

Knowledgeability culture: Co-creation in practice.

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Abstract: Co-creation is a term that traverses a philosophy, method and mindset of collective creativity. It is an evolving construct used by diverse disciplines, but as yet is imperfectly defined (Sanders & Stappers, 2012). This paper explores co-creation within a community of practice in Design Factory Melbourne (DFM) at Swinburne University of Technology. This community of practice includes researchers, academics, industry and external collaborators working towards shared meaning, which is the collective understanding of the industry problem-context. We understand co-creation as negotiation through which solutions are optimised rather than compromised. The community of practice is guided by five principles; safety, exploration, responsibility, communication and collaboration. This paper is a case study that applies these five principles to demonstrate how shared meaning is negotiated and achieved in practice. The paper is an artefact co-created by seven individual voices working together within the community of practice in an industry-integrated doctoral program.

Keywords: Knowledgeability; Co-creation; Industry Integration PhD Program; Design Factory

1. Introduction

The Design Factory Melbourne (DFM) is an open platform for interdisciplinary education, research and industrial collaboration located at Swinburne University of Technology Melbourne. DFM can be defined as a triage of nodes that intersect with university and with industry in a community of practice. As a theory, communities of practice are “a socially situated, practice-based approach to learning” (Wenger-Trayner, 2013, p. 266). In other



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words, learning is “seen as a collective, relational, and social process” (Wenger-Trayner, 2013, p. 266) that is part of a landscape of practice. The DFM landscape of practice includes students, academics, industry, researchers and community as stakeholders. In this way it is comparable to all landscapes of practice as a “complex system of communities of practice and the boundaries between them” (Wenger-Trayner & Wenger-Trayner, 2014, p. 13). Boundaries in this sense are the "boundary objects" identified by Leigh Star, who defined them as:

"both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites" (Star & Griesemer, 1989, p. 393).

They are an essential component of the DFM community of practice, acting as "a means of translation"(Star & Griesemer, 1989, p. 393) through which the knowledge of individual communities of practice can intersect, leading to co-learning and co-creation.

Within the DFM community of practice co-creation is the norm and is a fundamental way of working, thinking, negotiating boundaries and practice that is structured to facilitate innovation. Co-creation is a term that traverses a philosophy, a method and a mindset of collective creativity. It is an evolving construct used by diverse disciplines, but as yet is imperfectly defined (Sanders & Stappers, 2012). In relation to DFM co-creation is a process that includes stakeholders invested in working towards shared meaning. Co-creation is not easy. As stated, It involves the negotiation of differences within a landscape that consists of:

“competing voices and competing claims to knowledge, including voices that are silenced by the claim to knowledge of others” (Wenger-Trayner & Wenger-Trayner, 2014, pp. 15-16).

Co-creation is thus never unproblematic. It is instead a state of negotiation and optimisation of differences (Wenger-Trayner, 2013).

The community of practice in DFM as profiled in this paper is an industry-integrated doctoral program in which doctoral candidates from diverse disciplines, their industry partners, their supervisors, academics and DFM staff all co-identify and co-create solutions to industry problems. Within the community of practice in DFM the industry partner is an investor in problem identification and is equally accountable in the pursuit of solutions to the problem statement, and in so doing invests in shared meaning. Accountable here means the industry partner is actively engaged in identifying problems through co-creation workshops and discussions both in the industry workplace and in the DFM. This is an evolving program as the DFM PhD students are still completing their research. We aim to report on the final outcomes of the DFM model in later papers.

The DFM program is distinct from the industry partner delivering a brief in a linear transaction model where an individual doctoral candidate and supervisory team then respond to the outcome. At a pragmatic level the aim of co-identification and co-creation is

to produce a problem solution that will satisfy the industry partner who is funding the project and a successful PhD for the doctoral student. As we write this is happening within the doctoral program, but negotiating between different voices and differing assertions of both knowledge and power at this level of complexity can never be perfect. It is and will remain an imperfect process, and often a difficult one, but the essential by-product of this imperfection is learning for all individuals and all communities of practice involved. For the DFM community of practice learning includes devolving and accepting different levels of responsibility and being accountable for research knowledgeability in individual projects. For the industry partner, learning can manifest as involvement in challenging discussions and new and different forms of co-creation to clarify the context of problems and co-identify particular needs. These may not always have an immediate or simple solution, and a different context could define this as a failure, but in the DFM community of practice landscape it becomes learning that leads to innovation. As one of the co-creators of this paper writes in a later section, all ideas contain a tiny trace of innovation.

