CHAPTER TEN

HOW TO DEVELOP CREATIVE CAPACITY FOR THE FOURTH INDUSTRIALREVOLUTION: CREATIVITY AND EMPLOYABILITY IN HIGHER EDUCATION

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ABSTRACT With changing patterns of accountability in higher education, universities are becoming increasingly focused on performing well against a growing number of metrics. Many used as proxy measures to indicate value of educational experience, amongst the most common and perhaps most notable are those relating to graduate career destinations. Universities have never been more focused on ensuring that graduates are 'employable'. In the midst of the fourth industrial revolution, numerous studies highlight the potential significance and value of creativity, problem-solving and critical thinking, for successful navigation of the complexities of the future. Consequently, these capacities are becoming more significant in determining graduate career development and educational strategy in higher education. This chapter presents a synthesis of related fields of research to construct an outline framework for the development of organizational creativity and creative graduates concluding that there are aspects of current pedagogical practice capable of worthwhile reform.

Keywords: creativity, employability, strategy, future.

Introduction

This chapter explores the future of higher education and considers the implications of change for educational strategy. There is a palpable sense of pessimism and uncertainty in most reasonable projections about the future. Presented as though an increasingly unstable entity, the wider discourse reflects a

trompe-l'œil of sharply contrasting, but also paradoxical, promise and ominous risk in economic, environmental, geopolitical and industrial terms.

The world is moving rapidly into what is widely described as the fourth industrial revolution. Beyond mere continued mechanisation, the rise of robotics, machine learning, and AI, are beginning to fundamentally transform human experience and collective human endeavour. Imagined in quite positive terms by many, Professor Klauss Schwab (2017), Founder and Executive of the World Economic Forum, for example, highlights the significance of connectivity and potential for regeneration of natural environments and increased industrial efficiency through more effective collaboration. Others, including Harari (2014) note the increased rate at which jobs are being replaced by automated systems, and highlight the potential for a wave of industrial employment disruption synonymous with the 19th century, foreseeing divergent potential for either a god-like future for humanity, or a collapse in the need for a significant amount of current human expertise and endeavour (Harari, 2017)'. A potential future of human redundancy.

The possibility for there being a 'last job on earth' as a utopian ideal of a human future of leisure and creative endeavour has been explored in the literature extensively. However, the stark reality of the lights going out in offices and factories presents at least pause for thought in terms of the transitional process, whatever the 'other side' of this momentous change were to become. Grace et al. (2017) made predictions based upon a large-scale survey of opinions from machine-learning researchers to conclude that technology may outperform humans in many activities over the next ten years with a *"50% chance of AI outperforming humans in all tasks in 45 years and of automating all human jobs in 120 years"*.

Whilst technology is undoubtedly leading to the development of new employment roles, more redundancies in the workforce are inevitable for many (Susskind & Susskind, 2017), with entire professions likely to be absorbed by technology in rapid order. This might be the first technological revolution in which there is a net reduction in opportunities for human endeavour and application, and a commensurate and rapid decline in overall employment. Whilst this process is arguably an acceleration of industrial changes already centuries underway, the pace has, however, changed fundamentally. At some point in the near future, machine intelligence will overtake human intelligence and, potentially, machine creativity will eclipse biological creativity. Entire socioeconomic, never mind educational, models may require fundamental reconsideration.

The term 'technological singularity', initially denoting the technological end of humanity, was first attributed to Stanislaw Ulam in his 1958 obituary for John von Neumann. Later adapted by author Vernor Vinge (1993) to denote more specifically the point at which artificial intelligence exceeds the sum total of biological intelligence, the full consequences of which he identified as being as uncertain as the properties of physics beyond the event horizon of a black hole. Simply speaking, AI is seemingly inevitable, and the consequences are unforeseeable. Unlike perhaps other technological innovations, it is vanishingly unlikely that its significance is either being over played. After all, *"the ability to innovate, to generate novel behaviour, to invent new things or devise new ways to use old things"* is already a well-established machine behaviour (Shanahan, 2015: 7). This is not an abstract concern for the future, this is now.

In addition to the complexities of technological opportunities and uncertainties are of course are many and varied natural and very certain immediate challenges. From protection of the environment to the realisation of human equality and wellbeing, the list of aspects of human existence requiring new ideas is long and growing. With a specific focus on the development of creativity and related pedagogic practice, the paper explores the role of universities in developing the knowledge and skills necessary to meet the future needs of society and presents a critical analysis of related discourse and research. Facing a future of such apparent uncertainty, promise and risk, the question is quite simply how should education, and higher education specifically, respond to these dynamics and adjust strategic and pedagogic approaches? Artificial intelligence and machine learning alone provide cause for serious epistemological questions about the future of education, their implications challenging the fundamental basis of our understanding of what it means to be 'knowledgeable' or valuably 'skilled'. The very purpose of education itself is seemingly up for grabs. As posed by Susskind and Susskind in their analysis of the Future of the Professions, "What work will tomorrow's professionals do, and what are we training them to become?" (2015: 232).

What does the future need?

From an educational perspective, compared to current graduate capabilities, the future needs of society will require either:

A. Fundamentally the same intellectual and practical skill set
B. A subtly different skill set
C. An alternative or profoundly adjusted skill set

Given the dynamism and short period of time between the third and fourth industrial revolutions, and increasing sophistication by which business and industry are operated in synergy with new technologies, considerable expertise and energy is brought to bear in determining projections of future needs. Numerous organisations publish detailed reports and analyses on an increasingly regular basis outlining projections for the future so as to underpin effective and stable business operations and develop strategy for prosperity and sustainability. Whilst there is some notable variation in thinking evident between different reports, none reach the conclusion that A (above) is likely. There may be some variation of perspective of the focus regarding B) and C), but there is consistency in considering A) as a potential risk if change is not made, and that educational systems simply seeking to enhance existing approaches with a focus on the same outcomes could leave students at a personal and professional disadvantage.

