational necessity to imitate albeit in sound bites, the language of their research intensive counterparts. Not to do so runs the risk of being labelled a maverick and treated accordingly. However, the introduction of both TEF and GLA's arguably offer 'research-lite' universities an alternative marketplace strategy. Drawing upon the metaphor of a pedagogical crossroads for HEI's in UK (see Figure 1) until now REF-ville has been the sole destination for business savvy, market-led HEI's. However, that is arguably being challenged. Within a crowded and increasingly competitive marketplace, universities can diversify, focus, differentiate and make alternative choices simply because REF is no longer the only

journey's end. This may have the potential to arrest and possibly reverse the decoupling of theory from practice, and, we argue, positively affect teaching and learning.

5.2. Vignette 2: TEF-ville: the Teaching Excellence Framework

The Teaching Excellence Framework (TEF) originated in the UK Government Department for Business Innovation and Skills (BIS, 2015), however its subsequent development and implementation is now overseen by the UK Department of Education. Key documentation charting the motivation, aspiration and adoption of TEF include the initial UK Government green paper (for consultation), *Fulfilling our Potential: Teaching Excellence, Social Mobility and Student Choice* (BIS, 2015), followed by the white paper (setting out policy), *Success as a Knowledge Economy: Teaching Excellence, Social Mobility and Student Choice* (BIS, 2016a). A supplementary technical report to be read in conjunction with the white paper, *Teaching Excellence Framework, Technical Consultation for Year Two* (BIS, 2016b) has also been published. The initial green paper and accompanying policy publication(s) have prompted a new, albeit contested and uncertain landscape within HE whereby the REF's dominance has been questioned:

> 'For too long, teaching has been the poor cousin of research. Skewed incentives have led to a progressive decline in the relative status of teaching as an activity.…Excellent teaching needs to flourish across the sector; lacklustre teaching and unacceptable variability in quality need to be addressed' (BIS, 2016a, pp. 12–13).

Whilst the TEF's stated aims include identifying and promoting excellent teaching; recognising teaching as equal in status to research; and providing students with information on teaching quality to enable choice, critics such as the University and College Union (2016) argue that TEF is an extension of the ongoing commercialisation of HE and have called on the government to withdraw the current proposals. Furthermore, the white paper and the technical document do not explicitly address our call for a debate on recoupling theory and practice, rather, they could be considered to provide a surrogate long range weather forecast for TEF-ville. The technical document notes student experience could benefit from faculty links with professional practice evidenced by 'use of external consultants from business, industry or the professions, work placements or work experience, involvement of staff who teach in research, scholarship or professional practice, and involvement of students in real research projects' (BIS 2016b, p. 15). Responses to the technical document include one from The Engineering Professors' Council (2016) recommending the metrics for measuring the student learning environment could include the 'percentage of staff with relevant industrial/business experience'. This is more explicit than the description presented in the white paper that talks of a quality review visit (a peer review process) checking to see if 'suitable academic staff are involved in teaching' (BIS 2016a, p. 34).

Typically, activities may include industrial placements whereby students can address some of the problems associated with the decoupling through their own participation in industrial work placement. In responding to the technical consultation document (BIS, 2016b) Universities UK (2016, p. 10) recommended that 'consideration should also be given to opportunities for enrichment and co-curricular activities as a holistic university experience'. The Higher Education Academy (HEA 2016a, p. 5) point to the usefulness of Higher Education Achievement Reports (HEAR, 2015) in facilitating learning from 'co-,

or extra-, curricula activities undertaken by students' and called on Government to make this more prominent in the TEF consultation document.

However, the white paper lacks detailed exploration and discussion of pedagogical practice defining teaching excellence. It is arguably reticent to engage in such debate and takes a 'broad view of teaching excellence' and declare that 'it is not the intention of the TEF to constrain or prescribe the form that excellence must take' (BIS, 2016a, p. 43). Specifically, the National Student Survey (NSS) metrics may well be insufficiently refined to allow students in construction and engineering to express precisely *why* they feel their teachers are good teachers (Strang, Bélanger, Manville & Meads, 2016). Such debate has gone on for many years, with numerous prominent reports published by the Higher Education Academy (HEA) (Law, 2011; Cashmore, Cane & Cane, 2013; Gunn & Fisk 2013; Land & Gordon 2015; Graham 2016; Strang et al., 2016)) and the Royal Academy of Engineering (Graham 2012; Lucas, Hanson & Claxton, 2014; Broadbent & McCann (2016a, 2016b) including a recent practical guide (Graham, 2016) *Does teaching advance your academic career?*