The landscape of practice that exists within the DFM community of practice profiled here is thus a contested space of:

“potential misunderstandings and confusion arising from different regimes of competences, commitments, values, repertoires, and perspectives” (Wenger-Trayner & Wenger-Trayner, 2014, p. 17).

To navigate, mitigate and broker the multiple voices that reflect the structure of the landscape of practice of the DFM community of practice five principles were co-constructed within DFM through a six month series of meetings and discussions. Grounded in the methodology of co-creation (Sanders & Stappers, 2008) the five principles act as methods to apply the theories of co-creation in practice.

This paper interrogates the five principles and presents them through the different methods used by the five individual authors to explore how the principles function in co-creation and whether they are successful. We had the assumption that the principles worked in practice, however, we had never tested them or reflected upon the purpose and role they presented within the community of practice. Thus, our original purpose for this paper was to explore what we all took for granted, which was the five principles and to understand how the community of practice of the DFM PhD program can be validated through the theoretical lens of co-creation. This paper therefore has a dual purpose in that it (a) presents a co-creation model for university and industry integrated collaboration and research and (b) it is itself an artefact demonstrating this co-creation model in practice.

These principles are expressed as five statements that facilitate working towards shared meaning in DFM. The five principles are:

- Safety is everything
- Fail forward to learn fast
- Your parents don't work here

- Talk to someone new
- All people have potential

These principles mirror the Australian Government report *Defining Quality for Research Training In Australia* (2011) which identifies the PhD qualities most desired by Australian industries as self-management, problem solving, communication, teamwork, initiative and enterprise. These skills are paramount in an innovation mindset. The embodiment of co-creation in the DFM community of practice also reflects the argument of the Business Council of Australia that:

“creating a culture of innovation should not be an add-on instead it needs to be integrated into organisations and universities” (Business Council of Australia, 2014 p. 10)

and the statement by Australia’s recent chief Scientist that:

“the responsibility ... is a shared responsibility. We need actions that will encourage greater collaboration. We need actions that will break down cultural barriers between business and research sectors. And we need them now” (Chubb, 2013).

These five principles are discussed in this paper through seven co-authors participating in the co-creation culture in the community of practice. The co-authors include four academics with diverse backgrounds of education, digital media, industrial design, linguistics and design management who work with three doctoral candidates whose backgrounds include digital media, industrial design and interior design. Additionally, the contexts of the industry-integrated research problems for the doctoral candidates span hospital services, recycling waste materials and learning environments. The seven co-authors constructed this paper to give their interpretations of the five principles through a co-creation process of storytelling, workshops, synchronous and asynchronous participation, writing, editing and documentation. This was not an easy process. It involved co-creation in extended face to face discussions in large groups where competing ideas were strongly advanced, debated, written up, removed, revised and rewritten; co-creation in electronic writing through email and other web platforms; face to face, electronic and phone editing. This paper would not have been written without the five DFM principles as guide and the community of practice understanding of boundaries as practice.

Personal reflective storytelling was the main data collection method used (Cortazzi, 2014; Clandinin, 2007; Clandinin & Connelly, 2000; Schön, 1995). Each co-author constructed a story that unpacked one of the five principles. Storytelling was used as the data gathering methods as:

“telling stories about oneself, about one’s life, and about oneself in the world can be a way to help the individual negotiate a place in the wider world of society and culture” (Shaw, 2013, p. 3).

In other words, storytelling provided the foundation for the co-authors to reflect, analyse and synthesise upon their position in the DFM community of practice and on the impact the five principles have had upon their landscape of practice, mitigating the boundaries between co-creators. The co-creation of this paper required, as we have noted, solutions that were optimised rather than compromised. As an example of an optimised solution, each individual interpretation is expressed here in an individual authorial voice. We decided to leave these voices intact rather than homogenise them because this demonstrates both the power and the difficulties of co-creation in practice. Hence our first point, that co-creation is not easy. Co-creation is:

“complex and takes up a different nature for different stakeholders and unfolds between different stakeholders” (Degnegaard, 2014, p.107).

2. Contextualising knowledgeability

Lave and Wenger’s interpretation of community of practice states that learning and social practices are intrinsically tied as it is through social interaction that the human mind develops (1991, p. 31). This view of learning is implemented within Design Factories (DFs) globally. Specifically, social connection, interaction and community collaboration are learning vehicles in DFs. Lave and Wenger’s (1991, p. 51) community of practice involves the “relational understanding of person, world, and activity” over time and geographically in tangential and overlapping community of practice’s as creators of learning.