Receiving significant attention in the international media, The World Economic Forum's (WEF) *Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution* published in 2016, projects the following top ten skills for employment by 2020:

1. Complex Problem Solving
2. Critical Thinking
3. Creativity
4. People Management
5. Coordinating with Others
6. Emotional Intelligence
7. Judgment and Decision Making
8. Service Orientation
9. Negotiation
10. Cognitive Flexibility

Noting that 1 and 2 are subsets of 3, that 4-10 either benefit from creative approaches or are facets of creative thinking, and that creativity itself has risen in WEF's own estimation from their previous projections, the priorities would seem to align with scenario B in the introduction to this section. Others, including Williams (2016) are more explicit in making the case for the need for more profound change arguing that "educational institutions at the primary, secondary, and post-secondary levels, must realize that their current structures are largely the products of technology infrastructure and social circumstances of the past." Also making the case for increasing significance of people skills and social intelligence, Williams, whilst not highlighting cre-

ativity in specific terms, nevertheless identifies 'Novel and adaptive thinking', 'Cross-cultural competency', 'Transdisciplinarity' as well as 'Resilience' and wider team skills as being of increasing importance.

Common to all detailed future projections is an acknowledgement of the increasing significance and transformational impact of technology. Davies et al (2011) focus on 'Computational thinking' 'New-media literacy' and 'Virtual collaboration' as being of increasing significance, whilst Campbell's UK Government Office for Science report (2016) highlights 'Technological growth and expansion' and increasing related significance of 'Interconnectivity and collaboration' in developing the '4th generation workplace'. In common with many surveys projecting future needs, Störmer et al 2014 report for the UK Commission for Employment and Skills also identifies technological skills in broad terms as being of significance, and specifically key skills combinations and interdisciplinarity. For example, the emergence of 3D printing is highlighted specifically as one context in which technical and design skills may require new approaches to combined subjects and educational study.

Whilst there is consistency across nearly all detailed projections of the future of jobs and skills needs regarding technology in general terms, reflecting the uncertainties of an increasingly technological future, terminology shifts and changes on a rapid basis. Many still refer to 'ICT' (Information and Communication Technology) at a time when this is becoming less widely used as a term, whilst AR (Augmented Reality) is only recently being subject to focused consideration and more widespread adoption.

Such is the pace of change driven and facilitated by technology, the significance of new tools is seemingly possible to identify before specific implications are knowable. Nevertheless, all reasonable projections of the future identify space fundamentally transformed by technology, which in reality means both the augmentation of some aspects of human activity and capacity and the potential redundancy of others. For some this is simply the stark reality in which "Human professionals will have to come to terms with the need to defer to the superior capabilities of machines" (Susskind & Susskind, 2015: 117). Starkly, one of many possible futures is even one in which human creativity is no longer required for the purposes either of human survival or flourishing.

Whatever the needs of future skills mix and human capability, and recognising the subtle but occasionally significant variations in projections and interpretations, there is consistency at least in most analyses that the future is very different from the futures of the past. Unlike previous eras during which

'progress' was more actively driven and controlled, there is a prevailing sense to which the genie is very much out of the bottle and that not only unpredictable, the future is also something to be prepared for more than shaped.

This apparent pessimism or defeatism perhaps explains the reason for increasing focus on critical thinking and problem solving; not so much attributes necessary for tackling specific human challenges, but skillsets necessary for navigating complexity and uncertainty in and of themselves. We will have to be more creative as we cannot be certain what the nature of the challenges will be, but paradoxically, we can at least be clear that amongst these will be the need, it seems, to deal with new complexities of our own making.

The problem of creativity and employability in higher education

There are recognized tensions and incongruities between the structures and processes of university and the conditions experienced by graduates in employment. To a great extent this is nothing new. Whilst universities have increasingly become more business focused and absorbed many aspects of operational procedure common to the corporate and industrial sectors over time, higher education has, nevertheless, maintained a distinctive academic tradition. Whilst there may be more direct parallels between the cloistered tradition of an Oxbridge education and the archaic heritage of political life in older democracies, most students leave university and move out of academia into profoundly different patterns of work and professional lives.

It is important to confront projections of the nature of future challenges critically and seriously, especially given acknowledged uncertainties and apparent need for dramatic changes to educational strategies and objectives. Given the apparent consensus of an ever more technological and integrated future and simultaneous doubts about the sustainability of the very industrial and economic infrastructure maintaining this future framework, higher education stands at a significant juncture, tasked with adjusting approaches to meet different needs for an uncertain future.

Resistance within the academic community to large parts of the employability agenda has to a great extent given way to increased collaboration between HEIs and industry (Tran, 2016), and led to a shifting of the traditional emphasis on academic determination of student needs towards a mixed model driven both by subject discipline and external context, with increased involvement of specialist employability support services. Driven in part by an increasing accountability of universities for the success of graduates in the labour market, and by a clear indication of a current discrepancy between the knowledge and skills developed through university study and the capabilities

required in the workforce (Oliveri & Markle, 2017; Adecco, 2017; OECD, 2016; Green & Henseke, 2016; Cuschieri, 2016; CIPD, 2015; UUKb, 2015; Nagarajan & Edwards, 2015; WEF, 2014), employability metrics used as proxy measures of teaching quality nevertheless remain widely considered as "clumsy and contentious" (Rich, 2015) with continued uncertainty as to whether employability is developed most effectively through a discipline, in combination with other activities, or as an adjunct activity to disciplinary study; almost everything except the discipline itself.

