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A framework to embed employability initiatives in undergraduate Science, Technology, Engineering and Maths programs

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The concept of ‘graduate employability’ is not new in the higher education sector, and academics and educational leaders world-wide have developed and implemented a range of frameworks to assist students to prepare for a graduate role. In this paper existing models of employability are examined, and a new framework for employability (designed for a potentially non-expert audience) is presented. The proposed model provides a strong foundation for staff to develop innovative, embedded employability tasks, contextualised by their discipline, and aligned with the student life-cycle. It also introduces students to a structured program of ‘bite-sized’ activities designed to help them create strong connections between their university work, life experiences and future career.

Keywords: employability framework, student-lifecycle, employability in the curriculum

Introduction

Academics and educational leaders world-wide have developed and implemented a range of employability frameworks to assist students to prepare for a graduate role. There are strong indications, however, that the ongoing focus of employability-based learning (EBL) will be significantly impacted by the ‘new work order’ and the need to equip graduates with the skills to navigate a complex career across diverse industries (Foundation for Young Australians (FYA), 2016); to be ‘job capable’ with the ability to adapt their skills to multiple contexts (Finkel, 2016); and to be well-prepared and able to be life-long learners (Stephenson, 1998, cited in Yorke, 2006). Given the expected role science, technology, engineering and maths (STEM) graduates will play in the ‘future of work’ (PricewaterhouseCoopers (PwC), 2015), evidence generated by the Office of the Chief Scientist and the Australian Industry Group (among others) suggests there is a particular need for STEM graduates to develop their understanding of employability and to explicitly and intentionally align their skills with employers’ needs.

The challenge for tertiary educators is to ‘unpack’ employability and apply it in practical contexts so students can engage with a meaningful and cohesive program of activities to develop, evidence and articulate their employability. This is not straightforward, given

‘employability’ may not be well-understood by academic staff who are in a position to embed employability-based initiatives (Rich, 2016). To address this, a framework for employability has been developed for the Griffith Sciences Group that encapsulates the core, interlinked dimensions of Career Management, Academic Skills and Personal Attributes – the CAP Framework. This model visually highlights the interlinked nature of EBL in the areas of personal learning, industry-based learning and career learning.

The future of work and Science, Technology, Engineering and Maths graduates

Recently there has been significant discussion regarding disruptive shifts that will shape the future landscape, the so-called ‘future of work’ (Institute for the Future (IFF), 2011; FYA, 2016). This term refers to the changing nature of a future labour market that will be significantly impacted by automation, globalisation, digital disruption and innovation - creating an evolving job market that includes jobs and related skill sets that do not yet exist (FYA, 2015). These same changes are expected to contribute to an increasing number of non-traditional employment opportunities. For example, more people are expected to have multiple jobs with multiple employers (FYA, 2016), be employed in contract and part-time roles (Bennett, Richardson & MacKinnon, 2016), engage in entrepreneurial activity (Spike Innovation, 2015), and be impacted by the so-called ‘superstructured’ organisations that will allow problem solving to occur at a scale previously only attainable by large organisations (IFF, 2011). The expectation that today’s graduates will need to manage a complex career within diverse roles and industries, and that they will be required to apply and transfer their skills to multiple contexts (Committee for Economic Development of Australia, 2015), also aligns with the ‘future of work’ concept. Anticipating these expected changes is fundamental to understanding the challenges ahead.

In the 2016 report *The New Basics*, the Foundation for Young Australians (FYA) describes this period of disruption and change as the ‘new work order’, and the report emphasises that this is an era that has already arrived. The report refers to ‘enterprise’ skills that will allow young people (and graduates) to “navigate complex careers across a range of industries and professions” (FYA, 2016, p.3). These skills, known also as ‘generic’ or ‘transferable’ skills, will become increasingly important for graduate and life-long career success. In a discussion paper about STEM education published by the Queensland Government Department of Education, Training and the Arts (n.d.), strong links are made between the unknown future and the need for generic skills to “adapt to jobs and technologies that don’t yet exist” (p. 7). In this paper a case is also made for engagement with lifelong learning, with particular emphasis on the need to consider the skills the future workforce will need, and the requirement for life-long learning to meet the “social and economic demands of the 21st century” (p. 7).

