Knowing Practice:
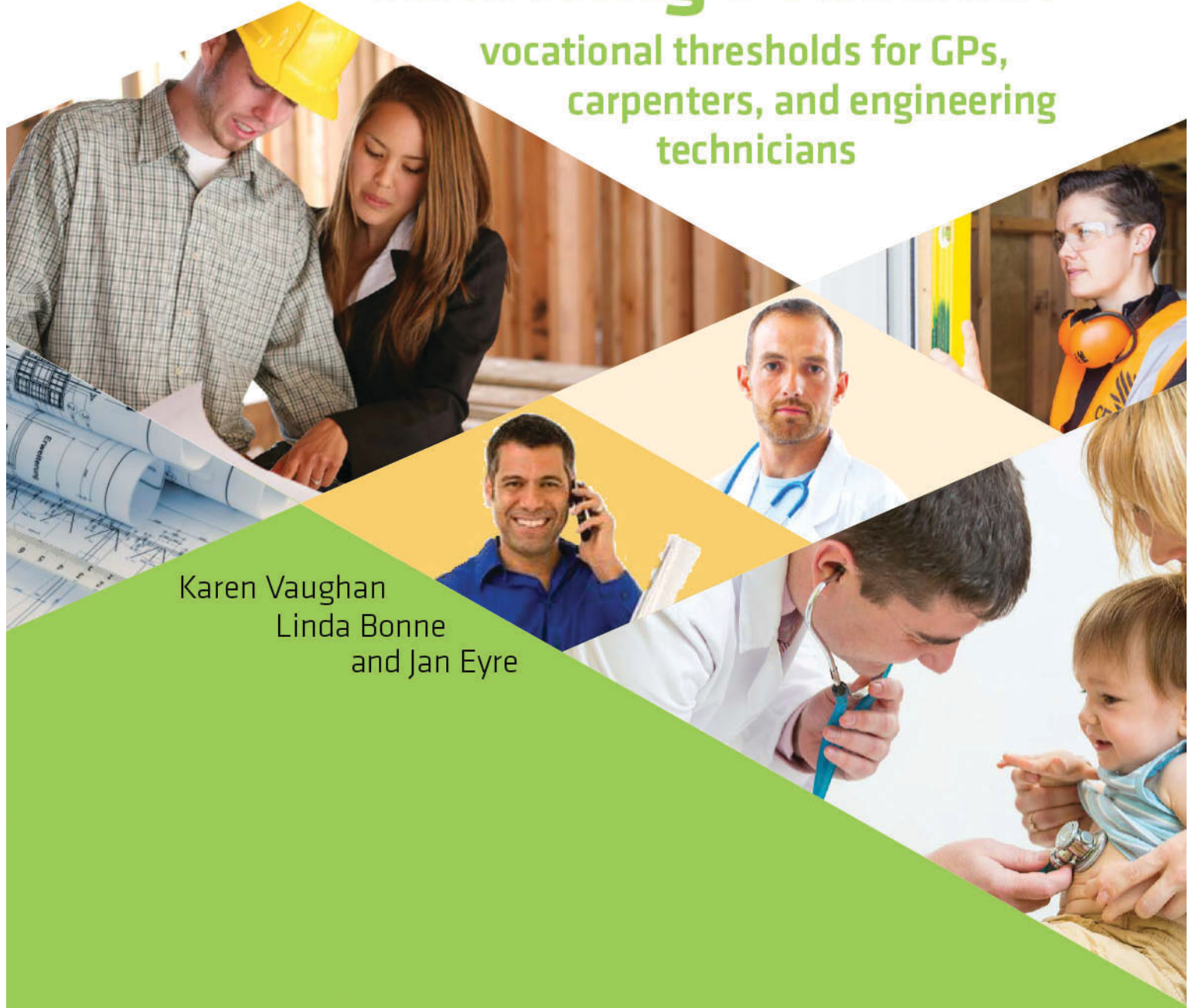
vocational thresholds for GPs, carpenters, and engineering technicians

Karen Vaughan
Linda Bonne
and Jan Eyre

Acknowledgements

Table of Contents

Tables

Figures

Appendices

1. Introduction to the project and approach

> For days and days, you make out only the fragments of what to do. And then one day you've got the thing whole. Conscious learning becomes unconscious knowledge, and you cannot say precisely how. (Gawande, 2002, p. 21)

In his book, *Complications,* Gawande is talking about surgical practice. However, his observation about practice development could apply to many different fields. It is indeed difficult to say precisely how someone becomes a capable practitioner. As a research team, we have at times struggled to understand and articulate our own processes of learning about and through research, while knowing that these processes certainly do contribute inexorably to something we will call in this report "vocational capability".

The enigmatic quality of practice development is of course contained within the word itself. As a noun "practice" refers to the carrying out of an idea and a way of doing things. As a verb it indicates regular performance and development that is ongoing. In certain professions this is an accepted and widely known thing. Doctors *practise* medicine in their medical *practice* and solicitors *practise* law in their legal *practice*, indicating that we members of the public who avail ourselves of these services are not simply making a money-for-service transaction. We are also participating—albeit perhaps unwittingly—in something far more complex, i.e., the continual building of someone's capability.

In this report we understand capability as something much more than technical competence to do a job. It certainly involves knowledge and skills. However, it also has an ontological or "being" dimension. Capability is not an individual possession so much as a collectively situated affair. It resides in the complexities of daily practice, in which knowledge is "continually reconstructed through the relationships and interactions between individuals" (Lee et al., 2004, p. 6). This three-dimensional view of capability—knowing, doing, and being—is based in Nussbaum's work on capabilities, which Scherrer (2014) summarises as: "not just abilities residing inside a person but also the freedoms or opportunities created by a combination of personal abilities and the political, social, and economic environment" (p. 20).

So when someone is building vocational capability they are not only knowing things, and doing things, they are *being* something. The latter is also intimately connected to being located *somewhere* within a "community of practice" which is based on a commitment to learning together about common issues through collegial, rather than reporting, relationships (Lave & Wenger, 1991; Wenger, McDermott, & Snyder, 2002). That community of practice is crucial to helping shape and legitimise practitioners' knowledge, not as possessed and inert but as knowledge-in-practice.

> If your doctor informed you that he had seen many patients in the last twenty years, but had not talked to any colleague, read any new article, or participated in any conference, you may question whether he was really qualified to deal with your health. Conversely, if he told you that he had read endless articles, but not treated any patients, you would have the same question about his legitimacy. You trust practitioners like your doctor to help you both for their experience and personal characteristics, and also because their actions reflect a competence defined by their community. (Wenger-Trayner & Wenger-Trayner, 2015, p. 14)

We therefore take vocational capability as a goal for learner-practitioners and focus on the process of practice-based learning towards this—with practice-based learning foregrounding learning-by-doing and structured novice-to-expert progression during employment-related practice. Practice-based learning is also variously known as "apprenticeship", "practicum" and "vocational immersion". The practice-based approach is increasingly important around the world. Education programmes are moving away from a simple alignment of "the theory" with classroom learning and "the practical" with work know-how. Workplace learning experiences are now an important part of becoming a knowledgeable, skilled and professional practitioner in all kinds of areas.

Begun in July 2013, the *Knowing Practice* project aimed to understand the way in which practice-based learning functioned. In particular we focused on:

- how learners integrate theory and practice, as these are often separately resourced and sequenced
- how workplace experiences are useful for learning, and could be more so.

We chose three different fields for the project: general practice medicine, carpentry, and civil engineering technician work. This report is a discussion of findings from our interviews and observations with learner-practitioners and their formal on-job learning supporters:

- **General practice medicine registrars** in the GPEP programme with the Royal New Zealand College of General Practitioners (RNZCGP)
- **Carpentry apprentices** in managed apprenticeships with the Building and Construction Industry Training Organisation (BCITO)
- **Engineering technician cadets** in companies associated with the Institution of Professional Engineers New Zealand's (IPENZ) Futureintech initiative.

The following table shows the learning and assessment features of each field. There is a fuller description in the Appendix.

Table 1 **Practice-based learning for GPs, carpenters and engineering technicians**

	General practice medicine	Carpentry	Engineering (technician)
Arrangements	RNZCGP's General Practice Education Programme (GPEP)	BCITO's managed apprenticeship	Cadetship with companies associated with the IPENZ Futureintech initiative
On-job learning	Everyday work GP teacher sessions (Year 1 only)	Everyday work Training advisor visit (min. 4 per year)	Everyday work Mentor meetings (monthly or as agreed)
Off-job learning	Learning group (weekly for year 1; 6–8 annually for years 2 and 3) Medical seminars (weekly for year 1) Self-directed as necessary	Self-directed as necessary	ITP classroom-based programme (weekly) Self-directed as necessary
Credential	Vocational registration with the RNZCGP	National Certificate (to become NZ Certificate) in Carpentry Level 4	New Zealand Diploma in Engineering Level 6 (also NZDE Practical)
Typical duration	3 years full-time	4 years full-time	5 years part-time
Learner support roles	GP teacher Medical educator	Employer Foreman Training advisor	Mentor Team leader ITP teacher
Formally assessed learning content	Syllabus ("scaffolds") Driven by the daily work	Carpentry standards or specification Driven by the daily work	Engineering standards Driven by the ITP programme
Assessment	Exam (year 1) Medical educator assessment (years 2 and 3)	Training Advisor Evaluator (employer or foreman)	Exam (ITP)

Approach to the Knowing Practice project

Knowing Practice has at its heart an understanding of learning as socio-cultural and as involving situated cognition. We understand people as fundamentally social beings and that their learning is situated and given meaning through the relations, content, and context of their world. This contrasts with cognitivist models of learning which focus more on individual, internal minds which are more separate from context and from the body. The idea of situated learning is closely related to learning through participation in communities of practice (Lave & Wenger, 1991)

where people engage in collective learning, mediated by (material and symbolic) tools, often as part of their development as practitioners in different fields. More recently this idea has been extended to the idea that people actually participate in a range of different communities—a "landscape of practice"—and there are important "boundary encounters" for learning (Wenger-Trayner & Wenger-Trayner, 2015). For example, carpenters may learn from interacting with architects and plumbers; GPs may learn from interacting with specialists and pharmacists; engineering technicians may learn from interacting with contractors and community groups.

We use the term "practice-based learning" rather than "apprenticeship" to make the nature of the learning central (the concept of apprenticeship), rather than the funding model (the institution of apprenticeship). Using practice-based learning is also a signal that we are talking about something broader than the industrial and pre-industrial age image of trades and artisan work. Forms of apprenticeship—practice-based learning—increasingly apply to knowledge workers (and have long applied to the later stages of practitioner development in some areas like midwifery and teaching) and today involve formal learning that extends beyond the point of initial certification.

Our approach of combining quite different occupational fields and industry contexts within one study allowed us to analyse the different adaptations and manifestations of practice-based learning principles *and* to see the similarities (in learning arrangements and nature of work issues) across those fields. By looking at education programmes that are apprenticeship-like in their expertise-through-experience form, and that have a connection to communities of practice and ongoing professional development, we can consider apparently incongruent disciplinary fields and systems such as those related to "technical" trades occupations alongside those involving university-based "professional" learning. This makes the project relevant to a wider group of learners than only those involved in formal apprenticeships, which involve a fairly small group of learners in tertiary education. Our focus across different practice fields also allows us to question conventional ideas about occupational hierarchies and status which tend to reinforce ideas of, for example, a brain-work/manual-work split in labour, or assumptions that builders are less intelligent than doctors.

Participation and fieldwork

Working with stakeholder organisations and recruitment
We worked with the stakeholder organisations (RNZCGP, BCITO and IPENZ) to recruit participants for the study. Working within the constraints of budget and timeframes, we wanted around 16 learner-participants for each field. We developed the following participation criteria:

- Learner-practitioners are engaged in structured, practice-based learning pathways (employed while they learn).
- There are on-job trainers/teachers and formal mentors or supervisors for the learner-practitioners.
- Where possible they are in the first or second year of their apprenticeship or programme.

- They are based in the Auckland or Canterbury regions, because these are
- broadly representative of the spread of practitioners in the fields
- where regional economies are comparatively strong and likely to mean our participants will remain employed for the duration of the project
- where our project budget can be most efficiently spent.

The project was not large enough for us to make gender or ethnicity mix a requirement (nor was it a particular focus for the project), although we were aware that, within each field, there are gender imbalances (e.g., there are fewer males than females in general practice medicine; almost no carpenters are female; and there are few female engineering technician cadets).