Recognising that most employability measures, including the current DLHE (Destination of Learners from Higher Education) survey in the UK, measure employment rather than employability, and given the numerous factors determining speed of appointment into a 'graduate level' job being both nebulous and imprecise and most certainly beyond the reach of universities to influence in part never mind fully, outcomes-based metrics of employability have been subject to critique for many years (Harvey, 2001; Knight & Yorke, 2003). How quickly a university graduate gains employment in a role or how much they earn, with their qualification as an essential requirement, is an obviously ineffective measure of employability for many reasons. Taking no account of economic or personal context, there are many reasons why university graduates may choose to take their time determining their next step, especially given that a considerable proportion that find themselves with opportunity to consider their choices more openly, out of education, than at any point in their lives. And, given the speed with which the employment landscape is changing and is projected to change, simple focus on the level of pay received by graduates also falls short of reflecting employability in a meaningful way. After all, given the internationalisation of higher education, graduates with notionally equivalent 'employability' may move into very different employment contexts and face very different opportunities on completion of their studies.

A key issue is that of the conception of employability itself with a recognised disparity between student and employer understanding of what this means in practice (Tibby, 2012). Beyond a general consensus of the value of 'relational skills' such as communication and teamwork, there remains little apparent consensus regarding precisely which skills combinations or attributes determine 'employability', but clear evidence from graduate employers of a gap to close in terms of preparedness (Suleman, 2016; Oliveri & Markle, 2017). Surveys of graduates and graduate employers indicate continued focus on skills and competencies, followed closely by relevant work experience, qualification type and subject (UUK, 2016) as being the key factors determin-

ing employability, with degree classification and completion of a formal placement activity judged to be of lesser importance.

Recognising the need for more sophisticated and holistic measures, 'LEO' (Longitudinal Educational Outcomes), in the context of the Teaching Excellence Framework (TEF) in the UK in particular, promise a more balanced and effective measure of overall educational impact. Modelling of established data demonstrates that overall employment or further study "vary little by subject" (DfE, 2016) but a subtler and context specific interpretation will undoubtedly be developed. In an era of increasingly sophisticated data analytics, the employability and impact of university graduates will undoubtedly be subject to increasingly nuanced and open analysis, but for the time being, measures are crude at best.

Assumptions that subject discipline related graduate employment denotes a greater success than a non-subject discipline related role are challengeable, particularly given the expectation of rapid reduction in long term career positions and increasingly dynamic labour market and careers landscape. Equally, we would argue that a graduate that adapts knowledge and skills developed in one domain and successfully translates these into other professional situations has demonstrated considerable creativity and adaptability.

The systems dynamics challenge: creativity in education

An increasing focus on creativity in education has been evident for several decades as has a growing awareness of the tensions between educational systems and the development or realisation of personal creativity. There being general consistency and commonality in student perceptions of barriers to creativity in higher education, whilst student awareness of creative opportunities has undoubtedly grown (Power, 2015), there remains a clear tension between creativity and formalized testing (Hillal et al, 2013) in particular, with key factors such as personal inhibition (shyness), lack of motivation, time and opportunity, and aspects of social repression (Morais et al, 2014) compromising effective realisation of creativity in formal educational contexts.

Paul Kleiman (2011) perhaps expresses the educational dilemma most succinctly with reference to creativity operating on the "edge of chaos", whilst certainty and consensus inevitably pull educational systems in the opposite direction, often challenged by a fixation on 'Learning Outcomes' (Benavot & Köseleci, 2015). Ground has undoubtedly been covered, but narrowness of curricula, educational resourcing, the emphasis on creativi-

ty, and the necessary tools and training for educators remain high priorities for developing creativity in education (Adobe, 2013).

Fundamentally, the most direct tension lies in the context of assessment and the competitive and high stakes nature of completing assignments to achieve the best quality degree outcomes. Whilst the proportion of students achieving top honours degrees has increased over time leading some graduate recruiters to call for other means of differentiation, there nevertheless remains a professional premium associated with achievement of a first-class degree through regulatory approaches that can fundamentally drive risk-averse approaches to learning. If creativity is to be developed in higher education, approaches to assessment that mitigate for 'mistakes' or that enable more formally the opportunity to recover from failure, need to be explored in more detail.

Hard vs. soft skills: the challenge of transferability

Amongst a series of challenges in terms of measuring 'employability' rather than 'employment', is that of transferable skills. Definable simply as attributes or abilities developed in one context that are capable of being usefully applied in other contexts, most degree courses articulate transferable skills whilst having little information on which to judge the extent by which this transferability is realised by graduates in their future careers. For example, whilst survey data such as the DLHE discussed earlier in this section provide some useful data, and LEO a potentially more holistic view of career development over time, the extent to which knowledge and skills developed in a given discipline transfer to other contexts is difficult to capture. This is a complex and difficult challenge for all aspects of transferable skills, but in the context of this analysis, 'complex problem solving' and 'creativity' particularly so. For example, precisely how a graduate transfers creative, problem-solving ability developed notionally through scientific study to a graduate level job in retail or finance is at best unclear. At worst, it is impossible even for the individual concerned to recognize.