A paper delivered by PricewaterhouseCoopers (PwC)(2015) emphasises the role STEM graduates will play in Australia’s potential for innovation, with data indicating 75 percent of the fastest growing occupations require STEM skills. The report also draws attention to the increasing need for the diverse skills developed within STEM disciplines (critical thinking, problem solving, analytic capabilities, curiosity and imagination) in addition to discipline specific knowledge. The link between transferable skills and successful outcomes for graduates in STEM disciplines is further highlighted in the 2015 Occasional Paper from the Office of the Chief Scientist. Challenges identified in this paper, *STEM trained and work ready*, specifically relate to the skills valued by employers of STEM graduates (the top six of which are transferable skills rather than discipline-specific skills) and the lack of alignment

with students' understanding of their skills and knowledge in these areas (Prinsley & Baranyai, 2015).

Data generated by the Australian Industry Group also reveals barriers for employers seeking to employ STEM graduates. The 2015 report *Progressing STEM skills in Australia* highlights a 'lack of employability skills', 'lack of applicants with STEM skills' and 'lack of qualifications that are relevant to business' as key inhibitors to recruitment. This is evident in the *New Work Order* report (FYA, 2016) which explicitly refers to a mismatch between the skills young people are learning and those required by industry. Hinchliffe and Jolly (2011, cited in Thompson, Clark, Walker & Whyatt, 2013) suggest one potential cause of this mismatch. They comment that "employers are generally restricted to assessing *potential* not performance" (p. 136) as the latter becomes evident only after employment. Our goal then, as higher education providers, is to adopt a systematic approach to transform whole curricula programs to strengthen student learning and develop their generic/transferable skills in addition to discipline specific skills and technical competencies. We must also ensure students have sufficient opportunities to reflect meaningfully on their experiences so they can competently and confidently articulate their skills, abilities and capabilities (i.e. their employability) to demonstrate their *potential* for success in graduate employment and beyond.

Embedding employability-based learning

The concept of 'employability' in the Higher Education (HE) sector is not new and institutions worldwide have developed and implemented a wide variety of programs – both curricula and extra-curricular – to position their graduates for success in the workplace (Thompson et al., 2013). What **is** new is the increased emphasis on, and the changing nature of, embedded employability tasks designed to help prepare graduates for a rapidly changing workplace. For this reason (among others) there is an emergent focus on improving and enhancing employability initiatives (Yorke, 2006; Moreau & Leathwood, 2006; Ferns, 2012) and there is ongoing work to develop employability frameworks to guide educators to implement embedded EBL.

Employability definitions and frameworks

Multiple definitions of employability exist, and generally they include reference to personal attributes, disciplinary knowledge or subject understanding, the ability to be successful in gaining work (career management), and the capacity to contribute positively to society or 'skills for life'. Cole and Tibby (2013) cite the work of various scholars in the field including Dearing (1997), Knight and Yorke (2003) and Hillage and Pollard (1998), all of whom provide definitions of employability with some reference to each of these key dimensions. Cole and Tibby (2013) also present two of the popular and frequently referenced models of employability – the USEM (Understanding, Skilful Practices, Efficacy beliefs and Metacognition) model developed by Knight and Yorke in 2003 (Knight and Yorke, 2006), and the CareerEDGE (Experience, Degree, Generic Skills and Emotional Intelligence) model proposed by Dacre Pool and Sewell (2007).

Yorke and Knight's USEM model (Figure 1) was deliberately designed to present employability thinking as a concept firmly underpinned by scientific evidence and academic theory, in part to appeal to academics on their own terms (Pegg, Waldock, Hendy-Isaac, & Lawton, 2012; Dacre Pool & Sewell, 2007). While Dacre Pool and Sewell (2007) agree that the USEM model has contributed strongly to scholarly work in the field, they acknowledge that it is less well understood or implemented by a non-expert audience. Pegg et al. (2012)

also raise a concern about a lack of evidence that this model is being readily adopted by HE institutions – although they do comment that it is a useful start-point from a curriculum audit, or a curriculum design perspective, and it is therefore included in this examination of existing frameworks.