The destiny for TEF remains unwritten and it is too early to pass judgement on whether it will support recoupling. To date, discussion has largely ignored whether academics possess sufficient exposure to disciplinary experience to ensure they provide real-world context in the curricula. Evaluating excellence in teaching and learning, particularly as judged through the student lens, will require academics to demonstrate knowledge, understanding and context beyond a threshold pedagogical competence. HE needs more construction and engineering academics with practical industrial insights and stories grounded in everyday practice. A cursory examination of recent academic job vacancies suggests a growing number of teaching fellow vacancies requiring practitioners with substantial industry experience to deliver curricula more reflective of industry practice. However, as noted by the HEA, the journey has just begun and the academic community are invited to help mould and shape the transition to a new era in HE (HEA, 2016b). One way in which lecturers could gain experience to help contextualise learning would be through the reintroduction of previous industrial secondment schemes (Royal Academy of Engineering, 2015). Such schemes allow academics a period of time in industry away from their work in the HEI. Nevertheless, in order to succeed from a teaching and learning perspective, such schemes must be committed to wholeheartedly with this purpose in mind. Otherwise, it is possible that academics may simply use the secondment to gather research data, and thus contextualise their research rather than to gain experience to contextualise their delivery of knowledge and understanding.

Regarding requirements for recoupling, Plimmer (2003, p. 5) cites the RICS agenda for Change task force underlining the importance of having '(i) excellent teaching faculties working closely with practice' (ii) more responsively developing sources to meet the need of the profession, & iii) a curriculum which is highly relevant to professional practice'. Whilst some validity in these areas is noted, insufficient granularity is given to the type of individuals that constitute an 'excellent teaching faculty'. Whilst a primary incentive for TEF adoption is to permit HEI's which achieve key performance targets to raise tuition fees in line with inflation (BIS, 2016a), this has been contested by the House of Lords who recently rejected attempts to link the two (Havergal, 2017). Nevertheless, TEF adoption would also appear to be a perfect opportunity to at the very least arrest decoupling and possibly recouple theory with practice in a construction and engineering context.

At present, TEF scores will be based on existing metrics such as the National Student Survey (NSS). Although it stands to reason that a skilled construction or engineering teacher will be considered excellent if they can deliver contextualised learning, an approach to knowledge and understanding that recouples theory and practice, it can also be argued that lecturers should be able to teach theory, and engage and enthuse students who have no experience of industry and therefore do not know any different. In contrast to teaching naive students, potentially devoid of both engineering content and context, an alternative option for HEI's at the pedagogical crossroads is the Graduate Level Apprenticeship (GLA).

5.3. Vignette 3: Apprentice Township: the Graduate Level Apprenticeship

In March 2015, Level 6 (degree level) and Level 7 (Master's level) Graduate Level Apprenticeships (GLA) were approved (National Apprenticeships service, 2015), giving HEI's the opportunity to engage in delivering these modes of education. The GLA model provides individuals (students) with access to full-time work, degree level education and ultimately the opportunity to attain a professional qualification if the programme of study is accredited (Skills Funding Agency, 2015). To enrol, apprentices must be company employees, and throughout the apprenticeship their study time is split between university and workplace. Although funding arrangements are yet to be clarified by the UK Government, it is increasingly likely universities will be permitted to negotiate their own fees with 'partner' companies.

Whilst engagement details remain imprecise, there is greater clarity regarding funding sources. From April 2017 employers who have a total payroll of more than £3 million will pay a levy of 0.5% of their total payroll (Department for Education, 2016). For organizations exceeding the £3 million payroll threshold this will be a minimum of £15,000. The monetary size of the levy is significant, especially for large national and multi-national companies; for example, it is envisaged HSBC and JP Morgan will pay in excess of £20 million each per annum. In many cases, this tariff on the corporate payroll will be bigger than existing training budgets for all employees training and staff development needs. A central government fund will be ring-fenced to pay for apprenticeships (at all levels) in a form of hypothecated funding (Boyd, 2017). It is expected employers will want to recoup this 'training' levy by employing and enrolling apprentices on GLA programmes of study. It should be noted that all employers (large and SME's) may access the central fund whether they qualify to contribute or not.

There are a series of 'Trailblazer groups' involved in the development of apprenticeship educational standards and assessment plans across discipline sectors (HM Government, 2015). New apprenticeship standards and assessment plans should only be developed if no existing framework or the current framework is up for review. Alternatively, if there is an educational standard (or framework) already approved then other employers can adopt the framework and implement it. Consequently, employers (not necessarily involved in the Trailblazer group) can develop their own programme based on the educational standard / framework and select organisations including Professional Bodies, training providers, HEI's – that they as employers and 'clients' wish to partner with to establish their own bespoke programme. Trailblazer groups comprise at least ten employers, of which at least two should be small employers (less than fifty employees) (HM Government, 2015). In addition to employers, Professional Bodies and specialist training providers may also be involved in

the Trailblazer group. It is interesting to note that despite a diverse membership, the group must be chaired by an employer. This however, is not a new concept. Several prominent academic institutions currently work in collaboration with major companies to deliver tailored / bespoke part-time degree programmes that address bespoke company needs (i.e. Nissan and University of Northumbria; Rolls Royce and the University of Warwick). What is new is direct UK Government sponsorship.