Transferability of knowledge and skills is more significant for some graduate subjects than others. For subjects aligned with medicine for example, often with highly scaffolded routes into related careers either through professional body accreditation or even sponsorship through study, transferability is considered more within profession than between professions. For graduates of humanities subjects or subjects aligned with art and design for example, transferability may be a more significant factor in determining grad-

uate employability, and whilst figures fluctuate and differ between different economic environments, approximately half of all graduates do not move into graduate level employment in fields directly aligned to their subject discipline.

Surveys regularly highlight how large proportions of graduates move into employment in fields not directly related to their subject of study or relatively quickly switch careers, moving away from discipline related work (UUKa, 2015). Given projections of future portfolio careers and shift of emphasis from consolidated progression in single organisations to increasingly expertise-led and agile employment practices, the transferability of knowledge and skills may become the most important issue for higher education. It remains currently one shrouded in uncertainty and treated somewhat peripherally, core subject knowledge and competences continuing to predominate. In terms if graduate 'success', a premium remains associated with a close relationship between subject discipline and career, or low transferability, whilst most indications suggest increasing value of the capacity for high transferability.

Fitting in or standing out: the challenge and inflexibility of discipline

Related to transferability is the question of discipline, a topic subject to significant uncertainty and tension in and of itself. Given the industrial change and disruption to traditional patterns of employment projected in most studies, the fact that professions will change more in the coming decades than they have for several preceding centuries according to some analysis (Susskind & Susskind, 2015), presents a real challenge to the concept and integrity of subject discipline and the relationship between discipline and the professions. In reality, the global higher education sector has to a great extent hedged its bets and maintained a balance between the old and the new. Traditional subjects remain highly popular whilst new niche courses emerge in all sectors often with short lifespans.

There is considerable variation between and across subject disciplines in terms of how creativity is conceived. Considering Quality Assurance Agency Subject Benchmark Statements for degree programmes in the UK (QAA, 2017), which "describe what gives a discipline its coherence and identity, and define what can be expected of a graduate in terms of the abilities and skills needed to develop understanding or competence in the subject", there are subjects such as Music, Art and Creative Writing, that refer to creativity both

as a serious topic of investigation and as a developmental attribute. There are others, including Accounting that make no reference at all to creativity yet that nevertheless have a track record of developing significant innovation. In terms of graduate attributes, there may be no distinct correlation between graduate creativity and the visibility or prominence of creativity within disciplinary study.

It is tempting to consider how the apparently dramatic changes projected for the professions might lead to or even necessitate fundamental changes to the conception and identity of disciplines in higher education. However, the extent to which changes to universities are necessary, or the degree to which universities should reflect the external landscape rather than stand apart from this reality, are less clear. Abbott (in Brint, 2002), for example, challenges the notion that changes are required and instead stresses the positive power of inertia as well as the resilience of disciplines and established structures and suggests a lack of need for significant change for decades. Recognizing the increasing value and significance of interdisciplinarity, for this to be adequately realised in educational terms, there must of course be 'disciplinarity'.

For example, whilst there are a number of intriguing developments occurring between and across disciplines, such as the research combining materials and biological sciences in the development of self-healing concrete (HealCon), the danger of immediate division into a 'new' sub-discipline may not increase focus, but could lead to ever smaller units of operation and a loss of consolidated strength. Equally, the realisation of one particular innovation combining elements of different disciplines does not in itself imply the development of further knowledge in this area. Intersections between disciplines may produce only a small number of new ideas and quickly subside in importance. Furthermore, such is the integration of global higher education systems, and comparative accountability of universities within national sectors, any profound changes to disciplinary structures would risk placing a given university outside, or at odds with, their most immediate 'competitors' in a way that could be perceived or realized as a risk.

Ultimately, it is the established disciplinary system that has a proven track record for innovation. Whilst there may be argument for universities losing their pre-eminence in some areas (such as development of learning technologies - a field of activity now almost entirely driven by the private sector), the elite parts of higher education remain elite, and remain amongst the most traditional and disciplinary based. Nevertheless, whilst disciplinary boundaries are clearly open borders and not prohibitive of the development of new courses or new research, interdisciplinarity and multidisciplinarity are

restricted depending on the maturity and strength of the centre of gravity of a given discipline. Connections between biological and materials sciences are perhaps to be anticipated given their notional proximity, but connections between other disciplinary contexts and the potential for their intersection to lead to new knowledge and insight, are less likely depending on the combinations involved. For example, it remains much more likely that scientists would speak to other scientists, than a theatrical practitioner and a mechanical engineer would find themselves in the same space never mind the same class. From a graduate employability perspective, deep knowledge and skills related to established disciplines with relevant and distinctive intersecting experience, could add considerable value in terms of employability.

The unpredictable future of creativity and technology

As highlighted in the previous section, perhaps the greatest challenge for universities seeking to develop the employability of graduates lies in the context of digital skills and competencies. In 2015, the House of Lords in the UK published a select committee report by the Digital Skills Committee which called for a radical rethink about educational strategy and for digital literacy to be considered as a third core subject alongside literacy and numeracy so as to meet the needs to the 'second machine age'. Incorporating detailed economic projections, the growth of the digital skills sector alone requires serious consideration in educational terms.

The challenge for universities and the increasing pace and shortening of technological life-cycles, is of determining how 'current', and indeed 'out-of-date', an organization can afford to be. Recognizing a huge investment in IT infrastructure in UK schools in particular but with limited evidence of any uplift in educational achievement, it has been said that "something is going wrong" (Luckin et al, 2012). Indeed, the discourse in higher education is changing rapidly, from misplaced consideration of university students being 'digitally native' experts on their way into university towards a recognition of a fundamentally different approach being required to develop the digital capabilities of students and staff (JISC, 2016).