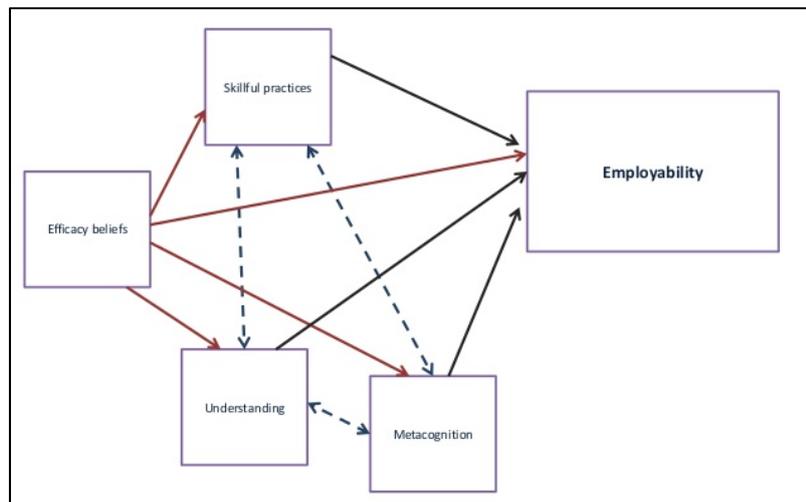


Figure 1: USEM model (Knight and Yorke, 2003)

Dacre Pool and Sewell’s CareerEDGE model (2007), conversely, is presented as a user-friendly model designed to communicate concepts of employability to non-experts. The authors specifically reference parents and students in this ‘non-expert’ audience, however, there are some who argue academic staff are likewise not experts in relation to teaching employability, or, that there are some academics who simply do not agree that addressing employability is part of their role (Rogers et al., 2016). Rich (2016) observes that while academics are well placed to teach employability, it does not necessarily follow that they are “able or motivated to succeed” (p. 11).

Bennett et al. (2016) also identify “academics’ lack of knowledge about the contemporary workplace” (p. 3) as a potential issue. Their work recognises the role of the educator in effecting positive change with regard to developing graduates’ employability, however, like Rich (2016) and Rogers et al. (2016), they acknowledge that not all academics will be willing to undertake this task. They identify three academic audiences for employability-based resources ranging from those who agree to their role in the task and have the skills to tackle it, to those who “do not agree they have a role in the development of employability and are unlikely to engage unless required to” (p. 3). Their response to the challenge of these varying attitudes was to explore the potential of a systematic approach to developing employability, and they proposed a new framework for employability which encompasses five key themes:

- develop skills and knowledge;
- develop self;
- develop career awareness;
- interact with others; and
- navigate the world of work (p.8).

Bennett et al. (2016) present these themes in a cyclical diagram (Figure 2) that illustrates the dynamic nature of the ‘steps’. They emphasise that “steps will tend to recur and learners will

move back and forth between the elements, most often engaging in more than one element at any one time” (p. 22).



Figure 2: Framework for embedding employability (Bennett et al., 2016)

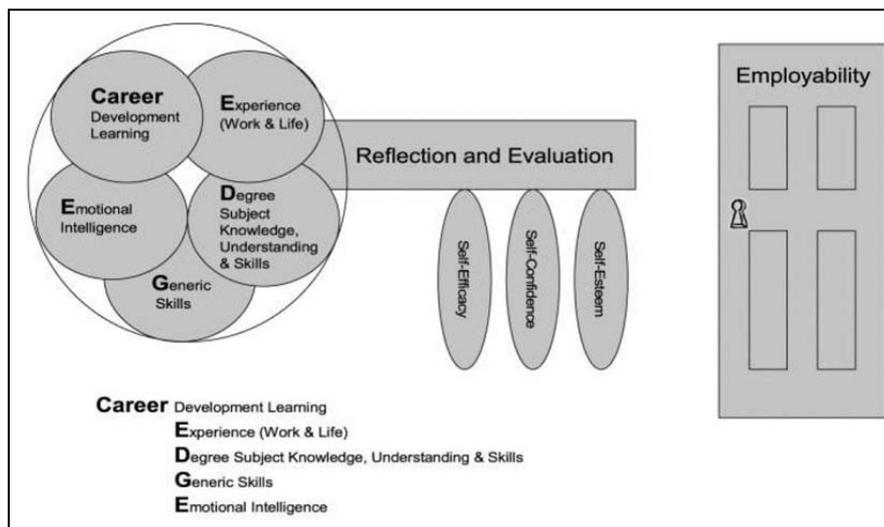


Figure 3: CareerEDGE - the key to employability (Dacre Pool & Sewell, 2007)