The foundation of Lave and Wenger’s community of practice concept is the exploration of how individuals learn within situated learning environments. In such environments individuals share their experiences and learn through participating (1991, p. 31). The co-created production of this paper is an example of Lave and Wenger’s theory in practice. Their community of practice embraces the concept of legitimate peripheral participation, which brings together:

“theories of situated activities and theories about the production and reproduction of the social order” (Lave & Wenger, 1991, p. 47).

When Lave and Wenger’s description of situated learning is applied to DFM’s doctoral program, the DFM’s environment constitutes a situated learning environment and the DFM doctoral students are situated within a learning environment. Their community, which is a physical, mental and social environment, constitutes itself as a community on both a local and global level. Individuals can both absorb and be absorbed within the culture of practice of their environment (Lave and Wenger, 1991, p. 95). Thus, the DFM PhD community of practice is “both a community and an economy of meaning”(Wenger, 1999, p. 209). As the PhD program located in DFM is industry integrated, the doctoral students thus also learn within the environment of their industry sponsor. Within the wider DF global community all researchers negotiate differing community of practices that intersect within their research. Negotiation, participation and boundary encounters within these global community of

practices are not the focus of this paper, but are still a part of the larger environment in which DF PhDs participate.

The theory of community of practice has had additional iterations since its initial theorisation by Etienne Wenger-Trayner and Jean Lave in 1991. As more recent scholars have noted, it now incorporates the idea of knowledgeability and places:

“a stronger emphasis on individual actors and their trajectories and experiences in complex landscapes of practice” (Omidvar & Kislov, 2013, p. 272).

Within the community of practice of the DFM PhD program this last theoretical iteration assists in explaining the interactions of the DFM doctoral students within the landscape of practice of the DFM research program.

The PhD students within the DFM PhD program are individually responsible for the knowledgeability within their specific research fields. Knowledgeability here:

“is not defined by the regime of competence of a single community but gets negotiated within a broader landscape including a set of practices in which an actor does not claim competence” (Omidvar & Kislov, 2013, p. 272).

Within the complex landscape of practice of DFM this means that all stakeholders who have multi-memberships within the DFM community of practice and their broader landscape of practice are responsible not just for their own knowledgeability but also for building the collective knowledgeability of the community. Universities should be active rather than passive in knowledgeability building, as Wenger-Trayner and Wenger-Trayner (2014, p. 158) argue:

“universities should come to play a convening role across complex landscapes of practice; not simply providing or transmitting knowledge but convening the co-construction of new forms of knowledge, new practices, and social change”.

3. Contextualising co-creation

As stated earlier, an essential by-product of the contested space of co-creation is learning. Bringing together multiple and diverse voices creates the “potential for unexpected learning. The meeting of perspectives can be rich in new insights, radical innovation, and great progress” (Wenger-Trayner & Wenger-Trayner, 2014, p. 17). To reiterate, co-creation is not easy. However, boundary crossing and boundary encounters of disparate individuals who each have their own personal knowledgeability are learning assets. Within the DFM the five principles act as a broker between the boundary encounters that occur within co-creation. Each of the co-authors of this paper brought their own knowledgeability to the project of writing this paper. In the landscape of practice of writing the paper knowledgeability occurred within the boundaries of the project and the authors’ own contributions through co-creation and collaboration became collective knowledge within the community of

practice. The result is a dynamic shared knowledgeability. Degnegaard (2014, p. 107) anticipated such a result, writing that:

“co-creation settings will result in a dynamic value concept...[since] value potential can only be captured in the relation between stakeholders”.

Furthermore, within the community of practice of the DFM landscape of practice everybody is considered a co-creator within the projects instead of being singly a stakeholder, actor, user, consumer, or participant (Brown, 2008; Brown & Wyatt, 2010; Greenbaum & Loi, 2012; Sanders & Stappers, 2008; Steen, 2011).