The question that emerges is one of consistency and ubiquity. Whilst digital skills are undoubtedly of increasing value given the growing significance of new technology in the world of work, there is a challenge in terms of finding capacity to absorb the necessary knowledge and skills though already busy universities and real questions about the extent to which currency can be maintained.

Predicting the future has always been an inexact science. Given the notional pace of change marked by the fourth industrial revolution and the concurrent pace of related technological innovation driving these changes, universities face an uncertain task of responding to a variety of drivers for change, new opportunities and new challenges. From renowned failures to recognise the significance of wireless broadcast and then television in the early 20th century, Thomas Edison's apparent insistence of the impending dominance of moving picture in formal education (quoted in Saettler, 1990, p. 98, in Tamim et al, 2011), to the infamously short-sighted projection by then IBM Chairman and CEO, Thomas J. Watson in 1942, of the global market for computers reaching five in total, potential to be spectacularly wide of the mark with predictions is well established.

Accepting initially that any increased focus on the significance of creativity is a positive thing, given the context of analysis, it is important to note that the uncertainty evident more generally in terms of future projections may also extend to the subject of creativity itself. Already a contested term routinely subject to misunderstanding and suspicion in education, the context in which this creativity is projected to operate itself provides reason to consider whether this remains a stable concept or one itself subject to transformation. If human creativity is likely to be more valuable in the future, do we mean creativity in the way we may currently understand the term? Whilst the landscape beyond the technological singularity may unforeseeable, it would be foolish not to acknowledge that it is technology that provides the most significant single factor in considering how future creativity may be considered in different terms. At the very least, coexistence and conceptual interaction with the creativity of machine intelligence is a very real and current consideration.

Our perception of what constitutes Artificial Intelligence has evolved, from the programming of computers that are able to implement procedural algorithms on to corporeal robotic systems that are able to imitate human behaviours and decision-making processes. Machine learning and neural-information-processing may be considered particular applications of AI; high-level machine intelligence (HLMI) is achieved when machines can, unassisted, complete a procedure more efficiently and more economically than human counterparts. How much faith should we place in algorithms of mechanised decision making that we did not directly create and do not effectively comprehend the inner functions of? How can we be certain that we are not subject to undesirable mechanically introduced biasing?

There are numerous *applied* systems that can for example, utilise automated analytics to interrogate Big Data sets to determine future trends in

business intelligence. There are currently less *generalised* systems able to exhibit learning characteristics as first imagined by Arthur Samuel in 1959 when he coined the term *machine-learning,* with Microsoft's *Tay* chatbox a prime example of how learning algorithms can be easily led astray, particularly if the behaviour they are observing is atypical or deliberately coercive. There are many examples of how automated systems have failed or have been corrupted, see Sample (2007); perhaps as Wachter et al. (2017) suggests, we do require some regulatory body that has the power to audit algorithms monitoring against discriminatory decisions. Perhaps one key future need for human creativity lies in agile regulation of AI and related technological systems. There are also concerns related to the wider impact of technology on learning. Carr (2010), discusses his fears of a generation with a shallow Inter- net derived knowledge because of a "*superficial comprehension of many subjects rather than a deep comprehension of just a few subjects"*. The Internet may be a system subject to constant interruption and distraction, the call of social media is ever present inducing *decision fatigue* and a diminished capacity for concentration, contemplation; failures in self-control and self-discipline result, see Baumeister (2010); our interactions may be monitored and consequently AI tailored to predict our needs and meet our expectations; predictive questions and the ordering of search results can be an unwelcome influence but despite this the potential for learning and creativity is immense, if the connectivity across massive networks of knowledge can be intelligently navigated.

One possible future for technology is simply that it disappears, becomes fully absorbed or integrated. Given the ease with young children readily accomplish digital skills and the increasingly intuitive, responsive and adaptable nature of technology, there is every prospect of pure augmentation of human capability rather than continued or increased 'technological skills' complexity. Equally, were pessimistic projections about potential malevolence of artificial machines to be borne out, human capacity for creativity would potentially be tested in very different ways. Nevertheless, inaction is unlikely to be a safe option and, as highlighted by Susskind & Susskind, *"To insist that machines should, as it were, know their place, namely, in the back office and not on the front line, is to ignore the signals of change"* (2015: 117).

Why more creativity could be a bad idea

It is important to note that in most studies of traits associated with high levels of creativity, there are grounds to consider where creativity may present a

challenge or even a fundamental problem. Whilst it is possible to envisage how professions could adjust to accommodate increased creativity, it may not necessarily be straightforward to suggest that increased creativity would be useful in every context. After all, most studies of exceptionally creative people are of individuals working very much at the centre of their own worlds often with high levels of personal autonomy (Csikszentmihalyi, 1996) whereas most professions operate in teams often with more tightly defined constraints of operation within specialist roles (Handy, 1996). Novelty may be disruptive in a negative way in particular contexts.