This cyclical approach to employability development is also present in Dacre Pool and Sewell’s revised CareerEDGE model – *the key to employability* (Figure 3). In this revised model the metaphorical image of a “key” is used to demonstrate the relationship between the elements they consider fundamental for developing employability – career development learning, experience, degree or subject knowledge, generic skills and emotional intelligence. They focus heavily on the potential for these elements to positively impact a student’s self-efficacy, self-confidence and self-esteem, and comment on the longer-term positive outcomes of this level of personal development. This is important in terms of the overarching goals of EBL, and these developmental concepts are therefore reflected in the model of employability proposed in this paper.

The multi-dimensional nature of employability is clear in each of the frameworks discussed, and is again represented in the model for implementing employability developed by the Higher Education Academy (HEA)(Norton, 2016)(Figure 4). Significantly, in this model,

‘embedding employability’ is placed at the centre and the authors identify ten key contributors integral to developing graduate employability. While not explicitly categorised into ‘career management’, ‘discipline skills’ and ‘personal attributes’, each of the suggested actions for developing employability could be sorted into these categories. The CAP framework builds on the ideas presented in the HEA model. Why then do we propose another model of employability?

Pegg et al. (2012) comment in the revised version of *Pedagogy for Employability* that a ‘one size fits all’ model for the pedagogical delivery of employability has not been established, despite the volume of work being carried out in relation to graduate employability. They suggest therefore, that it may be in the interests of HE institutions to “consider a more individualised approach to both their students’ employability needs and academic methods of delivery” (p. 21). Add to this Rich’s (2016) assertion that successfully embedding employability into the curriculum must be achieved with the “consent and enthusiasm of academics” (p. 12), and the rationale for a ‘customised’ employability framework is clear. To achieve our employability goals we must first provide a framework for employability that resonates with *our* academics and helps them ‘make sense’ of how they can contribute to the employability agenda within the specific context of their course, and the wider contexts of the student’s degree program and overall university experience. The Griffith Sciences CAP framework provides an interpretation of employability which attempts to achieve this.



Figure 4: The HEA Framework for embedding employability (Norton, 2016)

Career management, academic skills and personal attributes in employability-based learning

It has been established that **career management**, **academic skills (discipline and technical knowledge)** and **personal attributes** are all fundamental to developing employability. Anecdotal evidence suggests that in some instances there seems to exist (amongst educators

and students) a notion of employability that does not place equal emphasis on each of these areas. Bridgstock (2009) comments that career management should be introduced early in a degree program, but that some definitions of employability lack a reference to career management and therefore this crucial aspect of developing employability is not addressed in the curriculum. Barrie (2009, cited in Pegg et al., 2012) refers to problems that may arise from an artificial separation of transferable (or generic) skills from discipline knowledge that ignores and undermines an (evolved) understanding of developing employability and graduate attributes where these skills are contextualised by the discipline. The fact that there may be some who still adopt an approach in which ‘discipline’ skills are taught in one situation or context, and ‘transferable’ and ‘career management’ skills are covered separately, in a bolt-on or opt-in model, is fundamental to appreciating the relevance and potential of the CAP framework.