We did *not* consider the following participants suitable for inclusion:

- Learner-practitioners who constitute a known risk to the project's participation rates (e.g., known by their stakeholder organisations, or through an initial recruitment conversation with us, as likely to leave the field or go overseas before the project's completion)
- Learners who learn/work in such highly specialised settings that it would be difficult for us to grasp the general characteristics of the occupation and its learning demands (e.g., a GP registrar dealing only with end-of-life patients; a carpentry apprentice in a pre-nailed truss business)
- Learners who work for employers or in workplaces that would make it difficult for us to learn anything useful (i.e., businesses that are known by the stakeholder organisations to offer very poor learning opportunities or are about to cease trading for some reason)
- GP registrars who did their medical degree overseas and could not provide us with perspectives on New Zealand medical training leading into, and integrating with, their current practice-based learning.

Recruitment practices varied slightly but broadly used a snowball sampling approach. We involved each stakeholder organisation as a first point of contact in talking to potential participants or making a call for voluntary participation through internal communication means. For example, the RNZCGP advertised the project in its *ePulse* online newsletter to GPs, requesting volunteers to get in touch with the research team. We were then contacted by a range of GP teachers and GP registrars interested in participating. The BCITO asked its training advisors to recommend employers and apprentices they thought suitable and likely to be willing to participate. IPENZ contacted several large engineering companies on our behalf, who in turn put out a call for volunteers.

In total, we had 41 learner-practitioners participating. When we began the project, all but three of the GP registrars were in their first year of the GPEP. Three carpentry apprentices were in their first year; four in their second year; and eight in their third year (three completed their apprenticeships recently). Seven of the engineering cadets were in their first year of the cadetship and NZDE studies; the other five were further along, with two of the latter enrolled for the NZDEP (one completing this recently).

Our design required "matched pairs" or sets of learner-practitioners and their mentors or teachers. This meant we could not always confirm one person's participation until we had confirmation from the person in the other role. Usually we began with the learner-practitioner and went from there. However, as is the case with all research projects, there was no perfect sampling method and no perfect resultant sample. For example, despite speaking to the carpentry apprentices' employers, we just never managed to "pin down" some of them for a formal interview; however, we did interview all of their training advisors.

In other cases, the mentors or teachers for learner-practitioners in one field had different roles. For example, we mostly interviewed GP registrars and their GP teachers but sometimes we instead interviewed their Learning Group medical educators. In fact we recruited several GP registrars through their Learning Group after medical educators got in touch with us wanting to participate. The two major engineering organisations put out a call for participation and then provided us with a list of cadets when we needed a "top up" in numbers. We then contacted these cadets asking for interest in the project. We also recruited several through other cadets already confirmed as participants, when they knew of someone else in their office who might be interested.

The project was approved by the NZCER Ethics Committee. All participants were provided with verbal and written information about the project and promised confidentiality and anonymity (with the proviso that, in some cases, their company or stakeholder organisation may know they were contacted or are participating). We use pseudonyms throughout this report, with first or second interview indicated by number after the name. The following table shows participation and fieldwork.

Table 2 **Knowing Practice fieldwork**

		General practice	Carpentry	Engineering
Interviews	Learner-practitioners	14 registrars in 12 (small) businesses (including several multi-clinic practices) 14 first interviews; 12 second interviews	15 apprentices in 14 small businesses (15 first interviews; 11 second interviews)	12 cadets in 2 large organisations ("Company A and Company B") (12 first interviews; 11 second interviews)
	Learning support practitioners	6 GP teachers 2 medical educators (covering 8 of the registrars)	14 trainers (employed and foremen) 4 training advisors (covering 14 apprentices)	8 mentors 3 technical or team leaders 1 manager
Observations	Learning support sessions in addition to on-job learning	5 one-on-one teaching sessions 4 learning groups 1 medical education assessment visit 1 mixed group session	14 assessment visits (apprentice + training advisor)	7 mentoring meetings

Interviews and observations

We had two rounds of fieldwork. For the first, we observed a business-as-usual teaching or mentoring session in order to get a sense of the work, and what actually goes on in the formalised or semi-formalised parts of practice-based learning arrangements, without relying solely on participants' descriptions of what happens (e.g., in interviews).

We then interviewed the learner-practitioner and teacher or mentor in turn, face-to-face. We also asked learner-practitioners to show us where and how they recorded any learning (e.g., portfolios, sketches, photographs). We used the latter mainly to help us understand the participant's perspectives or as a prompt for discussion during interviews.

Interview questions for the mentors and teachers focused on:

• their perspectives about their role and supporting the registrar/apprentice/cadet
• the stakeholder organisation's support of them in their role, as well as learners
• their ideas about particularly significant learning experiences for learners in the field that could help learners understand what it means to be a GP/carpenter/engineering technician
• their perspectives about the integration of theory and practice in their field.

Interview questions for the learner-practitioners focused on background and context and their perspectives about their learning. We asked about:

- how they found the meeting/session
- how their mentor or teacher supports them (and who else does)
- how they know how well they are doing in their programme/apprenticeship (and how they keep track e.g., written or photographic records)
- how they find the programme/apprenticeship resources
- their most significant learning experience that has helped them understand what it means to be a GP/carpenter/engineering technician
- their perspectives about the integration of theory and practice in their field.

We had adapted our interview question about significant learning experiences from Grossman et al.'s (2009) study of career preparation for the clergy, teaching, and clinical psychology. Grossman et al.'s interview question was about "courses and experiences" that had the most powerful influence on people's development as teachers, clergy members, or psychologists. Their study was focused on learners and their *preparation* for work in teaching, ministries, and psychology. In contrast, our study was focused on the nature of practice-based learning and our participants were therefore already working in their field, with additional, systematic learning arrangements. So we asked about *experiences* (not courses) that shaped their development and nearly all interviewees talked about experiences they had had in the course of their work.

We conducted a second round of interviews with only the learner-practitioners, between eight and 12 months after the first ones. Learner-practitioners' stories of significant learning from their first interviews seemed a very fruitful line to follow and so the second interviews were designed to probe further those stories, as well as asking about further significant learning experiences. In the second interview we asked interviewees about:

- their initial story of a significant learning experience: What exactly happened? What did they learn? What, if anything, about their practice has changed as a result? Have they had another significant learning experience since the first interview—if so, what happened?
- what structures, practices or people might have facilitated the learning that had occurred?
- an imaginary line running from left to right, indicating practitioners in their field who are *not* very good, through to those who are very good. What characterised the practitioners at either end of the continuum? Where did they think they were on the imaginary line currently and why? What were their hopes and concerns about their own development?

Developing the notion of "**vocational thresholds**"

Through the report we develop an idea of "vocational thresholds" as a way to frame learner-practitioners' workplace learning experiences. We argue that these vocational thresholds incorporate significant shifts for learner-practitioners that are ontological (about their way of being), as well as epistemological (about what, and how, they know). We argue that deepening our understanding of these shifts offers opportunities to better support learner-practitioners in their development.

Using *threshold concepts* (Meyer & Land, 2003) as a starting point, we developed the idea of *vocational thresholds* to look at how our learner-practitioners develop capability in their fields. As learner-practitioners engage in practice, it seems there are certain kinds of experiences at work which are particularly valuable in practice development. These experiences are transformational learning ones, usually involving identity work, and they open up a new set of practice spaces in which people can not only know, and do, but also "be" as practitioners.

The idea of vocational thresholds first developed in response to our inductive approach to the data. After the first interviews, we sought patterns in meaning, moving iteratively between our field notes and verbatim quotes from interviews, and identifying and refining themes about learning content, impact, and context. We noticed common elements in the stories that learner-practitioners told about their most significant learning experiences. We decided to extend the narrative enquiry approach, using the second interview to enquire into the first interview stories and other stories of significant learning experiences.

Following the second interviews, we created a working model of vocational thresholds in a set of spreadsheets populated with interview data so we could analyse the learning described by respondents. This allowed us to develop the idea that certain kinds of experiences, and certain kinds of individual and organisational responses to those experiences, could propel people into a new practice space. It seemed that learner-practitioners could, or perhaps should, cross certain vocational thresholds in order to develop capability in their field.

The idea of vocational thresholds takes its cue from threshold concepts, most prominently theorised by Meyer and Land (2003) as concepts which move people to a new understanding from which they cannot turn back. Meyer and Land's work sets out threshold concepts as having five characteristics, summarised as:

- transformative in perception and perspective
- irreversible and unlikely to be forgotten (often)
- integrative of different and previously hidden aspects
- bounded conceptually (possibly)
- troublesome in relation to previous beliefs (possibly).

The epistemological (knowledge-related) dimension of Meyer and Land's work has been particularly embraced in tertiary education. Educators have been interested to identify the gateway concepts in a course. These promise to unveil a way of (disciplinary and disciplined) thinking or make intelligible a set of subsequent concepts for students. They help isolate the points at which students have difficulty and educators can direct more attention. Atherton, Hadfield & Meyers (2008) point out that threshold concepts have been understood as lending themselves to "hard" disciplines like science and economics, rather than "softer" or more applied ones like teaching.

A lot of research has focused on the implications of threshold concepts for the purposes of course design (Harlow & Cowie, 2013; Timmermans, 2014), for example, critical reflection in social work (Foote, 2013). Educators may use the idea of threshold concepts to understand where

students have difficulties and offer resistance to certain pieces of knowledge (Cousin, 2006). Engineering educators have a long history of engaging with threshold concepts, particularly to enhance students' problem-solving skills (Meyer, Knight, Callagahan, & Baldock, 2015). In these instances, the focus is on improving learners' overall quality of understanding and helping educators understand why learners may have such trouble reaching for it.

As useful as those investigations are, there can be a tendency to under-emphasise the ontological or "way of being" demands placed on learners. Although less explored in the research, this is clearly an important dimension of threshold concepts. Timmermans' (2014) study of educational developers (similar to "facilitators" in New Zealand) identified the threshold concepts of conceptualising collaboration, adoption of a scholarly approach to practice, and reflection, as crucial in developers' work. Harrison & Clayton (2012) examined the threshold concept of reciprocity for faculty who had been required by a policy change to work differently and had to learn to partner with community for their "service learning" courses. The threshold concepts in these cases were both epistemological—they required people to know and understand things differently. But they were also ontological—people had to "be" different and understand themselves within their work differently, in order to develop the capabilities required.

The ontological or "way of being" dimension in threshold concepts is particularly relevant to vocational thresholds. Vocational thresholds shift practitioners' identity, with identity being an important part of capability development in many fields. Vocational identity can be understood as the negotiated fit between self-perception and occupational perception (Klotz, Billett, & Winther, 2014). So learning in relation to a practice field is not simply about acquiring knowledge of that field, and the skills to do things within it. It is also "the becoming of a person who inhabits the landscape ... This journey within and across practices shapes who we are" (Wenger-Trayner & Wenger-Trayner, 2015, p. 19).

> Participation here refers not just to local events of engagement in certain activities with certain people, but to a more encompassing process of being active participants in the practices of social communities and constructing identities in relation to these communities. Participating in a playground clique or in a work team, for instance, is both a kind of action and a form of belonging. Such participation shapes not only what we do, but also who we are and how we interpret what we do. (Wenger, 1998, p. 4)

Vocational identity is a process then, enacted through practice, rather than a pre-existing thing to be revealed like a banana being peeled. Practice experiences can therefore be threshold ones—transformational, irreversible, and integrative in nature, possibly also involving bounded concepts and troublesome knowledge. Vocational thresholds variously involve changes in understanding and practice in relation to work subject matter, field-related worldview, and one's place and sense of self as a practitioner.

Vocational identity, as a process in which we "relentlessly find ourselves in the act of becoming; of seeking to belong" (Goodson & Adair, 2006, p. 5) is intimately bound up with workplace identity. Integration into a workplace is part of negotiating the fit between self-perception and

occupational perception (Klotz, et al, 2014). Chan's (2011) work on bakery apprenticeship is a good illustration of this. Even though most bakery apprentices enter the field through happenstance, it is their *belonging* to a bakery and attentive participation in baking (e.g., achieving consistency with constant vigilance over inherently variable products like yeast or flour) that leads to a sense of pride in craft and actually *being* bakers.

As with threshold concepts, there is an amorphous quality to vocational thresholds whereby some, but not all, of the five key characteristics may be evident. Vocational thresholds are, by definition, transformative, irreversible, and integrative. They may also be troublesome, as with some threshold concepts. They may sometimes involve bounded concepts, as threshold concepts sometimes do (Meyer and Land, 1983, refer to this as "possible"), but it seems less likely as the idea of vocational thresholds de-emphasises the epistemological (about knowledge) and highlights the ontological (about being).