Universities are weighing up their options. In some academic spheres there is doubt regarding whether time spent developing GLA programmes will be a worthwhile investment. One fear is that increases in GLA numbers will 'deepen the existing collapse in part time student numbers' (Morgan, 2017b) which represents 'simply a move of activity into a differently named qualification without any real benefit for individual, the employer, at the heart of it' (Phoenix, as cited in Morgan, 2017b). To some extent it is uncertain as the market for GLA has not been fully tested and may be seen by some HEI's as too risky. Furthermore, to date key development timeframes have been missed and some current UK Government information remains unclear. Crucially this includes future government funding figures. Such delays and uncertainties, combined with inherent commercial risks, arguably lessen the potential attractiveness of the GLA marketplace. Notably, the levels of bureaucracy surrounding GLA has been an issue, and many of the trailblazer standards have been repeatedly rejected (Boyd, 2017).

Setting aside the potential risks and concerns, there is clearly added value for universities to engage and develop GLA programmes. This is borne out by a Universities UK report finding that 'at least 60 universities and other higher education institutions across England [are] currently implementing or planning to implement degree apprenticeships for 2017/18' (as cited in Morgan, 2017a). There are undoubtedly opportunities to strengthen industrial engagement and build new relationships with potential research partners (cf. Anglia Ruskin University (University Vocational Awards Council, 2015)). This may aid in rapidly growing postgraduate numbers in line with current policies, and also create opportunities to recruit more students in line with widening participation and social mobility agendas. HEFCE are currently paving the way for increasing participation by inviting HEI's to bid for a share of £8 million development funding for GLA. In contrast to the block research grant estimated to exceed £1 billion per year (Matthews, 2016), £8 million may arguably be regarded as an introductory tester on the government's part with proposals to expand rapidly so that the funding levels in 2020 are double those of 2010 (Boyd, 2017).

Regarding the feasibility of developing and delivering GLA's, numerous challenges exist. Universities will need to accommodate students who mostly study remotely and off-campus, which may necessitate more flexible delivery models and substantial investment in Information and Communication Technologies (ITC) and online teaching provision. A potential obstacle is the notion that employers will be free to set their own academic standards for entry onto GLA's. These may not be compatible with 'partner' universities. Concomitantly, it is likely a substantial proportion of the entries may be non A-level applicants and therefore accreditation of prior learning may also be a significant requirement of these programmes. This may also require additional academic support and guidance throughout the GLA programmes, thereby increasing delivery costs. Importantly, there is often confusion regarding 'standards'; whereas for employers these 'standards' refer to industry criteria, conversely for universities, 'standards' are interpreted as how they align with a qualifications framework (Boyd, 2017). Nevertheless, despite the challenges of 'turning

traditional models of higher education upside down' (Buckland, 2017) success is possible and the workplace model can succeed, as demonstrated by the 100% employability rate from Uni@Work, part of Coventry University Group (Buckland, 2017).

Notwithstanding incomplete information, uncertainty and commercial risk, some universities are entering the game early. The Open University (OU) for example started three graduate apprenticeship programmes in October 2016, thereby capitalising on the introduction of the apprenticeship levy. Notably, the OU have seen a one third drop in student numbers on part-time degrees over the last six years and are very keen to reduce their reliance on the traditional model of part-time academic degrees. According to a spokesperson for the OU, 'students will combine work-based learning with online tuition and will be supported by a team of 'practice-led tutors' who will travel around the country offering face to face support' (Havergal, 2016). Indeed, the introduction of 'practice-led tutors' and 'employer-led' trailblazer groups hints at a pedagogical recoupling of theory with practice, a cornerstone of the Vitruvian tradition and an apprenticeship style of education. As a consequence, it is anticipated that HEI recruitment strategies are likely to alter in response to the new apprenticeship delivery model. No longer is the Career Academic, highly skilled in securing research funding and REF-returnable publication likely to be an asset in the delivery of an apprenticeship degree. Instead, more academic appointments will now arguably be made of industry experienced practitioners able to contextualise curricula in their teaching and learning in a move towards recoupling theory with practice.