4. Knowledgeability in practice

This case study begins by defining the five principles that encapsulate the DFM. These principles illustrate the collective knowledgeability of the seven co-authors. Five of the co-authors have written to one specific principle that relates to their current co-contribution to the DFM. The first principle ‘safety is everything’ encompasses not only physical safety but also emotional and intellectual safety. DFM creates an environment where it is safe for students, academics and external collaborators to contribute to the conversation, explore ideas and challenges norms. The second principle ‘fail forward to learn fast’ means that failure is not the end result but is part of the ongoing process of an innovation outcome. Failure is seen as a learning tool that supports risk within DFM. The third principle ‘your parents don’t work here’ applies responsibility, independence and accountability factors to all individuals who walk through the doors of DFM. The fourth principle ‘talk to someone new’ reflects DFM as an open environment where multiple stakeholders with diverse backgrounds and diverse knowledge co-create together. The fifth principle ‘all people have potential’ refers to a belief in people and their contributions. The principles are intertwined with one another and are under constant development to create the underlying culture that both overtly and tacitly guides the DFM community. This guidance is propelled towards creating a safe environment to explore and learn from failure, respecting the opinions of others while talking newcomers and individuals taking responsibility for their own actions. The following sections present the five individual narratives that co-create the case study.

Crucially the principles encourage idea generation through fostering a safe environment with a low hierarchical structure that encourages all within the community of practice to express ideas and discuss them openly without fear of crossing hierarchical boundaries. Most importantly, this model for conducting industry integrated doctoral research requires co-creation of problem-solving between all community practitioners. The model provides a fluid, adaptable physical location combined with a receptive but sharp intellectual space in which safety, risk, individuality and community lead industry and university to collaborate and co-create through the doctoral researcher. The DFM space itself is an environment and a cue for the community of practice and influences the doctoral researchers and the way they engage with industry partners and participate in design research.

3.1 Principle one: Safety is everything

My research focuses on outpatient experience within a hospital environment. This resulted in a new research partnership with a large Australian hospital. As a new research partner, the hospital is cautious to clarify how the collaboration can work given the differing work and research practices. Managing the hospital's expectations and understanding of research and design has been top priority as co-creation is not easy when involving stakeholders from different research fields. DFM teaches important real world learning skills of communication (not only of content but also process) and stakeholder management is an important component of the PhD learning.

The principle of 'safety is everything' summarises the stage that my research project is at. Stakeholder management is crucial to ensuring that the industry, university and doctoral candidate feel safe to conduct research, collaborate and engage people to develop innovative outcomes to the negotiated and complex problems discussed. DFM provides a safe place for the industry partner to experiment and co-create with this new model of research. DFM's environment is crucial to the collaboration between the industry partner and me. The environment is purposely designed to foster collaboration and co-creation. As the industry partner's engagement increases, it is DFM's and my responsibility to foster both a physical and mentally safe environment for this industry engagement and co-creative research to happen.

In traditional industry based doctoral studies the candidate would be employed at the hospital and thus expected to conduct their research under the supervision of a hospital member. However DFM's model values the partnership of the industry and doctoral candidate. The industry collaborator takes on a co-invested role within the research through co-creation of the problem context and design research planning. This breaks the tradition of collaboration by association commonly practised by universities with industry based doctoral candidates. In DFM's model supervisors are not seen as authority, in this context this is redundant and a departure from the traditional model of the role of supervising a PhD. In this context supervisors provide safe guidance and facilitate co-creative experience learning within DFM's PhD Program.

3.2 Principle two: Fail forward to learn fast

The principle 'fail forward to learn fast' guides the process of rapid exploration, iteration and evaluation that has formed a key part of my research. In this case I define failure as the absence of a linear answer as I believe that this best describes the views of industry. Failure within the DFM is seen as an on-going part of the innovation process. The safe environment allows failure to be seen as a learning tool within a broader research process.

Working with an Australian company in the recycling industry my research focuses on design integration with material science. DFM encourages students to accept failure and to utilise it as a learning tool in their projects and I have carried this through into my doctoral studies.

My research has been a process of continuous iteration sometimes moving backwards and then moving forwards depending on my communication with the industry partner and the unfolding layers of knowledge gathered through robust conversations with industry and academic experts.

The idea of co-creation and not getting a correct answer was at first confronting to the industry partner. Co-creative workshops between academia and industry generated a large amount of content as participants were encouraged to adopt the DFM principles and accept that failure with multiple outcomes to the proposed problem was part of the process. Co-creation without linear deliverables was an atypical model for the industry partner providing new and different or unexpected outcomes. This process of involving the industry partner in the research had a two-fold effect. Firstly is allowed for exploration of more radical ideas to be proposed and secondly the industry partner became accountable for their part in the research. A fear of failure would cripple this innovation process however using it as a learning tool and accepting failure as part of the process allows more radical ideas to be explored that can often lead to unexpected outcomes and radical innovation.