There are three other important differences between threshold concepts and vocational thresholds. Firstly vocational thresholds are based on lived (especially everyday practice) experience rather than classroom-based learning. Secondly there may be multiple vocational thresholds to be crossed by practitioners in development at different times, rather than a single conceptual transformation. Thirdly the idea of vocational thresholds foregrounds demands on learners in terms of how to "be" is over a focus on the demands of learning a gateway concept. The following diagram illustrates the vocational threshold process. It shows that, within everyday practice, there may be transformational experiences which build vocational identity, and lead to crossing a vocational threshold. The cyclic arrows indicate that this process may reoccur, with each crossing feeding into other transformative experiences and so forth.

Figure 1 **The vocational threshold process**
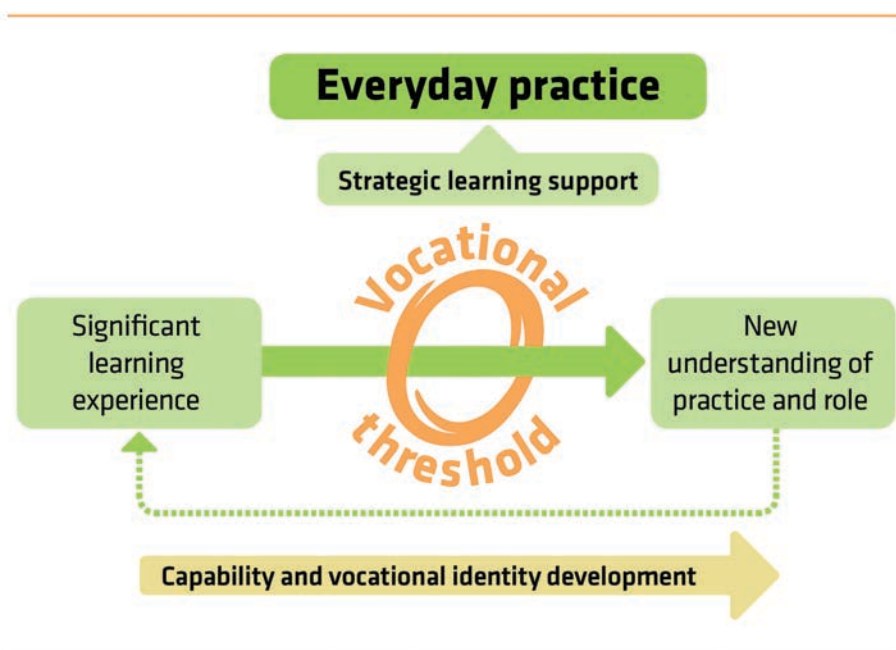
A note about the structure of this report

Working across three very different fields—general practice medicine, carpentry, and engineering—is not only challenging for the project itself but for reporting on the project. Our approach engages directly with the "paradox of the case study" to reveal both the unique and the universal and create a unity of understanding (Simons, 1996) in that first, we acknowledge and elucidate the distinctive practice-based models and vocational threshold experiences for different fields and individuals within the workplace, and then we consider the commonalities across them.

For this reason, Sections Two, Three, and Four—respectively about general practice medicine, carpentry, and engineering—can be considered stories in their own right. These sections are not designed to be directly compared, although of course the reader may see commonalities at a high level. However, this Section (One), has set up a vantage point over all three fields in respect of the kinds of learning experiences at work that constitute vocational thresholds. This is picked up again in Section Five which draws together and works across the perspectives of those in learning support roles within each field. Section Six is a discussion of vocational thresholds and their implications across the three fields.

Throughout the remainder of the report, there are quotes from participants. Attribution is by way of a pseudonym in brackets, with a "1" or "2" indicating the first or second interview.

2. Vocational thresholds for GPs: expertise in an uncertain world

Introduction

General Practitioners (GPs) are doctors with a clinical speciality in primary health care. The hallmarks of general practice are that it is accessible, continuing, comprehensive, and in the context of whanau, family and community. Most of us will have our own GP whom we visit, or who may visit us in our homes, on a regular or semi-regular basis over time for diagnoses, care, and treatment plans. GPs practice medicine as an anticipatory (preventative) form of care, as well as a responsive one. They may also consult with other specialists on their patient's behalf.

General practice medicine involves its learning practitioners in a journey of growing expertise over time and through varied experiences. GP expertise accrues around several dimensions: existing clinical knowledge which is continually supplemented and extended; judgement about the application of that knowledge in a primary healthcare context; and dispositional attributes. These enable GPs to "be" GPs and to use their knowledge and skills *and* their dispositions—values, intentions, and attitudes—in their work.

The dispositional aspect of becoming and being a GP is vitally important. The nature of GP work is particularly complex and unstable (van de Wiel, van den Bossche, Janssen, & Jossberger, 2010). The daily routine of GPs includes understanding patient conditions and formulating treatment plans in the face of incomplete clinical histories and undifferentiated (undiagnosed) conditions.

While becoming a GP involves apprenticeship-like programmes and processes, it does not involve a straightforward novice-to-expert progression as seen with other, more conventional forms of apprenticeship. Because the GPEP is designed to follow initial medical education and qualification, registrars or practicing doctors becoming GPs are already experts in a clinical sense—though there is still much more expertise to be developed. GPs therefore start out more like "expert novices" or "novice experts" than novices on a straightforward path to expertise, and they continue on in this vein. However, they lack deep knowledge and experience of community-based healthcare (though we note that medical schools have recently begun including several weeks of GP experience in the degree programme).

The difference between medical school and community health work is not simply a contextual distinction; caring for patients in the community challenges many ideas about the effective administration of clinical knowledge. The essence of medicine in the community is the patient-

13

doctor relationship. Developing empathy for this is no easy task for doctors who have come into general practice with a wealth of existing knowledge and (hospital) experience. The model of apprenticeship learning then repositions their existing (clinical) knowledge in relation to the new and different demands of general practice, casting the building of expertise in different terms.

Many doctors or registrars both relish, and struggle with, the transition from hospital-based to community-based work and the uncertainty that characterises general practice. There is uncertainty in hospital-based work—for example, medical specialists regularly confront the limits of medical knowledge—but GPs tend to experience a dramatic difference between the apparent certainty of work in a hospital and the obvious uncertainty of GP work in a community-based setting.

Patients typically spend only a brief time with their GP and present with an array of undifferentiated symptoms, only some of which may be clinically related, and which potentially span a very wide range of conditions. Treatment plans are the object of more negotiation than in hospitals, depending on patient circumstance, capacity, and preferences as much as on doctor decree. The GP clinic cannot provide in-house diagnostic testing or hold patients for observation at the same level as a hospital can. The relationship with the patient is usually ongoing and can encompass entire families. Uncertainty is a constant feature of the work.

Even as they build experience and expertise over time, including more clinical knowledge, general practice does not necessarily evolve into greater certainty about patient interactions, pathways, and outcomes. Thus a key task of becoming a GP is understanding that the inherent, unknowables in their practice are things with which they must thoughtfully engage, rather than reject. GPs need to understand themselves as good practitioners in a way that does not conflate expertise with all-knowingness and the eradication of uncertainty. This is not dissimilar to the challenge facing school teachers if they step up to be more "responsive" to students. When acknowledging the needs of different students and developing a wide range of ways to meet those needs, teachers cannot work with "the class" as simple receivers of messages from the expert in front of them.

Being the good doctor

The most significant learning experiences reported by our GP registrars were generated through their everyday work practice. Not surprisingly, these focused on interactions with patients—the core business of general practice medicine. Other research shows that medical learning is strongly driven by, and embedded in, the work of patient care (Chen, Sheu, O'Sullivan, Cate, & Teherani, 2014; van de Wiel et al., 2010). Thus it is *medical* problems which provoke reflection and problem-solving behaviour among medical professionals. However, when GP registrars' accounts of their experiences are cast in terms of vocational thresholds, they underline the dispositional— rather than clinical—knowledge, aspect of learning for general practice. This is because so much

of the work is about problem-finding (what, in fact, *is* the problem?) rather than problem-solving (where the problem is already known).

Given this focus on problem-finding, a vocational threshold in general practice relates to the integration of clinical and relationship knowledge. The epistemological (knowing) dimension of GP knowledge is repositioned. Reflection and learning are more commonly prompted by relational problems than clinical ones. What may first present as a possible clinical problem—someone is sick, a diagnosis is difficult, prognosis is poor, pain needs management—can turn out to be much more than a set of clinical issues and GPs have a central role in uncovering this. Critically the "problems" registrars identified as significant in their learning experiences were relational ones with patients. Specific events or interactions with patients provided an experience that was transformational, irreversible, integrative, bounded and troublesome because it highlighted where registrars' existing knowledge could not be applied as a straightforward translation from the clinical realm to the relational realm.

The ontological (way of being) dimension of the vocational threshold related to how registrars saw themselves as GPs. When we asked registrars what constituted a very good GP, most focused on the emergent trusting relationship as the key. Many were clear that while up-to-date clinical knowledge was necessary and fundamental to being a good GP, it wasn't in and of itself sufficient. The ability to establish and maintain relationships with patients, to communicate well, was seen as "the biggest difference between being a wonderful GP and a bad GP" (Mereana, 2).

Registrars stressed that they needed to make patients feel "really comfortable, well-cared for and well-listened to" (Lynda, 2) so they "open up and trust you ... It's pretty much as good as it gets" (Miriam, 2). In some instances, registrars contrasted clinical knowledge with knowledge of the patient as a person.

> [a very good GP] is personable, open, knowledgeable about what's gone on with a patient—medical conditions *and* general knowledge ... has a good memory about the patient so they're comfortable to talk with you—and not just about medical things. (Nita, 2)

> [a very good GP] looks at the patient as a whole ... not just the medical picture, but looking at the patient's social circumstances. (Cassie, 2)

By the time registrars enter their second year of GPEP, they are no longer employed by the RNZCGP and must find employment at a clinic. Registrars therefore gave a lot of thought to the kind of clinic that would best suit them—a decision facilitated by the GPEP's design whereby Year 1 registrars could experience two different kinds of clinics. Some registrars were scathing of clinics they had personally worked in or heard about, which took a more technical approach to patients, rushing them through consultations, and being overly-focused on generating financial profits. One left an employing clinic for this reason. He saw the GPs there as "far too busy and looking at turnover, getting the patient in and out, just quickly addressing the one issue but not really connecting with them" (Tamati, 2). Another registrar described wanting to avoid working for "practices who just want patients, have a high turnover, and see patients in 10 minutes" (Liza,

2). Another linked their idea about the kind of GP they wanted to be with the kind of clinic that could best support this.

> I like the idea of being part of someone's life. I get patients who tell me someone has been their GP for 40 years. Their kids have been there. And they bring their kids in turn. I don't want to be a GP in a big clinic where patients just see whatever doctor is free. (Nita, 1)

Fostering the patient's sense of being well-cared for could produce a corresponding feeling for registrars. Several recounted the thrill of being trusted with patients' secrets and fears, being seen as an important person in a local community, and playing an important role in someone else's wellbeing. These registrars were clear about who they wanted to be, and that how patients saw them was an integral part of their continued learning.

> [My most significant learning is through] having people come back to you, trust you with their help ... There was a young girl, 15, and I had to tell her she was pregnant. She was devastated. But she came back to *me* with her boyfriend. [I learn from] patients having faith in me. (Liza, 1)

> Earlier when I first started, there was a young man who came to see me. I diagnosed him with liver cancer. He was riddled with it and not much older than me ... He was one of my first patients where I [was the one to] see him, diagnose him, and then he passed away ... It brings me joy that his family still comes to see me. (Miriam, 1)

Some registrars went to a good deal of trouble to foster connections with patients. One described deliberately moving his office furniture around so the desk no longer formed a barrier between him and his patients (Bo, 2). Several others cited being conscious of their body language in order to communicate things like openness, authority, honesty and caring (Tamati, 1; Liza, 1). One registrar described creating follow-up situations, asking patients to come back later to satisfy any doubts she may have had about their diagnosis or treatment, and provide herself with performance feedback and opportunity to learn or reinforce learning—"I'll say: you come back in a month so I can check your ear but I won't charge you" (Nita, 1).

Healthcare without a prescription

While registrars were generally very clear about prioritising the quality of their relationships with patients, some were very surprised to find that this could mean their clinical knowledge was not utilised in the way they had expected. Several had transformative learning experiences where their value to patients lay with their listening skills—a situation that they had not necessarily anticipated.