Yet, there are arguably many issues with such schemes. Firstly, the vast majority of HE lecturers are 'Career Academics' (Morgan, 2014), meaning that students on a GLA may be following a journey of *parallel* but not *conjoined* lines: workplace experience in the industry and scientific knowledge in the university. The students themselves will need to contextualise and combine explicit knowledge (university) with practical experiences (industry). Moreover, the very transitory nature of the construction and engineering sector means that many employment contracts are short-term, and thus a likelihood apprentices may be unable to continue their GLA with one particular company. What is more, questions regarding the impact on employability have been raised. Should GLA guarantee employment, this in turn may have a negative impact on traditional graduate recruitment (Boyd, 2017). Moreover, it should be noted that the Apprenticeship scheme is being funded by the Government. Thus, whereas the UK Government has asked students to pay tuition fees and these will increase in line with inflation dependent on TEF results; Government is simultaneously sponsoring GLA's at significant cost. Given that funding is distributed in line with the Barnett formula, what this actually means is that Scotland, Wales and Northern Ireland are unlikely to benefit greatly from the current funding model and unlike England are not adopting the same digital voucher funding system for apprenticeships (Boyd, 2017). Whether such a system is either existentially sustainable or even desirable is questionable. The question of cost of education or who is paying for the training is always present. Traditionally the government paid for students to go to university (via fees), latterly students have paid the fees (England), either way the professional bodies would therefore attain well qualified new employees and did not have to bear the cost of training up to the point of graduation. The apprentice model represents a significant policy shift, transferring the cost and responsibility back to the professions in a quasi-voluntary dual system akin to that of the nineteenth Century and thus may herald the rise of experiential construction and engineering education.

6. Conclusions

Historically, operatives were trained in a Vitruvian experientially tradition that coupled theory and practice in an iterative learning experience. Additional theoretical understanding was attained through individual scholarly activities and ongoing experiential learning. This pedagogical route for artisan builders and engineers was common until the nineteenth century, when increasing complexity and greater specialisation meant supplementary theoretical instruction could no longer be undertaken individually. Simultaneously, the construction and engineering sector needed to enhance its professional image and reputation, requiring a more formal, structured and coherent curricular framework. Supplementary instruction was delivered via evening classes in what became known as 'the voluntary dual system'.

Over many decades, this pedagogical approach became increasingly formalised, codified and eventually certified. Instruction was delivered by HEI, and accredited by relevant professional bodies, which in retrospect had the contradictory effect of decoupling theory from industry practice. This was later exacerbated by UK Government policy prioritising research performance via the Research Assessment Exercise (RAE). This prioritisation fostered the recruitment of Career Academics in preference over those with industrial experience. Even for post 1992 universities, despite having a pedagogical heritage rooted in delivering theory tightly coupled with practice, the allure of research funding proved too great and over the past thirty years many universities have sought to become imitations of their more established, research intensive HE counterparts. In response and recognition of this decoupling, and perhaps also in acknowledgement of a misplaced bias on research performance, the UK Government is arguably currently attempting to arrest and possibly recouple academic theory and industry practice through pedagogical initiatives such as the TEF and GLA's. Yet, many challenges remain, especially given that many staff now have very little industrial experience (Morgan, 2014). Yet, recoupling is arguably essential to deliver the pedagogical needs outlined by Professional Bodies in helping develop industry ready and knowledgeable graduates and future employees. It is notable that the government's recent introduction of funded apprenticeships via an industry levy represent a stark departure in funding strategy from that of recent policy towards a policy of pre-tuition fees. Possibly, such a departure also indicates that recoupling of theory and practice requires initiatives and funding on a scale that can only be made by Government. Left to its own devices, the market may not be up to the job.

Interestingly, the GLA model has marked similarities with the voluntary dual system established in the 19th C. in both delivery and financing. The original system was composed of industrially oriented engineers (cf. Rankine) that fully understood the aspiration of the profession (as they were the profession). A return of this nature can be achieved but arguably requires balance to be achieved in terms of recruitment of experienced industry professionals. This would give a greater level of contextualised delivery of technical content and simultaneously enable enhanced programme credibility.

It is not our intention to fully reject the 'Career Academic' appointment model, as Career Academics can bring great benefits to the system and create new knowledge. Yet, at the same time, there are numerous difficulties of curricular design and delivery from staff with a highly specialised, narrow focused knowledge base. Given the scope of the recruitment challenge, a 'silver-bullet' solution is likely to remain elusive. A diverse faculty membership is essential to developing pedagogical academic / practice bridges that help students relate

enthusiastically with their individual professional identity beyond university boundaries. Visiting professors, site visits, mentoring and short-term industrial work placement are alternative educational approaches that may be drawn upon to ensure construction and engineering students develop employability capital and professional insight in relation to their future chosen career path. It is however, insufficient to simply employ more teaching fellows that have an interest in teaching and learning but do not conform to the required significant industry experience needed for the TEF and GLA strategies. Arguably, by reintroducing and encouraging industrial secondment schemes for academics could help give lecturers greater experience and the ability to contextualise their learning, but again this would need to be introduced wholeheartedly to succeed.