A further consideration when exploring the model is the mismatch between what academics think they are covering (in terms of employability content), and student understanding of what they are learning (Pegg et al., 2012). Added to this is an assumption that students may not understand *why* they are learning certain skills, that is, how they will be relevant in the future. This notion is supported by Burke, Jones and Doherty (2005, cited in Clarke, Marsden, Whyatt, Thompson, & Walker, 2015) who highlight a fundamental problem: students do not realise the extent to which they are developing their employability skills. Burke and colleagues further assert that this lack of awareness may impact the student’s ability to transfer their skills to be successful in a post-graduate role. Bennett and colleagues’ (2016) study supports this, and they comment “the relevance of coursework to the **real world of work** is often not realised by, or made clear to students” (p. 13). We can extrapolate that this lack of awareness and ability to transfer skills may impact the potential for graduates to engage in active, life-long learning – a skill we already know is highly valued by employers (Prinsley & Baranyai, 2015).

Statistics from the Department of Education (PwC, 2015) suggest enrolments and completion of university studies in STEM have stagnated compared to non-STEM areas, therefore authentic curriculum experiences that establish **explicit** links to the students’ future careers become critical. Students will become more confident when they are able to participate in authentic learning experiences that help them create connections between their personal aptitude and professional capabilities (Lombardi, 2007). Hmelo-Silver (2004, cited in Overton and Johnson, 2016) asserts that authentic learning experiences and student participation in scenarios that mirror relevant real-life contexts are known to motivate students. Further, the impact of actively engaging in personal and professional development within the curriculum can positively influence a student’s motivation and commitment to succeed in an academic sense. McCash (2008) contends that “student engagement with the home or main discipline can be deepened via the process of anticipating one’s own future” (p.14).

These key drivers for curriculum transformation in undergraduate STEM disciplines are reflected in the CAP framework which has the potential to improve learning-centred curriculum design in a broad sense (not just in terms of embedding EBL). When adopted for use within specific courses the model can be referenced to help academics create opportunities for students to engage in practical experiences that promote development of discipline *and* transferable skills. This interpretation of EBL activity – which places it at the core of the educational experience rather than viewing it as a ‘mere’ set of strategic tools (Deeley, 2014) – aligns with Deeley’s (2014) assertion that “the development of students’ skills and attributes is intrinsic to a...holistic pedagogical approach” (p. 41). van Roojen

(2011, cited in Ferns, 2012) also refers to the blend of theory and authentic practice-based settings (or learning experiences) that promote learning that lasts and prepares work-ready graduates.

The Career, Academic, Personal Framework for embedding employability

Like the HEA's 2016 model for embedding employability, the CAP framework (Figure 5) places employability at the centre – visually emphasising the relationship between the students' various university and life experiences, and their emerging employability. Placement of the concept of employability at the heart of the model reinforces the notion that if a student has knowledge and understanding of the key contributors to developing employability, and if they are able to successfully attend to the three core attributes (**C**areer, **A**cademic, **P**ersonal) they will be more employable. The limitations of an approach to employability that does not recognise all three aspects as equal are noted above, thus the diagrammatic representation of the CAP model strategically addresses this by assigning equal emphasis to all three aspects of employability. It also visually highlights the significant *areas of overlap*, reaffirming that elements of EBL should not be delivered in isolation. It is these areas of overlap, along with the idea that employability is explicitly linked with authentic learning that gives academics who implement the CAP framework the greatest potential to design innovative curricula that will maximise student learning and lifelong career success.

Importantly, the imperative to take a program-level perspective aligned to the student lifecycle is also included at the heart of the model. Yorke and Knight (2006) highlight that employability concepts are complex, and that the development of skill in this area takes time, practice and repetition, not unlike the development of discipline-specific skills and knowledge. They state that students need multiple exposures to employability concepts to understand what it is they are to learn, how to judge what they have achieved and to see how to improve. While scaffolding for the successful development of employability skills is recognised as important, many of the models of employability do not clearly emphasise the need for students to scaffold their skills, nor do they suggest a way to achieve this. The CAP model, by contrast, is combined with the **P**rofessional **L**earning for **U**ndergraduate **S**tudents (PLUS) framework in Griffith Sciences to explicitly address the need to scaffold employability-based learning within the curriculum.