This principle, 'fail forward to succeed fast', was only possible because it occurred in a safe collaborative environment. Having previously worked together the DFM and the researcher have fostered a relationship with the industry partner that has built trust in the DFM process. Without this trust the industry partner would be unfamiliar with the co-creation model and therefore not as willing to dedicate time and risk resources.

3.3 Principle three: Your parents don't work here

In this case the DFM principle 'your parents don't work here' is interpreted in multiple ways. It is a statement that can be viewed as a prompt to take responsibility for yourself and the DF you occupy. Students also interpret the statement as a reminder that despite being students in a learning environment, they are viewed and treated as adults and professionals within the DF and thus, should act accordingly. It is also a statement that suggests there is mutual respect between all participants. This includes respect between students, academics, researchers and external collaborators. It is therefore a statement that refers to responsibility, independence and accountability in relation to individuals' involvement and participation in the DF they occupy.

Sanders and Stappers (2012, p.135) state:

"diverse perspectives have the potential to set up a conflict between the interests of the student (learning) and the client (insights). The more time and/or money the client invests in the student project, the more likely these issues are to arise".

It is therefore important that all stakeholders involved within a co-creative industry-led project are aware of their responsibilities and are accountable for their own involvement. This awareness is done with sensitivity, it is mitigated through co-created shared meaning and expectation workshops. Combining multiple voices, perspective and the opportunity to:

“engage with the perspectives of other practices...can produce a two-way critical stance through multiple process of critique and engagement in reflection” (Wenger-Trayner & Wenger-Trayner, 2014, p. 19).

Which can strengthen the landscape of practice of the DFM community of practice and the given project.

I have been involved with DFM since undertaking my Masters at Swinburne. While participating within industry-integrated innovation programs with DFM the principle ‘your parent don’t work here’ has had different meanings. It was not until I commenced my PhD studies two years ago within DFM that the principle had connotations of promoting independence within my doctoral studies and involvement within DFM and the wider Design Factory Global Network (DFGN). During my PhD studies I have been provided with experience of overseas field research and visiting my industry sponsor who is located overseas. It was during my overseas field research that I became responsible for my research direction, organisation and orchestration of my field research. Support and guidance were provided by my supervisors, industry sponsor and the DFGN, however, I was ultimately accountable for conducting the research. DFM being part of a global network has the value of a diverse and complex community of practices who are willing and able to assist network members. The community of practices of the DFGN have provided support and guidance for my research outside of my supervisors and industry sponsor. The complex interplay that exists within my PhD studies between supervisors, industry partner and the DFGN functions because there is a shared understanding and awareness between all stakeholders. The stakeholders are aware of their own role and expectations in the research, thus providing an environment in which responsibility and independence are fostered. The supervisors, industry partner and the DFGN are there to act as guides, however, through the ethos of the DFGN, DFM and its PhD program there is a shared understanding that independence provides the opportunity for people to experiment and build on a level of resilience and skills gained through being a member of the community of practice.

3.4 Principle four: Talk to someone new

In this case study I interpret the DFM principle ‘talk to someone new’ from my perspective as an academic staff member who entered the DFM physical and intellectual space to work with the three doctoral candidates as part of their research training. For me, ‘Talk to someone new’ meant that I learned a new language, the language of co-creation, and a new way of interacting with a community of practice.

In the DF I came face to face with a doctoral learning and working environment that was different in the ways it seemed to dispense with traditional hierarchical structures. It was also different in the ways the three PhDs expected and had equal, opaque partnerships with their supervisors, their external industry partners, with each other, and with me. As part of

the DFM community of practice, I was also part of discussion where PhDs were given responsibility for managing problems beyond the DFM itself both within the university and in industry. I came to learn this was normalised DFM practice based on mutual expectations of trust, responsibility and accountability.

In my field of research training there has been long-running debate about doctoral supervision in Australia from the 1980s onwards. My own experience of PhD supervision has been different to the DFM's co-created supervision that entrusted so much responsibility to PhD students for managing their own research outside the university context. The DFM form of supervision scaffolded accountability through experiential learning, not just in doctoral research but also in working with all stakeholders. This meant that PhDs were guided in working with their industry partnerships and given increasing responsibility for managing these. As for this paper as an artefact of talking to someone new, I had written joint papers before but never with seven different voices all talking, arguing and writing, first asynchronously and then synchronously, to co-construct shared meaning. It was complex, it was not easy, and it was different, but it offered new and unexpected learning.