Our consideration of the above possibilities to recouple is not exhaustive. Another opportunity to recouple could be offered by part-time construction and engineering courses. Part-time courses have been offered for many years in universities and cater for students currently in cognate (and sometimes non-cognate) work places. The number of cognate part-time students reflects the relative buoyancy and economic strength of the sector. Yet, these other possibilities also face pedagogical challenges. As noted above, such students may be more critical and questioning of theoretical content, especially when content and delivery does not reflect practice they regularly encounter in industry. Here again therefore, challenges exist in the sense that such students with their industry backgrounds and experience may well be taught by 'Career Academics' who may not be able to contextualise the knowledge they are attempting to teach (Tennant et al., 2015; Craig et al., 2016; Pilcher et al., 2017). For students attending such lectures it is arguable that although the end qualification may well be desirable, the experience of being lectured by academics without any industry experience may be highly undesirable.

Ultimately, however, whichever choice or range of choices HEI's select, we argue there is an urgent pedagogical and curricular requirement to recoupling theory and industrial practice. This too, although less relevant an issue for traditional (ancient universities) subjects such as philosophy, humanities and arts, is undoubtedly applicable for HE programmes supporting professions such as Law, Accountancy, and Medicine. Ultimately, we argue that HEI's need a diverse faculty membership to ensure effective pedagogical delivery. In contemporary HE and especially in vocational disciplines such construction and engineering education, excellence in teaching requires real-world engagement combining theory and practice. Continuing on a teaching and learning trajectory that sanctions theory devoid of industry context will only serve to validate an impoverished student learning experience.

Disclosure statement

No potential conflict of interest was reported by the authors.

References

Aparicio, A.C., & Ruiz-Teran, A.M. (2007). Tradition and innovation in teaching structural design in civil engineering. *Journal of Professional Issues in Engineering Education and Practice, 133*, 340–349. https://doi.org/10.1061/(ASCE)1052-3928(2007)133:4(340).

Ball, S., Bew, C., Bloxham, S., Brown, S., Kleiman, P., May, H., … Waterfield, J. (2012). *A marked improvement: Transforming assessment in higher education. Higher Education Academy*. Retrieved from https://www.heacademy.ac.uk/system/files/a_marked_improvement.pdf

Barr, B. (2008). UK civil engineering education in the twenty-first century. *Proceedings of the ICE –Management, Procurement and Law, 161,* 17–23. https://doi.org/10.1680/mpal.2008.161.1.17

BIS (2015) *Fulfilling our potential. Teaching excellence, social mobility and student choice.* Retrieved from https://www.timeshighereducation.com/sites/default/files/breaking_news_files/green_paper.pdf

BIS (2016a) *Success as a knowledge economy: Teaching excellence, social mobility and student choice.* Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/523396/bis-16-265-success-as-a-knowledge-economy.pdf

BIS (2016b) *Teaching excellence framework, technical consultation for year two.* Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/523340/bis-16-262-teaching-excellence-framework-techcon.pdf

Blackmore, P., Blackwell, R., & Edmondson, M. (2016). *Tackling wicked issues: Prestige and employment outcomes in the teaching excellence framework*. Higher Education Policy Institute. Retrieved from http://www.hepi.ac.uk/wp-content/uploads/2016/09/Hepi_TTWI-Web.pdf

Bolden, R., Connor, H., Duquemin, A., Hirsh, W., & Petrov, G. (2009). *Employer engagement with higher education: Defining, sustaining and supporting higher skills provision, a higher skills research report for HERDA South West and HEFCE.* Retrieved from https://business-school.exeter.ac.uk/documents/papers/leadership/386.pdf

Bowyer, J. (1993). *History of building.* (2nd ed.). Bristol: Attic books.

Boyd, C. (2017). *Double standards, social mobility and the degree apprenticeships maze.* WONKHE. Retrieved from http://wonkhe.com/blogs/double-standards-social-mobility-and-the-degree-apprenticeships-maze/

Broadbent, O., & McCann, E. (2016a). *Experience-led learning for engineers – A good practice guide.* Royal Academy of Engineering. Retrieved from http://www.raeng.org.uk/publications/reports/experience-led-learning-for-engineers

Broadbent, O., & McCann, E. (2016a). *Experience-led learning for engineers – A good practice guide.* Royal Academy of Engineering. Retrieved from http://www.raeng.org.uk/publications/reports/effective-industrial-engagement-in-engineering-edu

Buchanan, R.A. (1985). *The rise of scientific engineering in Britain British Society for the History of Science*. Cambridge: Cambridge University Press.