The student-centred PLUS framework aligns specific tasks and activity to the student lifecycle identified by Lizzio (2012) in the broad areas of transition *in, through, up and out*. PLUS, initially an extra-curricular program is based on a series of 'bite-sized' tasks students can work through at each stage of their degree. Given the imperative to embed EBL in curricula, PLUS was revised to align with the concepts presented in the CAP model. At a practical level, the combination of a student-lifecycle approach to employability tasks, and the allocation of tasks to one or more of the key dimensions for employability provide a platform and a 'toolkit' to allow non-expert academic staff to increase and enhance their ability to understand and embed EBL.

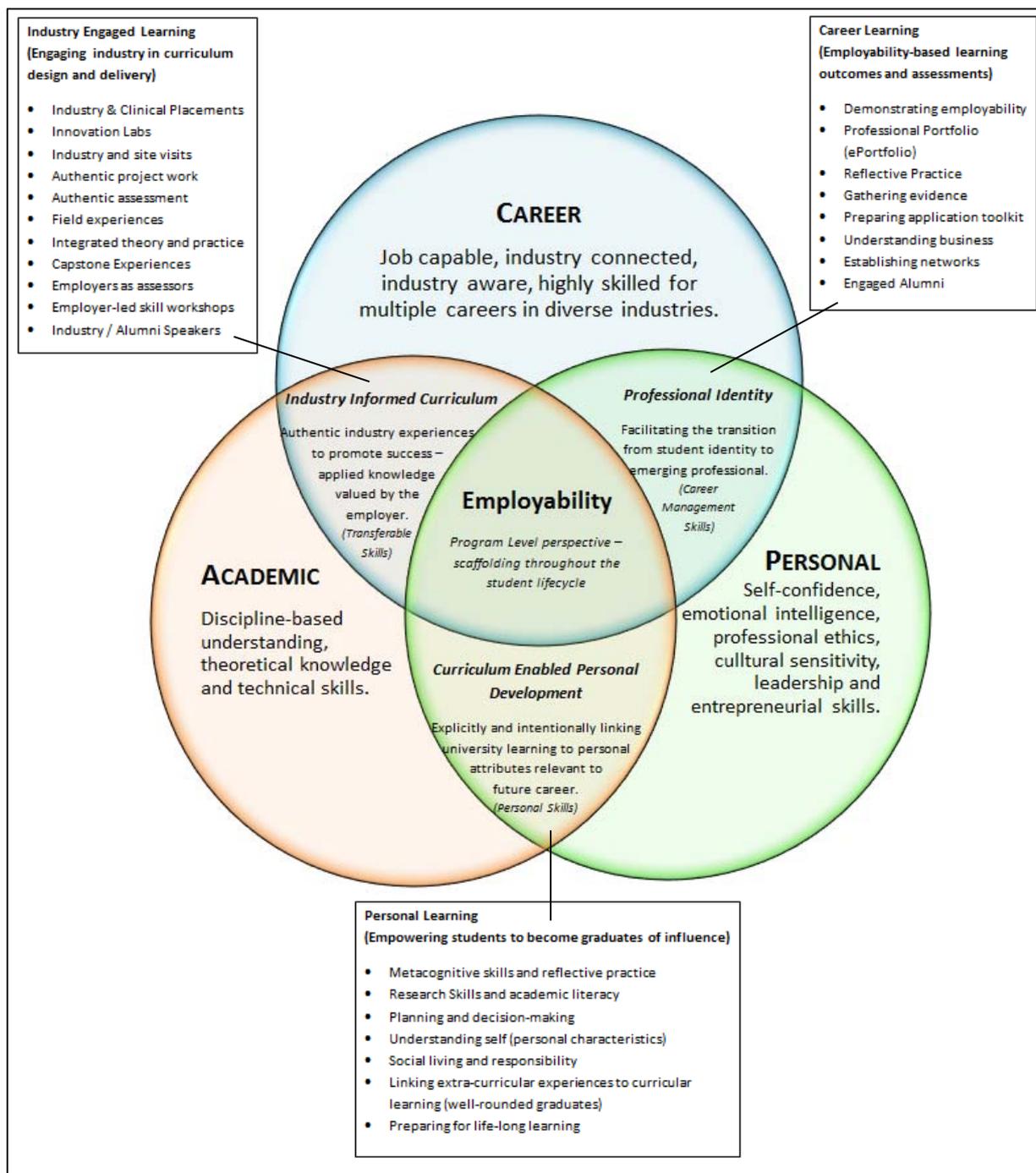


Figure 5: Career management, Academic Skills, Personal Attributes (CAP) model for employability