> [I learnt the most from] When you've made a difference but you haven't done anything. I mean, you haven't diagnosed or given medication or sent them off for a test. I think there's a lot of mental health issues and anxiety in the community. So someone opening up, trusting you, and talking to you—the power of talking. So you have done something but it's not

physical. ...There was one—she wanted to break up with her husband but she couldn't. [It was good] just being able to talk with her, without her kids there. (Nita, 1)

[The first time new] patients come in, they just test you for something minor. They're not telling you that they have a jock itch on the first time unless they're really suffering ... if they see they can talk to you, that you're on the same wavelength ... At the first encounter, I thought 'easy' and then the second time they came and I thought 'that's an easy one again'. And then suddenly they were crying their eyeballs out. And that's what it's all about. Because otherwise how can you really help them? (Tamati, 2)

Repositioning clinical knowledge like this can feel like a particularly troublesome aspect of crossing a general practice vocational threshold. Despite the many positive accounts of finding that listening and talking were important skills in the GP dispositional tool-kit, there is an irreversible shift once registrars realise *in practice* (not just in theory) that all the clinical knowledge—practical, useful knowledge—accumulated over the years of medical school and hospital work can actually be rendered impractical without careful and appropriate communication and application. These communication skills were certainly declared and developed to some extent during those earlier years of training but the significance of those skills, and the need to further hone them, is more apparent than ever once a registrar is actually working as a GP.

There can be a certain amount of disappointment for some registrars then. They must contend with the idea that their clinical knowledge, while obviously fundamental to their job and growing all the time, is not the be-all and end-all of their work. For registrars who enjoyed the technical, problem-solving challenges of healthcare, this can be very disturbing. At least one registrar found this very challenging to her sense of what a GP is and should do.

I guess the one thing I still struggle with, with the concept of being a GP, is that sometimes people just want to be heard and actually just being heard is a therapeutic thing ... I still kind of find that one a little bit left field. (Jem, 2)

I've been in hospital for four years where things are very much regimented and set out. Whereas with general practice, every patient is different, and we are patient-centred. We don't just *tell* someone but we *ask* them, consult, negotiate with each patient on their own terms. But it is hard because you feel responsible if something does not happen. Getting used to uncertainty is quite hard. Being confident enough in clinical skills to leave it and come back later is hard. Whereas in hospital, there's an answer in front of you. You ask them to go down the road and get bloods, and they might not do it or you don't get results immediately. Hospital is 'yes/no' but not here. (Liza, 1)

Several registrars described taking a bittersweet pleasure in coming across some interesting cases or conditions that could be difficult experiences for the patient but satisfying for the GP. One registrar described the excitement of diagnosing a thyroid problem, explaining how rare it is to really know what is wrong with a patient. This sort of test result is "awful" for the patient, she said, but "you feel good as a GP to get a positive result" (Ellen, 1). Another described a certain monotony and lack of challenge in using "pure pattern recognition" for 15 of her 20 patients a day:

The really enjoyable patients are the ones that present a puzzle. That's when I really think about basic principles and try to work out what's happening ... the six years of medical school comes in for these other, occasional cases ... only a few patients bring you satisfaction with what you know. (Danni, 1)

One registrar cited this repositioning of his knowledge and skills as his most significant learning experience. While this was clearly troublesome for some registrars, he provided a great example of the integrative and irreversible aspects of vocational thresholds, opening up a new, rewarding dimension to his practice. He was not focused on problem-solving, where the problem is already known, but problem-*finding,* where the focus is on first deciding—*with* the patient—which issues are worth pursuing, which are real problems, and why.

In hospital I learnt to address a problem and give the medicine. Here, I am trying to change lifestyle. When I get positive feedback, that it has clicked and [the patient] wants to change, that makes me a GP. In hospital we could not change anything. We could diagnose really good stuff—one patient had MMD receptor antibody, the 10th patient in the ward. That's a medical professional's pleasure. Your team solves this case and goes: wow, we have done it! That's what I miss. But here, there's a satisfaction in looking after a *man*. (Kendrick, 1)

An ethic of care through relationship

The centrality of the patient relationship to general practice emphasises consultation skills such as building rapport, empathy and listening. However, it is still possible that the "relationship" might only exist for the length of the consultation and that listening could conceivably be understood as a technical skill. Some GP registrars' significant learning experiences were based around another kind of insight about patient relationships: the medical ethic of continuity of care means relationships can, and should be, established and maintained *over time*.

[It's a significant learning] when you're seeing them for the third or fourth time, where you get that sense that, actually, I am involved in this whole person's life ... with a lot of the people that you're seeing for the first time, you don't necessarily get that same sense. I think for me that sense of being a GP is that knowing the person and having a good sense of who they are. (Mereana, 1)

One registrar described her growing attachment to her patients and the community in which she lived and worked. Being a small, rural community, she found herself forming closer relationships and facing situations that in a larger centre might otherwise be dealt with in a hospital. She experienced transformative learning as she cared for dying patients.

Now I have relationships with people and I am looking after them longer prior to their deaths. That's a nice learning curve in terms of my own emotional feelings about it. Each time this guy has come in, we talk about his different symptoms. ... it's obvious to me that he is deteriorating but we have not talked about it ... I learnt that I have been avoiding that conversation too ... It is a nice reminder of how short our life is here. If you go home, you tell someone that you love them. (Danni, 2)

While in theory GPs are well placed to provide continuity of care, in practice the increasing mobility of patients and GPs alike can mitigate against it. This makes it all the more important for GPs to understand their role in relation to different forms of continuity which might need coordinating or integrating across different healthcare providers, and in relation to the diversity in continuity of care needs across different patients or at different points in a lifetime (Guthrie, 2008). In other words, registrars need to pay attention to the kind of continuity that patients want or need. This is something that some registrars were dealing with by integrating the ethic of continuity of care into both their medical practice and their personal lives.

> [It was a significant learning experience] when I started having connections with patients. One patient moved but told me she took two buses and a train just to see me again. I wouldn't do that if I moved; I'd just change doctors! ... I had a commitment phobia. In fact that is why it took me a long time to decide what training to go into ... At the moment I am still enjoying that I don't have patients under my name. But I am getting used to the idea that I will do, and that I can stick with a few patients, whether I like them or not. (Fang, 1)

One registrar found that dealing with uncertainty in general practice was changing him, not just as a GP (in his GP practice), but as a husband at home.

> Looking back, I was quite volatile ... I find that I'm a little bit gentler when it comes to everyday situations or when my wife is telling me [about her work], whereas in the past I would have had a strong opinion. I'm not quite like that anymore ... I realised that in a hospital you can afford to have strong opinions and to stand your ground because you're fairly anonymous ... Whereas in general practice, they're always coming back. You have to maintain a relationship. (Tamati, 2)

Negotiating the boundaries of care

Necessarily focusing on patient relationships is a double-edged sword, bumping registrars up against boundaries of "care". In medical school or in hospital, the idea of taking a "patient-centred" approach involves being thoughtful about how a treatment plan is explained to a patient or listening well in order to respond to their concerns or indeed proceed with the most appropriate treatment plan. In general practice that same "patient-centred" idea can signal a full-on negotiation with a patient over a treatment plan. The plan may be the correct approach in textbook or clinical terms but quite the wrong approach for the patient for a host of other reasons such as living situation, religious beliefs, cultural imperatives, or family circumstance. In these instances, the concepts of patient-centredness and "care" take on new meaning and need to be reintegrated with that of clinical knowledge.

> We don't just *tell* someone but we *ask* them, consult, negotiate with each patient on their own terms. But it is hard because you feel responsible if something does not happen. (Liza, 1)

> I feel more stressed than I expected. You need to check how [patients] are motivated. They don't want to do some things ... in hospital, the registrar tells you what to do. But now if I

19

say things, the patient does not necessarily agree to do it. You have to negotiate. It is difficult to balance how much negotiation to make. (Sita, 1)

Several registrars described powerful experiences in which they found the boundaries of the notion of care were not quite where they had thought they were. These registrars had experiences of having to decline patient requests. What they experienced troubled their notion of the GP's role. This troublesome dimension of a vocational threshold was a challenge to the idea that GPs always or automatically "do good" by improving the individual patient's wellbeing. Registrars had to grapple with, and integrate across, boundaries in their responsibilities to individual patients and their responsibilities to patients' families and communities. One registrar captured this in her story of being caught between family members' demands about the care of an elderly family member.

I haven't even meet the patient yet and they're already demanding referral and this and that ... I still put my patients first rather than the family [but] it's just a bit trickier in GP land because the family is always important to the patient as well. (Jem, 2)

Another had tried unsuccessfully to negotiate with a patient having chest pain who refused to take medical advice and take an ambulance to hospital immediately. When the patient insisted they could drive themselves to hospital, the registrar saw the possibility that others might be endangered if the patient had a heart attack while driving. She found herself arguing with the patient while another was waiting to see her and other colleagues became involved in a situation that nobody could agree on. "I had no idea what to do", she said. "It's not just the patient's wellbeing we have to look after; we have to look after the public too" (Ellen, 2).

Registrars felt clear that they needed to engage with these dilemmas as part of their role and that not doing so would be destructive to a notion of care. Thus one description of the kind of GP not to be was one that "took the easy road", giving patients "what they are asking for when it is not necessarily not the right thing for them" (Mereana, 2).

Yet several other registrars described the feeling of pressure in practice when they were positioned as gatekeepers with the signing authority for various official documents. One struggled with the knowledge that this medical opinion and notes would irrevocably limit someone's career (Bo, 2), while another had to refuse the necessary sign-off on an adoption application (Ellen, 2). Two others dealt with patients behaving dishonestly and aggressively. One struggled to deal with "a lot of people who have a strong sense of entitlement", describing "making quite a few patients angry because I was suggesting that perhaps increasing work to 15 hours a week was possible" (Miriam, 2).

[This drug-seeking patient and ex-prisoner] tried to use everything he had learnt just short of being physical. ... that was quite a frightening experience and I had to call for help ... It was quite an emotional thing. You have been threatened so you have to start thinking ... what do I do when he next comes in? Because he is on a medical certificate, he will come back. (Tamati, 2)

Uncertainty and anxiety

A key part of the GP's role is helping patients to manage their anxieties. However, the nature of general practice means that GPs have to contend with their own anxieties. Typically the registrars we interviewed stressed having to come to terms with the high level of responsibility for the wellbeing of others. Most referred to times when they felt almost over-awed by it.

> As a GP, you realise you are the frontline. For instance, if someone goes to a specialist, another doctor has already seen them, already tried to work out what's wrong. I've worked in the hospital and there, someone else has already worked them up so you've got an idea of what you need to be doing. Whereas as a GP, you're the frontline. If someone comes to see you and they go away and something happens to that person, you're *it*. (Ellen, 1)

Consequently many registrars described the ever-present background fear that they might miss a diagnosis, which would turn out to be life-threatening. However, everyday work consisted mainly of routine diagnoses. Registrars seemed to find the biggest challenges were to their communication skills more than anything else. The difficult and uncommon diagnoses were faced on an intermittent basis, a situation made more perilous by the foreground of mundane busy-ness. The burning issue then was this: could registrars always tell which was which—routine and innocuous or uncommon and dangerous—and what if they got the distinction wrong?

> I recently had a mother come in with a young baby who was drinking and peeing a lot. She was only 3. I was worried that she might have diabetes so I did a finger prick test and it came back that the blood sugar was extremely high. So she had diabetes. It was life-changing, just like that. (Ellen, 1)

> In the textbook, post-menopausal bleeding equals endometrial cancer ... So I send them to hospital [for tests]. But nobody has ever come back with [a diagnosis of] cancer ...you're always scared of missing the not-common things ... somebody came in with a cough and I didn't think about TB. But she got a chest x-ray and she had TB! (Fang, 1)

Two registrars described a clear link between managing patient anxiety and their own. They understood all too well that it affected quality of care they offered at both the level of the patient and the level of the system.