Buckland, C. (2017). *Degree apprenticeships offer a new path to secure graduate employment.* WONKHE. Retrieved from http://wonkhe.com/blogs/analysis-degree-apprenticeships-offer-a-new-path-to-secure-graduate-employment/

Carr, D. (2009). Revisiting the liberal and vocational dimensions of university education. *British Journal of Educational Studies, 57*(1), 1–17. doi:10.1111/j.1467-8527.2009.00425.x.

Cashmore, A., Cashmore, A., & Cane, R. (2013). *Rebalancing promotion in the HE sector: Is teaching excellence being rewarded?.* York: The Higher Education Academy. Retrieved from https://www.heacademy.ac.uk/sites/default/files/HEA_Reward_Publication_RebalancingPromotion_0.pdf

CIOB (2016). *The chartered institute of builders 'professional review guidance for candidates'.* Retrieved from http://www.ciob.org/sites/default/files/Professional%20Review%20Guidance%20for%20Candidates%20-%20Industry_0.pdf

Collins, K., & Davies, J. (2009). Feedback through student essay competitions: What makes a good engineering lecturer? *Engineering Education, 4*, 8–15. doi: https://doi.org/10.11120/ened.2009.04010008

Confederation of British Industry and the National Union of Students (2011) *Working towards your future. Making the most of your time in Higher Education.* Retrieved from https://www.nus.org.uk/Global/CBI_NUS_Employability%20report_May%202011.pdf

Craig, N., Tennant, S., Murray, M., Forster, A., & Pilcher, N. (2016, July). The role of experienced practitioners in engineering education: The end of an era?. In *6th International Symposium for Engineering Education* (pp. 271–278). UK: ISEE - The University of Manchester.

Dearing, R. (1997). *The dearing report. The National committee of enquiry into higher education.* London: Her Majesty's Stationary Office. Retrieved from http://www.educationengland.org.uk/documents/dearing1997/dearing1997.html

Department for Education (2016). *Apprenticeship funding: How it will work.* Retrieved from https://www.gov.uk/government/publications/apprenticeship-levy-how-it-will-work

Durning, B. (2004). Planning academics and planning practitioners: Two tribes or a community of practice? *Planning Practice and Research, 19*, 435–446. doi:10.1080/0269745052000343262.
Engineering Council (2014). *The accreditation of higher education programmes*. London: Engineering Council.
Engineering Professors' Council (2016). Teaching excellence framework technical consultation—Response. Retrieved from http://epc.ac.uk/wp-content/uploads/2012/08/16-07-TEF-year-2-FINAL.pdf
Engineering Council (2014). The accreditation of higher education programmes, UK Standard for professional engineering competence (3rd ed.). Retrieved from http://www.engc.org.uk/engcdocuments/internet/Website/Accreditation%20of%20Higher%20Education%20Programmes%20third%20edition%20(1).pdf
Evans, C., Muijs, D., & Tomlinson, M. (2015). Engaged student learning. High-impact strategies to enhance student achievement. Higher Education Academy. Retrieved from https://www.heacademy.ac.uk/resource/engaged-student-learning-high-impact-strategies-enhance-student-achievement
Fayolle, A., & Redford, D.T. (2014). *Handbook on the entrepreneurial university*. Cheltenham: Edward Elgar Publishing.
Ferguson, H., & Chrimes, M. (2011). *The civil engineers: The story of the institution of civil engineers and the people who made it*. London: ICE Publishing.
Ferguson, E.S. (1992). *Engineering and the Mind's Eye*. London: The MIT Press.
Graham, R. (2012). *Achieving excellence in engineering education: The ingredients of successful change*. London: The Royal Academy of Engineering.
Graham, R. (2015). *Does teaching advance your academic career? Perspectives of Promotion procedures in UK higher education*. The Royal Academy of Engineering. Retrieved from http://www.raeng.org.uk/publications/reports/does-teaching-advance-your-academic-career
Graham, R. (2016). *Does teaching advance your academic career? Interim report on the development of a template for evaluating teaching achievement*. Royal Academy of Engineering. Retrieved from http://www.raeng.org.uk/RAE/media/Publications/Reports/RAoE-Temp-for-Evaluating-Teaching-Achievement_D8.pdf
Guardian. (2014). *University research excellence framework 2014—The full rankings*. Retrieved from http://www.theguardian.com/news/datablog/ng-interactive/2014/dec/18/university-research-excellence-framework-2014-full-rankings
Gunn, V., & Fisk, A.. (2013). *Considering teaching excellence in higher education: 2007–2013*. York: Higher Education Academy. Retrieved from https://www.heacademy.ac.uk/considering-teaching-excellence-higher-education-2007-2013
Havergal, C. (2016). *OU makes 'significant reorientation towards apprenticeships'*. Times Higher Education. August 4, 2016. Retrieved from https://www.timeshighereducation.com/news/ou-makes-significant-reorientation-towards-apprenticeships
Havergal, C. (2017). *House of Lords rejects plans to link TEF results to tuition fees*. Times Higher Education. March 6, 2017. Retrieved from https://www.timeshighereducation.com/news/house-lords-rejects-plans-link-tef-results-tuition-fees
Hénard, F., & Roseveare, D. (2012) Fostering quality teaching in higher education: Policies and practices: An institutional management in higher education guide for higher education institutions. Retrieved from http://www.oecd.org/edu/imhe/QT%20policies%20and%20practices.pdf
HEPI (2016). *Response to the higher education green paper,* Higher Education Policy Institute Report 81. Retrieved from http://www.hepi.ac.uk/2016/01/07/response-to-the-higher-education-green-paper/
Higher Education Academy (2016a) *Teaching excellence framework technical consultation—Response form*. Retrieved from https://www.heacademy.ac.uk/system/files/downloads/hea_response_to_tec_con_annex_h_final.pdf
Higher Education Academy (2016b) *HEA annual conference 2017 generation TEF: Teaching in the spotlight*. Retrieved from https://www.heacademy.ac.uk/training-events/hea-annual-conference-2017-generation-tef-teaching-spotlight
Higher Education Achievement Report (2015). Retrieved from http://www.hear.ac.uk/