3.5 Principle five: All people have potential

“All people are creative... [and] all people have ideas and contribute to the design process” (Sanders & Stappers, 2012, p.8). The fifth principle ‘all people have potential’ can refer to several aspects in DFM. As the coach at DFM it is my role to be the voice of the whole community of practice. I oversee the culture at DFM, and as the culture represents all people, by default my approach to everyone is that they all have potential and they all bring value in several forms to the community. In line with Hewlett, Marshall and Sherbin's work (2013) diversity boosts innovation by creating an environment where all people are valuable.

Diversity adds value in two different ways. ‘All people have potential’ applies to inherent diversity, as by default any person with any inherent attributes, that is, attributes the person is born with like gender, ethnicity and nationality, is valuable and adds to the overall combination of attributes in the whole community. This also relates to innovation, as it is said that innovation lies in the cross-section of different bodies of knowledge, and making the connection between two unconnected points sparks the innovation.

In addition to inherent diversity, acquired diversity as in personal traits a person gains from an experience and/or through learning, (Hewlett, Marshall and Sherbin 2013) plays a major role in building the community in DFM. As teachers and supporters of the community members which includes students, industry partners, researchers, we have the mindset that everyone has the potential to learn and acquire any necessary skills. This is in line with growth mindset thinking (Dweck 2012) which manifests that intelligence and ability can be developed and effort is seen as a path to mastery. Furthermore, research (Hewlett, Marshall and Sherbin 2013) supports that leaders with acquired diversity are more likely to apply behavior that sparks innovation, which is in line with DFM's principles. Leaders with acquired diversity are more likely to behave more inclusively and cultivate an inclusive

culture ensuring that everyone is heard, making it safe to propose novel ideas, giving decision-making authority, sharing credit for success and giving actionable feedback. It is important to note that attributes closely linked with innovation like creativity are not inherent attributes but acquired, which in line with Sanders and Stappers's work (2012).

Another issue in my role is coaching as pedagogical style, which relates to unleashing the potential in people. Coaching focuses on reaching a desired future state and the role of the coach is to support from behind; the coachee chooses the direction forward (Maclean and Hudson 2012). Specific tools taught by the coach form part of the curriculum. For example, students learn the feedback method tool 'I like, I wish' which is inspired by the Stanford d.school method (Stanford University d.school 2010), further developed by Rekonen (2014). The goal of the tool is to learn feedback given in a way, which is constructive, actionable and towards a desired future state. Emphasising the principle 'all people have potential', as coach, it is my responsibility to ensure that the coachee, who can be any community member in DFM, understands that oneself is the focal and starting point of any actions and behavior for change.

Finally, the principle extends beyond people and combines the mindset of focusing on achieving a future state. All ideas contain a tiny trace of innovation and in my role I aim to extract the positive aspects and form them into actionable items from constructive feedback, explorative projects, combination of knowledge sets without clear connection.

4. Conclusion

In summary the core guiding principles that form the ethos of DFM are interlinked, intertwined and evolve as participants of DFM engage with one another, research and industry. The need for universities and industry/business to engage with each other and for universities to ensure research graduates have skills that industry/business require have been points often raised in Australian Government publications (see for example the recently released review *Higher Education Funding in Australia, 2015* or *Defining Quality for Research Training in Australia, 2011*; *Research Skills for an Innovative Future, 2011*; *Boosting the commercial returns from research, 2014*). Through engaging with the principles of safety and failure the candidates and their supervisors have built a solid foundation with the industry partners. They have formed a common language, expectations, respect and trust that have provided the foundation for the doctoral candidates to be independent and demonstrate leadership within their research and their community of practice. The level of independence within each candidate's doctoral studies provides the opportunity for each to conduct their research locally or overseas and to formulate the community of practice of their research within loose boundaries provided by the supervisors and industry sponsors.

This paper has demonstrated how the five DFM community of practice principles of respect, independence, safety, experimentation and communication guide co-creation in DFM community of practice and affect the industry-integrated doctoral program. This paper is a

co-created artefact of the DFM community of practice. As stated at the start of the paper, co-creation is not easy. This paper has not been easy to write and has involved rigorous argument, contestation and robust debate working towards shared meaning. In that sense we agree that the artefact is incomplete, but we also agree that the process of co-creation has been worthwhile, and we will continue to co-create in this way as an on-going iterative process in the future.

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