One further aspect of the CAP model that must be noted here is the inclusion of the ‘breakout’ boxes in each of the key learning spaces. These provide more detail about potential employability-based learning and teaching activity within the curriculum, whilst maintaining the ‘easily understood and interpreted’ goal of the model. Importantly, it is within these breakout areas that academics (and students) can readily identify the stakeholder groups that are essential to successfully implement employability initiatives. Ideas for authentic assessment tasks which include effective ways to engage with the various stakeholders are

also suggested. The way these ideas are presented within the framework establishes a clear objective for the inclusion of certain assessment types. It also creates the opportunity for tasks to be designed with an unambiguous rationale that has clear links to the student's emerging professional identity, and which allows students to produce authentic outputs to align with industry expectations.

The systematic implementation of the combined CAP/PLUS model for employability is in its initial stages within the Griffith Sciences Group, however, there is evidence to suggest this approach has significant potential to influence curricula design that will impact graduate employability positively. Research was conducted within a final year, core course in the Bachelor of Science in 2016 to evaluate the effectiveness of intentionally-designed employability-based curriculum on student preparedness to transition from university to a professional setting. Analysis of data revealed a significant, positive shift in terms of student confidence to prepare a job application and overall readiness to apply for a graduate role (Brent, 2016). The course design comprised 70% employability-based learning and assessment, with tasks representing the three core employability dimensions represented in the CAP model. Tasks were also aligned with all lifecycle stages represented in the PLUS program. Anecdotal feedback also collected in 2016 suggests many students were dissatisfied with having to complete tasks they felt were 'too easy' or 'like something a first year student would do'. This feedback reaffirms the need for an employability model that highlights the imperative to scaffold employability-based learning throughout a degree program.

Conclusion

Although significant work has been done to implement employability-based learning initiatives within higher education institutions there is still strong evidence from employers, industry and graduates themselves (Bennett et al., 2016) that there is more to be done for these strategies to have real impact. Although many frameworks for employability exist, they can only be useful if they are truly understood by academic staff who are best placed to deliver innovative, employability-based curricula that integrates learning experiences with real-world contexts to create an authentic learning environment. Employability frameworks that include practical steps, ideas and suggestions for how to achieve this are therefore becoming essential for HE institutions to address the strategic employability agenda.

The FYA (2015) has conducted substantial research into the impact of the changing nature of the future labour market which is being shaped by three key forces: automation, globalisation and what they call 'collaboration' (many jobs with many employers). These changes are driving the need for graduates to be better prepared to navigate a future career that may include jobs that do not yet exist. Transferable, generic, or 'enterprise' skills are therefore becoming more critical as it is these skills that will allow graduates to work across diverse industries and roles, retraining for specific disciplinary contexts as required (Finkel, 2016). The role of the HE sector in preparing graduates for this type of non-linear career has been clearly established, and it is now widely accepted that to effect these changes we must look to implement curricula strategies alongside extra-curricular activity (Cavanagh et al., 2015; Yorke & Knight, 2006; Ferns, 2012). The FYA asserts that "the high demand for enterprise skills underscores the importance of general capabilities being retained and elevated in the curriculum" (2016, p.19). They advocate for integrated curricula that do not deal with discrete subject matter but instead embrace a change in pedagogy that includes greater use of project-based (or authentic) learning and that mirrors real-world situations.

The CAP framework for employability proposed in this paper is a student-focused model designed to present the core dimensions of employability in a way that can be easily interpreted and understood by a non-expert audience that may include academic staff and students. The model highlights key learning areas for developing student and graduate employability, and includes practical ideas for how this might be achieved. It also identifies key stakeholder groups who should be involved to facilitate successful implementation. The model presents career and personal learning as a series of achievable tasks that can be adapted by the academic to integrate with discipline-specific learning, and it therefore has significant potential to facilitate changes in the way embedded employability-based learning activity is developed, delivered and assessed.

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