Higher Education Funding Council for England (2007). *Developing higher skills in the UK workforce: A guide to collaboration between higher education and employers*. Retrieved from https://www.heacademy.ac.uk/resources/detail/fdf/guide-to-collaboration-between-he-and-employers

HM Government (2015). The future of apprenticeships in England. Guidance for trailblazers – from standards to starts. Retrieved from https://www.gov.uk/government/publications/future-of-apprenticeships-in-england-guidance-for-trailblazers

ICE (2015). Institution of civil engineers (ICE), 'professional review guidance'. Retrieved from https://www.ice.org.uk/my-ice/membership-documents/professional-review-guidance

ICE (1828). Royal charter. Retrieved from https://www.ice.org.uk/about-us/who-runs-ice/royal-charter

Kealey, T. (2008). *Sex, science and profits*. London: William Heinemann.

Kreber, C. (2013). *Authenticity in and through teaching in higher education: The transformative potential of the scholarship of teaching*. London: Routledge.

Land, R., & Gordon, G. (2015). *Teaching exellence initiatives: Modalities and operational factors*. York: The Higher Education Department.

Law S. (2011). Recognising excellence in teaching and learning: Report from the consultation on the UK Professional Standards Framework (UKPSF) for teaching and supporting learning in higher education. Retrieved from https://www.heacademy.ac.uk/sites/default/files/recognising-excellence_0.pdf

Lucas, B., Hanson, J., & Claxton, G. (2014). Thinking like an engineer: Implications for the education system. Royal Academy of Engineering. Retrieved from http://www.raeng.org.uk/education/thinking_like_an_engineer/pdf/full_report.pdf

Machiavelli, N., (1532). *The Prince.* Italy: Antonio Blado d'Asola.

Macfarlane, B. (2011). Prizes, pedagogic research and teaching professors: Lowering the status of teaching and learning through bifurcation. *Teaching in Higher Education, 16*, 127–130.https://doi.org/10.1080/13562517.2011.530756

Macleod, A. (2010). The education of innovative engineers. *Engineering, Construction and Architectural Management, 17*, 21–34. doi: https://doi.org/10.1108/09699981011011294

McNay, I. (2014). *How to get your first paper published.* Times Higher Education. September 4, 2014. Retrieved from https://www.timeshighereducation.com/news/how-to-get-your-first-research-paper-published/2015485.article

Matthews, D. (2016). *Stern's review of REF: What will it mean for academics?*. Times Higher Education. August 11, 2016. Retrieved from https://www.timeshighereducation.com/news/sterns-review-of-the-research-excellence-framework-what-will-it-mean-for-academics

Morgan, M.H. (1960). Vitruvius. In *The ten books on architecture*. New York, NY: Dover publications, Inc.

Morgan, R. (2014). *The universe of engineering: A call to action*. London: Royal Academy of Engineering. Retrieved from http://www.raeng.org.uk/publications/reports/the-universe-of-engineering

Morgan, J. (2017a). *Report predicts significant growth in degree apprenticeships*. March 9, 2017. https://www.timeshighereducation.com/news/report-predicts-significant-growth-in-degree-apprenticeships

Morgan, J. (2017b). Apprenticeship levy 'could worsen part-time degree crisis'. April 21, 2016. https://www.timeshighereducation.com/news/apprenticeship-levy-could-worsen-part-time-degree-crisis

National Apprenticeships Service (2015). *Employer guide to higher apprenticeships*. Purfleet, UK: The National Apprenticeships Service.