> You can over-investigate patients to manage your own anxiety. We all do it to some degree ... You make sure of things you do not want to miss. Otherwise you cannot sleep at night. (Tamati, 1)

> Because my experience is less than others, I tend to over-investigate things. On one hand that makes me quite thorough. On the other hand, it costs the system money and it provokes patient anxiety. (Ellen, 2)

Registrars' stories here indicate a need to integrate two forms of care—one for patients and one for themselves. The concept of "care" in general practice is a double-edged sword. It serves as motivation to enter the career. It drives (ongoing) learning in clinical knowledge and relationship management and communications. It provides the values that drive how GPs build capability, run businesses, and know themselves as good GPs. However, it also tugs at GPs' own wellbeing. As

they gain experience of patient care, they gain experience of where it affects their wellbeing. Integrating these into a bounded concept of care means understanding how one affects the other. Becoming sick or overwhelmed, behaving unprofessionally, or not managing private life will ultimately affect the ability to provide good patient care.

> You go home drained. If it went on for a long time, it would become detrimental for patients. You would start not wanting to care because you know what it's going to do to you ... It's even hard to talk to your wife or a family member about it ... To have someone come in who wants to kill themselves ... You see a mother ... and she immediately starts crying ... It does build up. (Bo, 2)

> Every single minute is bang, bang, bang, every 15 minutes. Every gap I have, I am checking tests and notes ... at the end of the day, I'm like 'Yay, I made it through'... I try to keep medicine out of my life outside work. (Liza, 2)

> I get that lump in the throat quite often ... but I definitely learnt to control it ... At the same time, people like you to be real but there's a boundary I think. (Miriam, 2)

> There was a child, pretty much dead, on the bed. There were five different doctors there ... My job was to talk to the parents. They were beside themselves. The next day I remember going to the rugby and I was thinking: how can I be doing this? These parents have just lost their child. How can anyone go out and do something fun? (Ellen, 1)

It is not surprising then, that so many registrars voiced a fear of becoming the kinds of GPs who no longer really care. This is a concern that is all too real against the backdrop of learning how to be a professional practitioner who cares just the right amount and in just the right ways.

> I'm always conscious not to overload myself and burn out and loose the passion for it. (Mereana, 2)

> Guys who've been in the game for 25 years become apathetic ... I don't want to get apathetic about my patients or my work. (Danni, 2)

> [A bad GP is] someone burned out, so they don't care and lose empathy. (Liza, 2)

What constitutes "care" is literally a series of boundaries such as professional and personal opinion, primary and secondary care responsibilities, and the inviolability of the doctor-patient relationship.

Crossing over for GP registrars

GP registrars face important ontological challenges to become and be certain kinds of people, in addition to what they know and can do from their medical training. Using relationship as a basis for patient care changed who GPs were as people—not just at work but at home too. Registrars highlighted the relationship with the patient and continuity of care over time. But what often changed was not so much the relationship with the patient but the relationship with the self. Our

registrars referred to experiences they saw as making them variously more cynical, more self-aware, less certain, and less opinionated.

Registrars' experiences also heralded the idea that resolution could be open-ended and that patients might find compassion-based interactions more fruitful than instruction-based ones. Their experiences of caring for "the whole person" opened registrars up to the idea that treatment could be negotiated and that medical knowledge was not the only knowledge worth having. Registrars' strong connections with people over time required the maintenance of professional boundaries and facing the possibility of staying close to those patients as they died. It is specifically these sorts of experiences that delineate a vocational threshold for GPs, allowing them to shift their perspective and be a different kind of GP than what they might have envisaged during medical school and hospital years.

Registrars grappled with troublesome and counter-intuitive aspects of their job. For example, as they endeavoured to do the best for their patients, they had to face situations where the patients did not see the issue in the same light. Saying "no" to certain demands forced registrars to live out a broader definition of doing good work, beyond the individual patient. As with all thresholds, things might go either way. Our registrars provided good examples of becoming aware of their own frailties, vulnerabilities, and anxieties and how they might secure their own care in service of themselves and their patients. These are the points at which reflection can be encouraged and capability can be strengthened.

3. Vocational thresholds for carpenters: pride in the craft

Introduction

A carpentry apprenticeship is the first step in the journey towards being an expert builder, taking a learner from beginner to qualified carpenter over a period of about four years. Further years of experience will be needed before the carpenter becomes recognised by the industry as a tradesperson, and in turn, an accomplished craftsperson.

During the apprenticeship, carpentry expertise develops in several main areas: technical skills, which are continually refined through practice and repetition on the job; knowledge of theoretical aspects underlying principles of building; practical judgement about how to use these skills and knowledge to produce work of an acceptable industry standard; and values and attitudes associated with the craft of carpentry. An apprentice must therefore acquire not only technical skills and knowledge, but also ways of integrating and applying these in practice so as to become immersed in "doing, thinking, feeling and being" (Chan, 2013) as a carpenter.

During the apprenticeship, carpentry apprentices learn primarily through practical on-job experience as they work with colleagues on different building projects. At first, they learn by watching and working alongside others to develop and practise individual skills, under supervision. As their competence develops, they begin to work independently, taking on responsibility for the quality of their own work. Alongside this hands-on learning, they also build complementary knowledge of theoretical aspects of building through self-directed study.

Apprentices may work for residential or commercial builders and on a variety of jobs from small renovations to full house builds or challenging, large-scale commercial projects. They must learn how to apply their skills and knowledge in complex situations in order to problem-solve and meet building challenges. Over the course of their apprenticeship they learn not only the discrete skills needed to complete each part of the job, but also how to draw these skills together to produce a finished product of a high standard. This involves internalising standards associated with excellent workmanship so as to complete work that is recognised as being of high standard, that meets industry and regulatory requirements, and that is valued by clients.

Practical knowledge and skills, therefore, are not sufficient for an apprentice to cross the threshold to professional identity as a carpenter. They must also learn how to "be" carpenters—to have the disposition that will enable them to eventually become a carpentry professional who is respected by others and recognised for the quality of their work. These attitudes and values include an

appreciation of what makes high-quality work; personal pride and satisfaction in producing work that is valued by clients and recognised as high standard by other builders; and an ability to form positive working relationships with colleagues, workmates, subcontractors and other members of the team. This latter point is important because builders do not work in isolation, but alongside a range of others in different trades and roles. Most building projects involve communication between a range of people, including architects, clients, other builders, and subcontractors such as electricians and plumbers. If apprentices wish to become professional builders, they will need to develop organisational, relationship-building and communication skills so as to coordinate the work of team members and ensure the project is completed in a timely and effective manner.

From our interviews with apprentices, it seems that the dispositional aspects associated with carpentry develop alongside practical skills and knowledge, but may be precipitated by particular kinds of learning experiences. These learning experiences are ones which shift apprentices' views about themselves as potential craftspeople. They allow apprentices to begin to stand back and focus less on mastery of individual skills and more on the quality of what they are doing and the vocation of carpentry as a whole.

The most significant learning experiences reported by our carpentry apprentices were generated through their everyday work as learner carpenters engaged in building projects. Often apprentices described situations where their skills were stretched or applied in a new way, contributing to a sense of their developing craftsmanship and their ability to recognise and produce work to an industry standard that would be respected by their colleagues and clients.

Critically, the incidents that apprentices identified as significant for their learning were associated with taking on greater responsibility for their own work and with receiving feedback on the quality of their work from clients or colleagues. Specific experiences were transformational, irreversible, integrative, bounded and sometimes troublesome because they challenged apprentices' existing perceptions about their competency or about the nature of building work.

Skill, dedication and respect

Apprentices' observations about the qualities of a "very good" builder provide insights into the values and attitudes which might provide models for their own learning. When we asked apprentices to describe a very good builder, they talked about characteristics such as passion for their trade, quality of workmanship, and ability to relate to a wide range of people. They understood excellent builders as people who care deeply about their work, have excellent technical skills, produce work that is recognised as excellent by their peers and clients and the building industry, and are able to establish effective working relationships with people from diverse backgrounds.

As might be expected, apprentices tended to stress technical skills first and foremost. In their view, excellent builders were highly experienced craftsmen who cared about their work and were willing to keep learning:

> A really great builder has been building for ten years, doing architecturally designed homes, really important, specific jobs working with high quality timber ... a real master of the trade. Not like being a guy who can whip up an A1 home or something like that. (Pete, 2)

> [A very good builder] takes a bit of pride in their work, keeps everything water tight, goes by the book with it, and pretty much knows what he's doing. (Billy, 2)

> Having 30 years' experience is great, but if you're not willing to keep learning, you're stuck in that position. But if you're willing to keep learning, you keep moving forward to being a better builder. (Ricky, 2)

Many of the apprentices emphasised other things too: that good builders need to have leadership, communication and relationship-building skills. The need to show respect for others, both colleagues and clients, was a recurring theme in their comments. Positive, open communication was seen as essential not only for effective team work, but also for client relationships and building the professional reputation that would lead to repeat work and referrals.

As learners, apprentices had worked with a variety of people, and this gave them some firm ideas about the importance of communication skills. From their perspective, they value working alongside builders who are respectful, communicate effectively and openly and have good leadership skills. They contrasted this with their experience working with builders who didn't have good communication skills or who treated apprentices in a high handed or disrespectful way as if "they are better than someone who is beneath them" (Kit, 2). One apprentice described a previous employer, who lacked these leadership skills, as almost never providing positive feedback and being more "interested in making money than keeping his guys happy" (Pete, 2).

The apprentices were clear—being a good builder involves both a high level of technical skills *and* dispositional attributes such as passion for your work, organisation, people skills, and a willingness to keep learning:

> You know there's a way of helping someone understand a certain thing. Some people don't have that patience or some people just can't shape or form instructions to suit an individual. That's a really important thing and quite fundamental especially in an environment when you are relying on two or three or maybe six or ten guys ... you got to have the technical skills, but the people skills is a huge part of it. (Mike, 2)

> They'd be able to coordinate other builders … take up a leadership role. It's not just about how good they are at building, it's about leadership as well. They have to have a high standard of skills in the building industry, and leadership towards people like me who are learning still. (Abe, 2)

> You have to have both the personality *and* the trade. (Sami, 2)

The high value that apprentices placed on communication skills was apparent in their descriptions of the kinds of builders they aspired to be. They talked of wanting to be builders whose main source of work came through referrals from satisfied clients or who were respected by their colleagues and workmates:

> [I want to be] good at problem solving, be onto it, always willing to take advice and learn. Have my work to a good standard that I am happy with and the client is happy with. (Joey, 2)

Accumulation of experience and embodied cognition

Certain types of experiences could help apprentices redefine their perceptions of their competency as carpenters and so open up a new layer of vocational identity. These significant learning experiences fell into several main types: routine practice and repetition of skills, leading to a sense of gradually developing competence; situations where they were given increased responsibility and opportunity to work unsupervised; taking part in projects where they were able to experience the complete building process from planning to finished product; and receiving positive feedback from clients or colleagues on the quality of their work.

For some apprentices, no individual learning experience stood out as being particularly significant. Rather, they described their learning as an accumulation of expertise through repetition of technical skills over time and in different situations. As they reflected back over the period of their apprenticeship, they recognised how far they had progressed along the journey towards competence.

Nearly all of the apprentices we spoke to described a preference for hands-on learning—being shown how to do something and then copying it as they worked alongside their colleagues and practised the skill, over and over. Many talked about how they learnt best by doing something practically, then relating theoretical learning to this practical skill.

A level of competence in these basic skills was required before apprentices could begin to appreciate the wider context of the work they were engaged in, and how individual skills contributed to larger projects and carpenter-like thinking. One apprentice described the very early stages as "scrambling to actually focus on the job at hand rather than take into consideration all the elements and what it actually means" (Mike, 1).

As apprentices grew more confident in working with materials and tools, the physical skills became more automatic but, crucially, not mindless (Rose, 2005). They developed "embodied cognition", an interdependence between mind, body, and environment (Rice, 2010), that facilitated continuing responsiveness to the physical environment and development of related thinking processes.

The importance of developing "embodied cognition" meant that mistakes were regarded as a particularly important means of learning. Many apprentices, employers and foremen referred to the idea that mistakes were simply opportunities to learn, and that there was no such thing as a mistake that could not be fixed. One apprentice described mistakes as embedded in the learning process:

> I don't like getting things wrong, but I understand that's probably the best way, because it's visual and you can feel it and experience it. (Kit, 1)

Another apprentice captured this in his story of a powerful learning experience from making an error in cutting the framing for a chimney. He described this as helping him begin to think like a carpenter. Previously he had thought he had good measurement skills; with the error he realised that an extra level of accuracy is a vital component in good workmanship:

> The foreman told me what to do and I just set things at the wrong angle. We were struggling to get it plumb and the foreman checked the angle. He told me I'd cut it wrong and I said no I hadn't. I was gutted—I thought I was doing a good job but I learnt from it. I learnt to make sure you check it. (Chris, 2)

Pete described his fear of making a mistake when deliberately set up in a situation designed to stretch and test his abilities.