Drawing from the work of Lennox, Wilson and Brown (2016), creativity in teams and through established industrial or professional working practices could be considered problematic in a variety of ways:

1. **Clashing creativity/creative sensitivity:** In team-based professional environments, established leadership structures usually determine decision-making processes. An increase in the supply of creative ideas could align with increased emotional investment and diversity of perspective, and lead to tensions about selection.
2. **Tolerance of ambiguity:** Creativity aligning with a high tolerance for ambiguity and willingness to defer judgement and to leave issues unresolved could compromise productivity in some fields.
3. **Intolerance of boredom:** High levels of creativity align with an intolerance of mundane routine, which could compromise wellbeing and productivity in some industrial roles requiring high levels of specialism and a narrow range of overall experience and activity.
4. **Rebelliousness and nonconformity:** Creativity is inherently rebellious and characterised by challenge to the status quo. Highly creative people are also noted to embody traits of irresponsibility that may be considered a risk in some professional contexts. Whilst popular culture may celebrate the hero maverick trope through pilots or law enforcement officers who 'don't play by the rules', in reality, legal and ethical frameworks exist precisely to mitigate against the negative implications of malpractice. Creative people embrace failure but there are professional contexts where the consequence of failure is too great and a tendency towards the unconventional would be actively discouraged.

Whilst it might be tempting to assume that increased personal and social creativity are unquestionably useful and inherently positive, in terms of employability this may be subject to question. Whilst industrial change is pro-

jected to transform working lives over the coming decades and at least the rhetoric about creativity is positive, there are working contexts within which either creativity may be less desirable or even counter-productive. Discipline-specific creativity deployed in professional circumstances inhibiting opportunity to apply that creativity could erode personal wellbeing and potentially constitute a strategic risk. Professions with high degrees of specialization and articulated expertise may resist innovation even to one part of a process because of the risk of inefficiency or compromise to wider processes.

Summary

The expansion of higher education internationally has led to a congested graduate labour market itself marked by "persistent inequalities in class, gender and ethnicity" (Tholen & Brown, 2017). Actions and initiatives by universities themselves are unable to address these alone. Ranking systems being subject to constant challenge and reinterpretation, with more integrated approaches incorporating different metrics including overall employment rates, quality of employment, business links and institutional reputation amongst graduate recruiters amongst many being explored (Hopkins, 2016).

There is clear indication of the value of 'employability' related activities in higher education (Divan & McBurney, 2016), but also evidence of continued scope for integration of employability with core programmes of study and for optionality of many key opportunities for students across the higher education sector leading to inconsistency rather than effective personalization of experience. Recognising the considerable variation of approach to the employability agenda in the HE sector, there is a developing focus on 'embedding' employability and increasing recognition that "employability is not only about getting that first job. It's beyond that simple measure of employment" (Norton, 2016: 2). Quite how far beyond is subject to very different interpretations and open speculation. Nevertheless, for the purposes of this discussion, employability is considered in the broadest possible terms. Recognizing the influence of metrics-based scrutiny of albeit contentious employment data, and inevitable requirement for universities to adjust approaches to meet the most immediately favourable outcomes, employability in broad terms also encompasses longer term implications. In this text, the term is treated holistically and therefore synonymous with not only economic productivity but also personal flourishing.

Possible futures: developing creativity in universities

Universities find themselves in the unenviable position of having to prepare graduates to 'fit' into defined roles with explicit professional requirements, to 'stand out' within these environments, and to be prepared for the potential transformation or even dissolution of related professions and employment roles. Consider for example the number of university students currently studying degrees related to accounting and finance despite the growing trend towards integration of AI computer systems in related business operations and seeming inevitability of the handling and processing of unstructured information becoming AI rather than human led in the near future (Dhar, 2017). With what certainty and over what timescale should a projection of professional decline trigger changes to disciplinary study in higher education? Should academics in the field of accounting be working to find new roles for accountancy skills alongside computers? Resisting the technological transformation of their profession? Or simply focusing on the transferability of education in accountancy fields to other professional environments? At what point should a profession, if indeed ever, be 'let go'?

The sustainability of current educational systems is worth consideration for two reasons: 1) The potential for risk associated with failure to reform or to reform quickly enough; And, 2) The risk that reform is undertaken uncritically or at too great a pace. Nevertheless, the seriousness with which very different future needs are being considered does at least represent an opportunity for positive transformation. There is renewed receptiveness to change and openness to new ideas. Recognizing decades of advocacy and research, there has never been a more open opportunity for serious discussion about creativity in higher education.

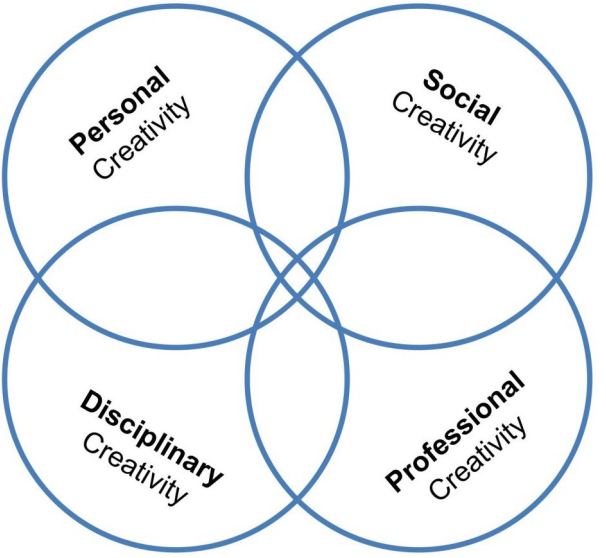

Figure 1 - Domains of creativity

Recognizing the value of an integrated focus on creativity rather than, for example, distinguishing between the teaching of creativity and creative teaching (Jeffrey & Craft, 2010), the four domains encapsulated in Figure 1 above reflect a pragmatic view of where creativity is realised and most commonly associated, reflecting the overwhelming consensus in the literature of creativity being dependent on a defined context for recognition and appreciation (useful novelty measured against established conventions), and a consequence of integrated experience and effective "bisociation of perceptual matrices" (Koestler, 1964). The predominance of each of these domains, their relative diagrammatic importance or size, and extent to which they respectively intersect, will of course vary significantly according to individual circumstances. Nevertheless, that they intersect is fundamentally important for creativity to emerge, and be recognized.