Peel, D. (2006). Planning educational research and the UK research assessment exercise. *Journal for Education in the Built Environment, 1*, 30–50.https://doi.org/10.11120/jebe.2006.01010030

Pegg, A., Waldock, J., Hendy-Isaac, S., & Lawton, R. (2012). *Pedagogy for employability*. Retrieved from https://www.heacademy.ac.uk/sites/default/files/pedagogy_for_employability_update_2012.pdf

Pilcher, N., Forster, A.M., Tennant, S., Murray, M., & Craig, N. (2017). 'Problematizing the career academic in construction education: Does the system want what the system gets? *European Journal of Engineering Education, 2*, 1–19. doi:10.1080/03043797.2017.1306487.

Plimmer, F. (2003). *Education for surveyors: An RICS perspective*. FIG Regional Conference Marrakech, Morocco, December 2–5.

Pons, D. (2016). Relative importance of professional practice and engineering management competencies. *European Journal of Engineering Education, 41*, 530–547.
QAA (2016). Quality assurance agency. 'Enhancement led institutional review'. Retrieved from http://www.qaa.ac.uk/reviewsand-reports/how-we-review-higher-education/enhancement-led-institutional-review
RICS (2014). Royal Institution of Chartered Surveyors *'Assessment of Professional Competence; APC Requirements and Competencies'*. Retrieved from http://www.rics.org/Global/RICS-APC-Requirements-and-Competencies-Aug-2014-WEB.pdf
Robbins, C.B. (1963). *Report of the committee appointed by the Prime Minister under the chairmanship of Lord Robbins*. London: HMSO.
Roodhouse, S. (2007). Special issue introduction. *Education + Training, 49*, 161–169. doi:10.1108/00400910710749297.
Royal Academy of Engineering. (2014). *The universe of engineering: A call to action.* Retrieved from http://www.raeng.org.uk/publications/reports/the-universe-of-engineering
Royal Academy of Engineering. (2015). Visiting teaching fellows. Retrieved from http://www.raeng.org.uk/grantsand-prizes/schemes-for-people-in-industry/ove-arup-raeng-visiting-teaching-fellows
Russell, J.L., & Russell, L. (2006). Change basics. Alexandria, VA: American Society for Training and Development
Skills Funding Agency (2015). *Higher Apprenticeship and Degree Apprenticeships Delivery from April 2015 to April 2016. Higher Education Institutions Fact Sheet.* Coventry, UK: Skills Funding Agency.
Snell, K.D.M. (1996). The apprenticeship system in British history: The fragmentation of a cultural institution. *History of Education, 25*, 303–321. doi:10.1080/0046760960250401.
Strang, L., Bélanger, J., Manville, C., & Meads, C. (2016). *Review of the research literature on defining and demonstrating quality teaching and impact in higher education.* The Higher Education Academy. Retrieved from https://www.heacademy.ac.uk/resource/review-research-literature-defining-and-demonstrating-quality-teaching-and-impact-higher
Teece, D. (2016). Universities must think 'think like business leaders' in face of financial cuts. Times Higher Education. August 23, 2016. Retrieved from https://www.timeshighereducation.com/blog/universities-must-think-business-leaders-face-financial-cuts
Tennant, S., Forster, A.M., Murray, M., & Pilcher, N. (2015). Hunt the shadow not the substance: The rise of the career academic in construction education. *Teaching in Higher Education, 20*, 723–737. doi:10.1080/13562517.2015.1070342.
Thompson, F.M.L. (1968). *Chartered surveyors the growth of a profession*. Westerham: Westerham Press Limited.
University Vocational Awards Council (2015). *Case studies on higher and degree apprenticeships*. University Vocational Awards Council.
University and College Union (2016). *Teaching excellence framework technical consultation—Response Form.* Retrieved from https://www.ucu.org.uk/media/8226/UCU-response-to-BIS-consultation-on-TEF-July2016/pdf/UCU_response_to_BIS_consultation_on_TEF_July_2016.pdf
Universities UK (2016). Teaching excellence framework technical consultation—Response. Retrieved from http://www.universitiesuk.ac.uk/policy-and-analysis/reports/Documents/2016/response-to-tef-technical-consultation.pdf#search=teaching%20Excellence%20Framework%20Technical%20Consultation
Williams, A. (2005). Industry engagement in the built environment. *Transactions, 2*, 1–5.
Williams, J. (2013). *Consuming higher education: Why learning can't be bought*. London: Bloomsbury Academic.
Wilson, T. (2012). *A review of business–University collaboration, department for business, innovation & skills.* Retrieved from https://www.gov.uk/government/publications/business-university-collaboration-the-wilson-review