> [Foreman] said he and [employer] talked about it and were giving me a job to extend me ... they said, "You are not allowed to ask questions". It was nerve-wracking. I thought, if I fuck this up, it's on my arse. I was real nervous. I don't like making mistakes. To have all that pressure, especially from [employer], to know he would be looking. He would come on and talk to [foreman] about the whole job but at the same time, have a nosey at what I was doing ... He would tell [foreman] and me, "it looks really good". (Pete, 2)

As they developed competence in basic skills, apprentices described their confidence growing. They were able to step back a little and gradually become aware of how the different skills could be brought into play to complete projects of increasing complexity. This stage could be troublesome as apprentices saw that there were multiple ways in which the individual skills could be used to problem-solve complex building challenges. In contrast to the surety of "one right way" to tackle a problem, apprentices sometimes came up against tricky situations which required them or their more experienced colleagues to adapt traditional ways of working and apply skills in new or different ways. In addition, as they work with multiple people over the course of their apprenticeship, apprentices were liable to be exposed to multiple ways of doing things. This offers a range of possibilities and the apprentice must then decide which method to use:

> Someone will tell you to do it this way and someone will tell you to do it this way, and maybe that person's way will be easier or quicker or the other person's way is more accurate. You've just got to gauge between the two. (Abe, 1)

> You learn a lot from different people's interpretation of things. Instead of learning off one person, this was a better way to do it. (Joey, 2)

While there is a correct way to go about certain building tasks, this does not always work out. Building involves problem-solving in the moment in order to work with complex, irregular or unusual situations. One apprentice, Kit, described becoming aware of "red light" situations that "require a bit of a thinking process":

> There is a set method to do things but it doesn't mean that it all works out ... it is real construction and you need to be a problem solver. (Kit, 2)

This realisation has some of the hallmarks of a vocational threshold—the knowledge is both integrative and troublesome, in that it might disrupt the apprentice's previous belief that building is a straightforward process, with a single, correct method that can be learnt and followed. Through these experiences, however, apprentices deepen their understanding of the nature of building work. Rather than being a straightforward, lock-step process, building involves complex problem-solving. This complexity may challenge apprentices' previous beliefs about building, but it ultimately becomes a source of satisfaction and pride, and integral to their notion of craftsmanship. For example, Billy described a complex renovation challenge where the textbook approach to applying window tape would not work:

> The window tape is not going to work out how the book says so you have just kind of sort of alter it a little bit to make it work … It's not all by the book all of the time sometimes you have to sort of figure it out for yourself. (Billy, 2)

This developing knowledge involves a practical judgement about the best approach in any particular situation and being able to apply the "tricks of the trade". This was often described in our interviews with training advisors as building "nous". There is considerable mental imagery, as well as aesthetic values involved in this, as apprentices learnt to use their knowledge of different materials, tools, and operations for "assembling the structure in the mind's eye" (Rose, 2005, p. 94).

Seeing the whole thing through

Apprentices who were able to see a complete job through from beginning to end described it as a significant learning experience. There were two aspects to their learning. Firstly, the experience allowed them to understand how their contribution fitted into the overall project and how different aspects of building work come together. Secondly, it gave them a chance to experience pride and satisfaction in a finished product of high quality.

> I felt really happy that I was asked to go on that job. At the same time, I felt like I wanted to see it through. I didn't want to get moved off somewhere else. I didn't want to get moved off to another job 'cos I wanted to see it finished. (Abe, 2)

One apprentice described working on a complete rebuild of a playcentre building. This was a significant experience as it allowed him to experience all aspects of a build, and see how the different processes fitted together:

> You got to see all the different stages—from piles to walls. It was cool seeing the building going up. That was just the coolest thing. It took six months. It's good for the apprentice because you get all the different stages. You can see how it all works. You don't get the same when you're building add-ons and stuff. (Billy, 2)

This same apprentice described how, once the job was finished, he was able to stand back and appreciate his role in the building—he could see how his individual work had contributed to something of significance. His pride in this achievement signalled a shift in identity, allowing him to see the impact and scale of his work as a carpenter.

It was clear from our interviews that knowing that they had contributed to a project enabled apprentices to develop a sense of pride in their developing skills:

> It's once you've finished a whole project, it's like you think, 'Shit, I actually worked on this'. That's what excites me with building. (Sean, 1)

> Just seeing the finished product is a great feeling. It's really great. (Joey, 2)

Working on challenging or unusual projects offered significant learning for a number of the apprentices in a way that was similar to seeing a job right through. This challenging or unusual work seemed to prompt more discussion and a greater level of collegiality between the apprentice and their colleagues, including their employer or supervisor.

One apprentice was able to work alongside an experienced colleague for a concentrated period of time, during which they built a house from start to finish. Because the build was in a different location some distance away from their regular employment, the apprentice and his colleague shared accommodation near the building site. They worked long days, doing 10 days on and four days off, and discussed the day's work in the evenings. Besides allowing the apprentice to experience all aspects of a "high end" build, the concentrated time on site with a more experienced colleague offered a chance for reflection and discussion about the building process, using the photographs that he had taken during the job:

> It was a significant learning experience. The new house isn't the crux of it, as you do learn a lot from old houses. The main thing was being able to talk through things at night and take photos and reflect on them. (Tim, 2)

This opportunity to work intensively alongside a more experienced colleague was transformative in showing him an aspect of building (a high end build that was "charge up") that would not have been possible during his routine work, which was largely renovations on older buildings. This expanded his appreciation of the kinds of work that a builder might be involved in and the scope of a builder's work: not only routine renovations but also top-end architecturally designed houses.

Other apprentices experienced similar shifts in vocational identity through being involved in unusual or challenging projects, particularly when these were in the public eye. Apprentices described significant learning from working on large-scale projects such as museums, luxury apartment complexes, or large commercial buildings. As they talked about these experiences,

apprentices described not only the learning that occurred from working in a new or different context, but also the sense of pride they felt in the finished products. One apprentice described how the work was particularly significant because it marked a change in the kinds of work that his building company was usually involved in:

> [This project] was quite an abnormal thing to do. It was lots of stuff that we wouldn't normally do as a company. It was like the start of a different time for our company. And we were the first to experience it ... The amount you learn on these jobs is incredible ... It was just an interior company before that. We just did like walls and ceilings and stuff. When we started on that job we were using the crane and concrete and constructing holes and steel and stuff. Yes, it was quite interesting. (Abe, 2)

This same apprentice also worked on a large project that was part of a national event, with a public opening of the building. It involved working with a large team of both sub-contractors and designers to meet a tight deadline. Being able to attend an open evening before the public opening, where there was public acknowledgement of the quality of the work, was a proud moment. Significantly, being part of the project afforded this apprentice the opportunity to develop new perceptions about both his own identity as a carpenter and about the kinds of work that carpenters are involved in.

Another apprentice was involved in a large and complex build that involved working in water to build the foundations for a quay-side apartment block. The whole team worked long hours in difficult conditions, which often involved night shifts to work around the tides. This apprentice described how he had struggled to reconcile the reality of this work with his previously held ideas about building:

> During the time I was working there I thought damn, this is not the type of job I wanted to do, but I just had to do it. When I look back on it, I'm glad I had the opportunity to do it—man, what an accomplishment to go through that experience. It actually changed quite a few things. When you're at school, you think building is about building houses: building is building houses. The experience of working in the water—I realise that any builder could actually build anything. Now, my thinking is that to be a builder you have to be doing everything—concrete, timber, steel, managing other people. A builder has to give direction to other builders, subbies. It's changed a lot for me—a big overview of what a builder means as a worker. (Sean, 2)

Increased responsibility and unsupervised work

Being trusted by their employer or foreman to do a job by themselves, without supervision, was a significant experience for several of our apprentices. Being given the opportunity to work unsupervised allowed apprentices to test their skills and begin to build the confidence in their ability that would ultimately shift their own and others' perception of themselves from apprentice

or "bottom of the food chain" (Pete, 1) to skilled practitioner. Indeed, it seemed that being able to complete a job independently was viewed as a significant milestone in the journey from apprentice to tradesperson:

> I can do some things within the job and within a team of builders so I'm not, I don't actually see myself as a builder yet ... when I'm a builder is when [employer] can put me on a job by myself and I can just do it from start to finish, you know I can just go out and build something ... so I don't see myself as a builder, I see myself as an apprentice. (Kit, 2)

The transition from supervised to unsupervised work was often scaffolded by the employer or foreman. This required a judgement about the apprentice's level of skill and readiness to take on more responsibility. By giving them responsibility for small jobs such as ceilings or gibbing and then gradually letting out the reins, the employer or trainer could help the apprentice to "find their feet".

> All my other jobs had been little—like, "go put dwang[1] this up". For this one, I had to prove myself, do it on my own ... That was a big learning curve for me with the older guys stepping back and letting me do all the thinking for myself, rather than just doing the doing. It was the best learning for me—the guys stepping back and letting me make my own mistakes and correct them. Better than being spoon-fed like a baby ... Aaron said, "I have noticed you work better when I just give you the plans and let you go and do it". From then on, he'd just do it that way. (Pete, 2)

Apprentices described being trusted with responsibility as very motivating. There were benefits associated with being able to practise what it is like to direct their own work, including making mistakes and finding solutions to problems:

> I can draw on what I've done and make a plan by myself and that lets me build confidence ... the chance to do things by myself is what I learn the most on. (Tim, 2)

> I like to do things myself. I don't like being told: 'go do this, now go do that'. The other way is more satisfying. (Pete, 2)

For the apprentice, feeling that the trainer/more experienced colleague trusts them enough to let them do the job reinforces their sense of themselves as a growing professional:

> When I am on my own, you have to think for yourself, find out ways to do the job, the best way, the easiest way, and to a good standard. If I am challenging myself on my own, then I can work to a better standard and all that stuff. (Joey, 2)

One apprentice described being given a job to run and the effect it had on his growing identity as a competent builder. He was moving from being the raw beginner, the junior, to a space where he could practise taking the lead and making decisions:

> It's good, you know—I'm not just being someone's boy all the time, I getting to do ... take the lead and doing stuff as well for myself. (Ricky 1)

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[1] A dwang is a piece of bracing used in constructing framing. It is also known as a nog.

This experience, which involved reading plans and giving directions to other people, had opened up a different part of the job. Another apprentice recalled being asked to take out a window, square it up and replace it by himself, without asking questions. Once he had proved himself with this job, he was allowed to do other jobs by himself, rather than being told what to do step-by-step. He felt that this experience really changed him and helped to propel him into a new practice space where he could see himself moving from apprentice to builder:

> I realised: wow, I can actually do this ... This was a turning point in my apprenticeship. I suddenly saw that I could do it ... it completely changed how I thought about it. (Pete, 2)

Because this was such a powerful experience in his own learning journey, this apprentice was testing out this approach with a new, junior apprentice. Working with a model of graduated responsibility, this apprentice described having the more junior apprentice "on a leash" which he would "let out a bit" at a time, while being close at hand for inevitable mistakes. It's almost like parenting." (Pete, 1)

Several apprentices described doing "perk jobs" or work outside their standard employment arrangements. Away from the auspices of their employer's business, these private jobs offered apprentices the chance to practise planning and running a whole job, and being in charge. One apprentice had done perk jobs most weekends throughout the year, beginning with small jobs for family members and then progressing to larger jobs with a friend acting as his apprentice. Running these jobs allowed him to take control of the process and try out the role of professional builder, including costing jobs and being an employer:

> I've got to run it all, do it all, it's all me. There's no one behind me telling me that this is how you do it. I got to take control. I got to be the boss. (Sean, 1)

> My best mate is a builder and we kind of do it together. I work it all out and get the job and I tell him what to do and pay him and he's my apprentice. (Sean, 2)

Some of our apprentices had already qualified by the time we spoke to them a second time. One of these apprentices reflected on the amount of learning he was gaining from having responsibility to do a job by himself:

> They say you learn as much a year out of your apprenticeship as you do three years in, because you get jobs given to you for yourself. I get a full sheet of plans and I've got to build a whole house. So it's not like being given just a tiny little part of a job. So you learn a lot from doing things yourself, out of apprenticeship. (Pete, 2)

Many of the apprentices described the powerful impact that positive feedback had on them. This feedback enabled them to see themselves as capable builders and added an important dimension to their work. Being able to contribute to an outcome that clients valued helped them feel good about their work and their identity as professional builders:

> Once you've finished a house, you get to see the house and you see, you see the client's joy ... see their positivity about it, how much they like it. The good feedback you get after—that's the part I like most. (Ricky, 1)

In his second interview, this apprentice described having clients look at his work and say "That's exactly what I wanted" and the good feeling that, "You've not just made it work; there's a sense of achievement, over and above. You've done it to a level that's accomplished." (Ricky, 2)

Another apprentice described the thrill of receiving an email of thanks from a client. The client thanked the team for doing a good job and recommended them to other clients. This led to "a bit of enjoyment of being recognised as a builder, as being a good builder it makes you feel good" (Billy, 2). Another apprentice told his friends who were not in the building industry to go and "check out" a building he had been involved in, because it was "really good" (Abe, 2).