For creativity in universities, effective consideration of these domains from an organisational strategy perspective is most usefully framed by the following questions:

Personal creativity

- What capacity and opportunity do students and staff have to develop their personal creativity?

- How does the university encourage and support personal creativity?
- How does organizational strategy make the most of creative diversity?

Disciplinary creativity

- Where is creativity in the disciplines?
    - Is this clearly articulated?
    - Is this actively taught, encouraged and supported?
    - Is this recognized and assessed appropriately?

Social creativity

- Is student and staff creativity through learning connected to real-world problems and challenges?
    - Is collective creativity applied in solving real problems?
- Is creativity sufficiently socialized, socially engaging and celebrated?

Professional creativity

- Do organisational strategies maximise the creative potential of the academic community?
- Are learning and teaching strategies for creativity professionally informed and applied?

Recognizing that the answers to these questions will themselves undoubtedly raise further questions, require reinterpretation depending on the higher education context, or possibly even surface difficult truths, they are, nevertheless, the right questions to ask.

Depending on the answers to these questions, the following framework represents a range of possible points for further consideration and methods for the development of creativity through higher education study. Key points of reference are:

1. Creative pedagogies
2. Transferable creativity
3. Integrated creativity
4. Applied creativity
5. Digital creativity

1. Creative pedagogies

Reconsidering creativity and levels in higher education

If creativity is to flourish in higher education, it needs to be nurtured throughout higher education. More importantly it needs to be anticipated and recognized. Given that most students beginning their studies at university have been encouraged to recognize their own creativity through preceding educational experience, it is somewhat anomalous to arrive at university only to be told that creativity is then again out of reach or even off the agenda for a few years. How quickly universities understand how students are creative and provide opportunities for the continued development of creative abilities may be critical. If the search for that understanding does not begin at the start of university study, it may never be possible to discover, never mind then nurture and develop.

There being considerable debate about the value of 'level descriptors', 'learning outcomes', 'assessment criteria' and indeed the whole process of academic recognition more generally, the 'Frameworks for Higher Education Qualifications of UK Degree-Awarding Bodies', or 'FHEQ' (QAA, 2014), for example, which is the 'definitive reference point for all UK higher education providers', refers only to creativity in the context of 'creative arts' disciplines, and as an outcome of study at postgraduate Masters level. We have at least to talk about creativity if we are to notice it, and expect it, to find it. We need to acknowledge that creativity is inherent to learning at all levels and develop more nuanced language and understanding to define creativity through all levels of university study. If 'Pro-C' creativity is to be realized, 'mini-c' creativity needs to be fostered and developed earlier and in a coherent way (Kaufman & Beghetto, 2009).

Being clear and fuzzy about disciplinary creativity

Whilst it is of course important to consider receptiveness to creativity, it is also important to be 'fuzzy' in this expectation. After all, it is not possible to accurately anticipate the nature of novelty that will emerge where creativity is concerned. This means that frameworks for the reception, evaluation and response to creativity need to be open and flexible.

Revisiting assessment design

The problem of assessment is perhaps the most important and paradoxical of all. Creativity only becoming apparent on recognition or judgement, related

protocols and their experience highlight the often consequential and invariably inhibiting tendency towards risk aversion, fear of failure, the problem of standardization, as well as numerous other judgement accuracy issues relating to unconscious bias and general reliability. Where creativity is judged to be so can be the scariest place to be when that is what is being aimed for, scrutinized and judged. It is therefore important to consider ipsative or more personalized approaches to the assessment of creativity for this to mitigate against the inhibiting effects of standardized approaches. In simple terms, consideration should be given to the assessment 'for' rather than simply 'of' creativity.

For example, whilst not wanting to open a more substantive discussion about the value of learning outcomes here, it might be possible to develop more open approaches to the assessment of creativity, or assessment for creativity, through learning outcome design. Consider for example how a focus on 'recovery from failure' or development of 'ridiculous solutions' to a given challenge might engender different approaches to assessed work, its interpretation, and a narrow focus on the 'right' answer.

2. Transferable creativity

Fundamental to any conception of creativity is the notion of novel connections and combinations. To foster effective patterns of creative thinking, opportunity must be provided for novelty to emerge. This may be most effectively supported by integrating opportunities for application of subject knowledge and expertise in unusual contexts. For example, this may involve students tackling challenges more commonly associated with other subjects and then reflecting on their experience with reference to their own discipline, or more active collaboration between and across disciplines.

Development of longer-term measures of employability such as the 'Longitudinal Education Outcomes' (LEO) measures being explored in the UK, and related focus on 'Learning Gain' and metrics to evaluate personal and education development, provide an opportunity for closer consideration of creativity and a more holistic approach. Reconsideration of 'success' in graduate employment to acknowledge where expertise has successfully transferred from one disciplinary context to another, as a creative act in and of itself, could help to develop a fundamentally different conception of the transferability graduate knowledge and skills. If the future is to be characterized by diversification and more routine career change, then transferability of knowledge and skills is likely to become more important. The application of

knowledge and skills in unfamiliar contexts may therefore become a more effective way of developing graduate capabilities.