Several apprentices mentioned wanting to be the kind of builder who got recommendations and referrals from satisfied clients, rather than having to advertise for work. Developing a reputation as a "good" builder was very important:

> I'd like probably 80% of my work to come through a referral ... from one client from doing a good job with them and getting repeat work from other clients. (Kit, 2)

> The client is the most important person on the job; you are working for them. (Pete, 2)

Getting feedback from colleagues is also important. Pete describes the satisfaction of having others confirm that he had done a good job:

> As soon as you've done a good job and you look back at it and you think it's a good job and then someone else comes along and sees it finished and you can see it in them: they say, 'That looks awesome, mate'. Just getting that from them—it feels amazing. (Pete, 2)

This apprentice also described the importance of receiving feedback at various stages of a build. He had recently qualified and was now responsible for working alongside other apprentices and helping them with their learning. He remembered how crucial it was to give feedback, so as to help apprentices understand what good work looks like.

> I am quick to tell them 'That looks great!' They need that feedback. Like when your mum tells you 'You did great at soccer'. I always grew up with that. But on the building site, when you've done something, you're told 'Sweet, go on to the next thing'. So you would not get satisfaction from knowing you had done a good job. You think, 'Oh it must not be that good. *Now* [at the end of my apprenticeship] I know when I've done a good job. But when you're an apprentice, you don't know. It might be the first time you've ever done it. As you get experience, you get to know if it's right. (Pete, 2)

As they practised practical skills, apprentices needed their colleagues' feedback to know if they were doing a good job. However, as they progressed they were gradually able to internalise this feedback until they had a sense of competence and an appreciation of an acceptable standard of

work. A key shift was internalising judgement about what constituted good work, as Pete described (above).

> Now I feel a lot more confident in my ability and also how to tackle things without, you know, constant need of … not reassurance, but just a helping hand. (Mike, 2)

Apprentices described the pride they felt as they began to see themselves as competent builders with practical skills that affected the choices they had in life:

> I love the fact that I can buy the worst house in the best street and do it up. I can build my dream home. (Sean, 2)

> I just walked into a building site and thought, I can easily just make a house, and no-one else can do that. I can walk into a building and just look at everything and just know how it's made, and most people won't. (Tim, 1)

However, they were clear that the apprenticeship was just the beginning of the journey towards being a good builder. During our second interviews, we asked apprentices how they would position themselves on a continuum from worst to best builder. Nearly all put themselves at the midway line, with several citing 20–30 years as the time needed to become a master of their craft. They knew they had many years' experience ahead of them.

Crossing over for carpentry apprentices

Carpentry apprentices tend to enter their apprenticeship focused on gaining, and refining, their skills in working with physical materials and tools. However, what appears at first to be work involving mathematics of a relatively low order (measuring length, calculating angles) is actually a rich source of higher-order thinking (Rose, 2005, p. 205) as apprentices learn to bring together the concrete and the abstract as they problem-solve their way through more complex jobs involving mental imagery.

It quickly becomes apparent that part of what attracts apprentices into the field spells a challenge for them in how to "be". Their employer, foreman, and others onsite model a craft identity which starts to make visible the importance of taking pride in doing a good job. This pride is intimately connected to how they work with, and are recognised and respected by, others onsite, visiting subcontractors, and clients. Carpentry apprentices work towards a capability to independently recognise and carry out this workmanship. The idea of "standards" is no longer a question of meeting standards or specifications contained in qualification outcomes. It is a question of internalising the standards of independent, good workmanship and identifying oneself with the industry—*being* a carpenter.

4. Vocational thresholds for engineering technicians: a vital cog in the wheel

Introduction

Being an engineering technician cadet involves spending time in a range of related but discrete roles, including surveyor and draftsperson. Cadets work in different areas of civil engineering: geo-tech, roading and environmental. Collectively, these experiences are intended to provide the cadet with opportunities to develop the range of skills, knowledge and judgment needed to practise as an engineering technician to solve problems that are less well-defined.

Engineering cadets are involved in authentic work from Day 1—developing the knowledge, skill and judgment needed for the role—rather than rehearsals or approximations of practice that are more typical of university-based professional education (Grossman et al., 2009). The tasks a cadet undertakes early in their cadetship are more well-defined and closely controlled than the tasks they are expected to undertake towards the end of their cadetship.

Exactly how their work contributes to the bigger picture may not be immediately obvious to a new cadet. Much of their work is in the symbolic realm (e.g., traffic flow calculations; terrestrial measurements and positioning; the precise notation in drawings). Their role in a team is likely to involve responsibility for only a small part of any job. A cadet's emerging awareness of their role in a wider team, and sometimes also the effect of the overall work on public safety, for instance, develops in parallel with their engineering knowledge, skills and judgment. These collectively contribute to their vocational identity as engineer technicians—the way they see themselves as "being an engineering technician".

Alongside the various areas of focus in their work, the cadet develops much of their technical knowledge via their part-time studies. The application of this knowledge to real-world problems happens with the support of the cadet's more experienced colleagues and immediate team mates, the wider project team in the case of large projects, and their mentor who is deliberately selected from outside the cadet's work team in order to focus attention on more dispositional and career development matters. When they begin to use judgment about which of their repertoire of skills and knowledge to draw on to solve a given problem, they undergo an ontological shift that can be thought of as crossing a vocational identity threshold into *being* an engineering technician. One cadet summed up his early sense of such a shift:

> Something that you don't think can happen, but actually you can engineer it, make it happen ... [We] had to move 3000 litres but the pumps had to stay where they were. The fire

engineer said, 'You can't do it'. The [other] guy said, 'Just engineer it out'. I went to our water engineers and they had ideas: 'here's the equations'. I thought: wow, there's no 'you can't do it'. That's the power of engineering. And they show you the examples and how you *can* do it. That's the first time I realised the power of engineering. You can go from 'no, you can't' to 'yes, you can'. (Dylan, 1)

Arrivals and departures

The continual process of developing vocational identity means that "previous experiences and also expectations of the future can be regarded as part of one's vocational identity" (Virtanen, Tynjälä, & Eteläpelto, 2014, p. 49). Transitions of one sort or another, both arriving in new roles and the prospect of leaving roles, were a theme in the engineering cadets' interviews. The changes inherent in the various transitions affected cadets in different ways. For some cadets, the transition into their first job involved a somewhat troublesome re-orientation, and even a feeling of being slightly overwhelmed. Later, when they were more settled in their cadetships, transitions between different roles became important. Some tension was evident between cadets wanting to remain in a role long enough to develop confidence, but wanting to leave a role before "getting stuck" there.

For some cadets, achieving their engineering qualification and completing their cadetship was their goal. Others saw gaining this qualification as part of a longer-term plan that included further qualifications or management roles, consistent with Virtanen et al.'s (2014) ideas about vocational identity development including a person's expectations for the future. Unless we sought more precise identification, the cadets usually referred to their current or future professional selves as "engineers" rather than "engineering technicians". Except with reference to career plans to become university degree-qualified "professional engineers", cadets' usage of "engineer" was a shorthand reference to their technician work, and in keeping with common usage around New Zealand, which is generally followed with a stipulation such as "fitter and turner".

Just over half of the cadets had made transitions from secondary school to a combination of employment and tertiary study. Several cadets had learnt about cadetship possibilities only in their final year at secondary school.

Some, like Anil, were not prepared for what their first workplace experience would be like:

> When we started the cadetship, I didn't fit into the workplace. I was taken aback by it all. It's a different environment, a professional environment, and unlike school. For a few weeks, I felt like I was in over my head. I was unprofessional, inexperienced, and younger than everyone else. (Anil, 2)

Some cadets, like Dylan, came to a cadetship from a previous career. Dylan reflected that his expectations did not match his experience of the nature of the work in the early stages of his cadetship:

> I didn't really know what I was walking into and I don't think I really had an appreciation for what each of the disciplines within engineering did ... I'm kind of more of a hands-on learning type person. (Dylan, 2)

In contrast, Anne's transition to work and study was eased somewhat by having already done some engineering study at university and having some work experience at the company during school holidays.

> Engineering was appealing to me because it is partly field-based and partly office-based. That's what I saw when I envisioned what an engineer was. My initial role was in surveying. Ninety percent of that work was field-based. Just by experience I discovered that I didn't enjoy having a role that was entirely field-based, but I noticed that when I *don't* get out on site very often, I miss it. That idea that I had initially, of what I envisioned an engineer to be, now that I've tried it out, that is indeed what I want—a mix. (Anne, 2)

The opportunity to gain experience while studying part-time had been an appealing feature of the cadetship for a number of the cadets we spoke to. When Mike was asked what he thought about coming to engineering via the cadetship route, he responded:

> It's a good route, mainly because of the age-old conundrum where nobody wants to hire you unless you have experience but to gain experience you need to be hired. This way sort of bypasses that problem because it's on-the-job training and I spend more time at work than in school and as a result I learn here about directly dealing with things at work and I learn all my technical knowledge at school, and I think that's a really good balance. (Mike, 2)

Within an engineering company, there were likely to be those who had completed university degrees working in the same teams as cadets.

> I've got friends doing a university degree and they are asking *me* questions because I have work experience and I have learnt that 80 percent of what I know is work experience and 20 percent is book studies. (Jack, 2)

Another factor that could influence the transition into an engineering technician role was the perception that colleagues might have of those entering the profession via a cadetship route, as Mike's comment indicated:

> Some of these guys—they would never say it—but I personally think they don't agree with bringing in guys like us with zero experience and zero knowledge and starting from point one. [Researcher: And they came how?] They probably came the normal route; they went to uni. (Mike, 2)

During a cadetship, two types of understanding were being developed in parallel: specialised knowledge and skills for particular roles, and how the roles collectively formed the "bigger picture" of engineering projects. So by rotating cadets around different roles, the aim was to provide opportunities for them to develop specialised skills and knowledge, and also an understanding of how different roles relate to one another as parts of the whole company. The expectation that cadets would rotate around various roles had helped attract Anil and Jack to a cadetship:

I've heard that in this company they're really good at giving you different kinds of experience, they won't just bog you down in one team, because as of last year, I still had really no idea what I wanted to do as a career. (Anil, 1)

In uni, you'll soon know what you like and what you don't like, but you'll come out in something quite specific … with the cadetship you can rotate round and see what you like, and then I can go and do a bachelors. (Jack, 1)

Cadets described becoming confident and comfortable in a role and feeling reluctant to move to a new role, in which they would inevitably need to once again develop skills and confidence. This re-positioning seemed to be a troublesome feature of them developing a rounded vocational identity as an engineering technician. Some cadets responded by staying in a role—especially their first role—when they were due to be rotated to a different role.

When we had the opportunity [to rotate to different roles] I didn't want to ... change everything and start in a whole lot of new work that I didn't know ... Where I just got comfortable in what I was doing ... it was good and everything was flowing … (Kane, 2)

There's sort of about one year per position, but I would think for drafting it would probably be better to stay at least two years, because there's a lot more to it than I'd originally thought and it would take at least two years to become reasonably proficient at doing your own projects. (Anil, 1)

It was not only cadets themselves who might be reluctant about being rotated from one role to another. As a cadet became competent in an area, their value to their team increased.

That's a good thing about [the company]: the fact you've got these young cadets and these young graduates who can move around ... I mean, it's difficult for the team leader who wants to build a team up and support the team and get the job done, balancing that against the need … of the graduates, to give them that experience. (Bob, 1)

Several cadets expressed an awareness of the potential to "get stuck" in particular roles. One described the dangers of becoming "too valuable" to a team (Kane, 2) and another worried that they might become "stale" and pressed their mentor to help them shift around (Liam, 2). One found advantages working for a large engineering company through the possibility of moving between offices and learning different practices and processes in each (Minnie, 1).