3. Integrated creativity

For creativity to be developed and recognized, it needs to be embedded and part of routine discourse. Staff and student development in knowledge and understanding of the nature of creativity, the language of creative interpretation, and methods for creative thinking and working, need to be supported.

Creativity is best developed in universities through an academic community approach. Dialogue between and across subject disciplines and the integration of different perspectives all serve to enrich creative dialogue and discussion. Defined opportunities for interdisciplinary and collaborative working through project-based or problem-based learning activity can also enrich opportunities for learning.

4. Applied creativity

Creativity also flourishes where it is applied. Consideration could be given to the development of longer-term projects, indeterminate projects and supplementary skills development in university study. For example, given previous discussion about the enrichment of creative potential through exposure to different ways of thinking and different contexts for applying knowledge, the extent to which connections are made between curricular and extra-curricular activity could be developed. Life drawing classes for electrical engineers, sport and fitness study for graphic designers, or software coding for biologists, could all provide real opportunity for new connections and ideas to emerge.

Equally, the tendency in higher education for modularity, or the compartmentalization of degree study into smaller discrete units of study with defined assessment and completion points, may stifle the development of longer-term and larger scale creative ideas. There is considerable value in developing opportunities for students to engage with both longer term and more indeterminate projects throughout university study. For example, there are considerable metacognitive skills benefits in the study of a musical instrument, but this requires a more consolidated and longer-term approach to realize benefits fully.

5. Digital creativity

Finally, and perhaps most significantly in the context of this chapter, is the question of creativity and technology. The development of digital capabilities and fluency in the use and application of technology requires investment and focus. No longer simply the means by which creativity is documented, shared or demonstrated, technology provides a context for creativity itself. Consequently, dexterity and confidence in the application and exploration of technology needs to be a more explicit and more active element of university study across all disciplinary domains. Equally, creativity in the context of increasingly sophisticated technologies needs to become a more active topic in the wider discourse about disciplinary practice and personal development.

Summary

Ultimately, a perfect education system is impossible to achieve. Such are the constraints inherent in all education systems that compromise is inevitable, and such are the number of compromises that imperfection is unavoidable. Equally, educational systems can never be perfect in isolation. Wider socio-economic and employment conditions ultimately determine the extent to which university graduates succeed, in tandem with their capabilities. Educational systems work if they 'work' where they are, in the conditions in which they operate, and where there is receptiveness to the knowledge and skills developed through education. Nevertheless, whilst boundaries between education, work and everyday life have become more porous in recent decades with the development of online education, MOOCs, and work-based-learning as typified by degree apprenticeships as in the UK, most educational systems maintain restrictions of access to education, both deliberate and inadvertent that need to be addressed if full creative potential is to be realized.

Conclusions

The focus of this chapter has been the future of creativity and the role of higher education in responding to the fourth industrial revolution. Given the uncertainties evident in most reasonable projections of the future of jobs and the seeming inevitability of continued and increasingly pronounced technological disruption, educational systems are adapting, or at least now beginning to ask serious questions about change. Whilst there is an element of déjà

vu about any discussion of creativity in education, a topic that has been actively explored for decades, there finally seems to be a receptiveness to the value of rethinking educational systems more substantively. Preparing for uncertainty is a complex challenge. Nevertheless, creativity thrives on uncertainty and creative people are more open to the challenges faced by 'fuzzy' problems.

Que Sera, Sera (Whatever Will Be, Will Be)?

If the future is to be marked by an increased pace of change in the need for new knowledge and skills acquisition in employment, different approaches may be required in terms of flexibility of educational opportunity. Considering the paradox of discipline—*What subjects will be most important? Where can we best focus our educational efforts?* —the answer may not be the direction adopted by most educational reform processes. Rather than concentrate efforts into an ever-narrower range of technical subjects, uncertainty suggests that knowledge needs to be disaggregated and diversified, and educational opportunity developed for inclusivity. It is undoubtedly the case that digital skills are, and will become, increasingly valuable. Nevertheless, inferring therefore that other knowledge and skills will become less important might be a dangerous assumption. Equally, given the anticipated needs for retraining and updating of skills for future careers, universities will need to develop more flexible opportunities for engagement.

The future is, ultimately, not being sold well. There is a sense to which we are in an increasingly obstacle strewn race of our own making and that decisions about next steps are driven more by reaction than by design. Change itself is inevitable as it has always been but increasing speed of reaction and reform in universities could be as risky as no change at all. Perhaps the most important questions in this discussion are about the extent to which universities respond to external environments or seek to disrupt and shape them, and whether graduate knowledge and skills is about productivity and definable 'fit', or much less definable personal fulfilment. In the context of uncertainty and change, nature would suggest that diversity always proves most resilient. Greater diversity in universities might not only be the most effective way of developing the knowledge and skills required for the future, it could also be the most effective way of developing creativity itself.

Creativity is ultimately very simple. It's just thinking and adapting rather than just remembering and repeating. It's just making new stuff. Rather than thinking about creativity as a defence mechanism for the future, perhaps we

should simply focus more on the here-and-now and how we can be creative in shaping that future.

> *"In the end, it all comes down to people and values. We need to shape a future that works for all of us by putting people first and empowering them. In its most pessimistic, dehumanized form, the Fourth Industrial Revolution may indeed have the potential to "robotize" humanity and thus to deprive us of our heart and soul. But as a complement to the best parts of human nature—creativity, empathy, stewardship—it can also lift humanity into a new collective and moral consciousness based on a shared sense of destiny. It is incumbent on us all to make sure the latter prevails."*
> Schwab, K. 2016.

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