Around half of the cadets in our sample were looking ahead to the potential of a cadetship to lead them into their long-term careers, although such plans were generally quite tentative. Some cadets were content to focus on completing their cadetship before deciding on a direction in which they might subsequently head. Others already had an idea about where they would like to be in the longer term, and saw the role of engineering technician as part of their career pathway.

Technicians are there to get the data for the engineer and pass that on. I don't think I want to get stuck purely on collecting data. I want to get a management degree or something, maybe go into site management. I really wouldn't want to get stuck as a technician. The cadetship is more a bridge, getting work experience before deciding whether to do a degree. (Jack, 2)

The challenge that lies ahead is finding something that I will do as a career and will be able to bring value to a company. So yes, going around doing lots of different jobs is nice but eventually I will need to probably pick something and say, "I'm *this* engineer". So a civil engineer is probably a good one to do because you will do roading, you will do bridging, you do geo-tech, you will do a lot of everything. (Liam, 2)

Transformational learning: seeing with a technician's eyes

Many of the most significant learning experiences described by our engineering technician cadets were transformational of their understanding of the effects that their seemingly minor roles could have on the public. These experiences tended to shift cadets' thinking from seeing their work as something that happened at their desk, to seeing it as work that eventually materialises in their local environment, for instance, in the form of safer road signage or new cycle ways, or road repairs after storm damage. Dylan described a good engineering technician as understanding this big picture rather than only focusing on the small things.

Other cadets talked about significant learning experiences that involved them realising that their perspective as an engineering cadet was at odds with the public's perceptions of the "best" solution for engineering problems. These experiences suggested a growing understanding of the bounded nature of engineering knowledge—sometimes, but by no means always, overlapping with the public's understanding of a situation requiring an engineering technician's input.

Realising that their work resulted in physical changes in the real world that often had implications for public safety helped cadets develop identity as engineering technicians. Although this would contribute to an increased sense of responsibility, it also seemed to motivate cadets and gave them a sense of pride in being part of the engineering community.

> Most of the stuff is local work and I get to drive past it or you go out of your way to have a look. Generally I feel proud to know that you've had input into it and it's going to be there for a hundred years or so. (Brendan, 2)

> It was really cool, the other day [another cadet] came in and he said, "Do you remember this?" and he showed me the drawing that I had done, and I said, "Oh, yeah, that was the first job I ever did". Well, now they're installing it! (Roy, 1)

In his second interview, Roy also commented on the effect his work has: "what I am doing is important. Rather than something I am doing on paper, it has an actual real world improvement … that has an effect".

In some cases, a cadet's awareness of the real-world effects was heightened by the project having a high profile in the media. Kane explains that publicity was a factor that made a project he worked on a "major" one:

> [A slip] knocked out half the road for a good hundred metres and I think within two days the contractors had built a temporary road around it, but it was still down to 30 kilometres and it

was one of the major roads, the only road ... There were major earthworks, the urgency and the publicity. Because it was [a main road], it was in the news a lot ... I did the drawings for that and it made me think how important some of the work that we do is, that it doesn't just affect us and MTA and the council or whatever, it actually affects a lot of people, because the road was shut ... I sort of think more about it and why we are doing certain things and what the effects of it are, or positive or negative effects and stuff, so I guess it's just encouraging me to think about it more than just drawing it. (Kane, 2)

The following two cadets talked about an experience of their work that was holistic. Jack saw the significance of overlooking a seemingly small piece of information in the context of the entire project. Liam gained a sense of his engineering technician's role in relation to the general public through an opportunity to plan a small job from start to finish.

It may seem insignificant, digging up some dirt, but the results of your testing can impact the whole project. That's something I didn't realise. I had thought that the guys who are building it are most important, but it turns out that if you don't have good foundations, you won't have good buildings. That was the biggest thing: how small and insignificant something can be, but it isn't. (Jack, 2)

[The point where I] started thinking 'this is what an engineer does' [was when] I worked on a local road that needed the curve advisories upgraded. The idea is to set a standard for everyone so when you see the sign, you know what the corner is, and you create consistency ... We try to keep people safe. I went out, did the fieldwork, got the data, put it together. Then I started looking through the standards and designing the sign work—this sign here, this one here, and so on. So that was a real experience learning how to engineer. I did the whole thing. (Liam, 1)

The cadets were developing an understanding of how their work was part of a bigger picture, and that it had real-world impacts. Other cadets also identified recognising the relationship between their role—no matter how apparently minor—and others in the team, as significant learning for them. As one cadet put it, "I'm just a small cog in the wheel but if I do my part right, hopefully the person next to me will do their part right and then we all win" (Dylan, 2).

A number of cadets raised the issue of different perspectives from which people see an engineering project. This awareness seemed to be part of a growing realisation that engineering is bounded by sets of rules and standards, of which non-engineers are largely unaware. One cadet described his awareness of the conflict between the public's perspective and the constraints under which he worked:

I get to see it quite often and in the newspaper every week, people complaining about it. A lot of the designs are narrowing up the existing road, slowing vehicles down. People complain that it's inconvenient, don't understand the finished product, complain during the construction process, don't think it's a wise choice to spend rates money on it...I can see why people complain about it. Some of the treatments are inconsistent throughout the route. We get concept plans and we turn them into constructible solutions and sometimes we can't change the original concept—it's frustrating in that way. (Brendan, 2)

> There were a lot of holes done right, but not the one. It was a tight working area. The location was chosen based on the easier place to work without having to close roads. … For future projects involving drilling, I will look more closely ... In the future, this might mean more work, maybe getting residents' permission, but that costs less than getting a water main sorted. (Jack, 2)

Some cadets seemed to be aware that the specific knowledge and skills that they were developing would irreversibly transform how they thought about engineering problems and that they would never be able to see things again with the same naïve eye through which the public might view the same problems. What they perhaps had not anticipated was that such transformations might cause tension between themselves and other stakeholders in engineering projects. These stakeholders might include the wider team—"That's a classic issue … the architects want to do one thing and the draftsmen another thing" (Anil, 2).

Learning towards, and from, greater responsibility

Issues around increasing levels of responsibility are a feature of practice-based learning. Cadets highlighted the role of increasing responsibility in two distinct ways: as something they could graduate to as their learning progressed, and as something they could be thrust into which improved and hastened their learning.

Cadets' vocational identity came with increasing experience, the development of independence and, alongside that, confidence in themselves:

> I can do things by myself without needing help. … It has given me more confidence around the worksite, not having to ask questions the whole time. I have a sense of knowing what I am doing. (Christian, 2)

> If I compare my work now to 12 months ago, there is a huge difference. I am more confident to work on my own. That's 18 months of experience. That's the main thing. (Jack, 2)

> I started off with not much responsibility, but now I've got a guy that's under me and I'm more involved with dealing with the clients and getting more into having input into the management side of it. (Brendan, 2)

In addition to being able to work more independently, for some cadets, experience contributed to their growing sense of how their role fitted into their company's projects.

> When I first started on the drafting team, I would get an instruction on what to do with the drawing but I wouldn't know why I was doing this or even what the object was that I was drawing and what it directly related to. The more experience you get, the more it all ties in and you get to know that you need all these components. (Anil, 2)

Building up technical knowledge was understood as a fundamental aspect of accumulating experience. Cadets' descriptions of what constituted a good engineering technician included

reference to understanding engineering techniques, processes and relevant standards. In this respect knowledge and experience were inseparable.

> Knowledge of what needs doing, to the point where you know stuff about a certain system or aspect that people come to you for advice rather than you going and asking for help. (Roy, 2)

> I guess the challenges are gaining more experience and becoming a senior member of the team and managing my workload and helping other people, sharing the knowledge that I've gained. I'm starting to do that more and more. That's good because you need people with more experience to share their knowledge with you and help you out. (Brendan, 2)

The inseparability of knowledge and experience reflected the way that some cadets understood the relationship between theory and practice. They saw being a good engineering technician, and for some being a good engineer, as involving an understanding of real-world engineering in its complexity.

> I think problem-solving skills are important, similar to thinking on your feet. A lot of problems that you face don't fall into the category where you know how to solve them. It is quite different to the classroom, where they give you the variables and then tell you to work out the unknowns. That is quite a straightforward way to sort out a problem. (Anne, 2)

The combination of theory and its real-world application often includes an element of professional judgment, as Anne explained:

> I have to tell the client why the levels of some parameter in the water—say, chloride—why it's gone up or explain the trend of that parameter. It is not a straightforward yes or no, it is not just a number, it's analysis of the information. I am doing a hydraulics paper this semester and you are given a question and they tell you the parameters—the diameter of the pipe, velocity of water in the pipe—and you have to calculate the flow rate in the pipe. There is only one answer to that. But in engineering *application*, you might work out the numbers but application of the numbers is the thing. That's where what you learn in the industry counts. (Anne, 2)

However, it could not be assumed that because a cadet was doing well in both their studies and their work that the two would necessarily be aligned. One cadet highlighted the need for opportunities to apply the particular knowledge learnt during their studies in their work context:

> Well, you graduated from there, and you've graduated with a very high score, but because of their role they are not having the opportunity to apply their learning so they become very much blinkered. (Bob, 1)

Without this knowledge of theory/practice alignment, responsibility made little sense. At the start of his cadetship, Jack was unaware of how his work in an entry-level role was important to the project overall.

> I had no idea of the consequences for something that small. But then again, I probably should have been told ... In hindsight, I probably shouldn't have been given as much responsibility and maybe the engineer that was with me should have picked that up as well.

... I was only one week into work and suddenly I was responsible, kind of held accountable. (Jack, 2)

For Brendon, taking on more responsibility was something he associated with becoming a good engineer: "It's just experience and exposure to different projects and gaining more responsibility. You have to step up and take control" (Brendan, 2). He also commented on the importance of others being able to rely on the judgment of a good engineer:

You would trust their judgment—trust is the biggest thing. If you are going to them for advice, you have got to be able to trust them that they're giving you good advice and won't give you something that's not workable or shoddy. (Brendan, 2)

Responsibility was a feature of an engineer at the "very good" end of the continuum, according to Anne:

If all you do is CAD drawings for somebody who asks an internal colleague or if you're just an assistant to someone on fieldwork, that puts you at the left-hand end ... I think of people in the business who are in charge of signing off other people's work and that's a big responsibility, because it's their name on the dotted line ... There's a big correlation between having responsibility and learning, putting it into practice. It's a bit of a shame that you can't learn all of those things before you get the responsibility. Often it's not until the responsibility is dumped on you that you have to learn a lot of things. (Anne, 2)

Mike talked about unexpectedly being in a position where he felt he had more responsibility than normal because so many other staff members were away and he was left on his own. "That was overwhelming. If I made a mistake, there was nobody there to ask, I wouldn't know" (Mike, 2). The experience had a positive outcome for him though as people returned to the office. "I had completed a drawing over the course of the day. They looked it over and said they couldn't have done it better themselves. That was a confidence booster" (Mike, 2).

Developing greater confidence also seemed to contribute to cadets strengthening their vocational identity. In a couple of instances, cadets had needed to learn a new role quickly, with only a small hand-over period, when the person in that role was leaving. After initially doubting he would be able to meet the extra expectations, the outcome for Brendan was increased confidence.

Sometimes it's good to get chucked in the deep end because it pushes you and you realise that you can do the task. That happened to me with [a specific] job. It was overwhelming—I think it was confidence. I hadn't used the design software that much and the deadlines were tight and they were always questioning and it makes you doubt yourself ... It showed me that I can do anything if I put my mind to it and ask for help or try and figure things out myself. (Brendan, 2)

Cadets also talked of confidence as a factor in their image of a good engineer. Bob thought of a very good engineering technician as "a technically confident individual, somebody who had the experience, the knowledge, the tools to approach different tasks in a professional confident manner" (Bob, 1).

Being able to produce good results and with confidence. Not thinking, "I *think* that's right" but, "That's right". Being reasonably quick about getting things done. (Anil, 2)

I guess a lot of it is just trying to learn to deal with it, you know, by yourself and just have enough confidence, we get enough empowerment to make some big decisions and so it's a case of "I've got myself into it, I can get myself out of it." (Dylan, 2)

Crossing over for engineering technician cadets

The vocational identity of engineering cadets develops as they establish attachments to their work, their workplace and the company they work for, locating themselves in a wider engineering community. These attachments reflect the cadet's growing commitment to the values of civil engineers, and include having a sense of pride in their engineering achievements and an understanding of their role in relation to a wider team. The approach to this threshold is unlikely to be sudden; it is more likely to involve "travel through a lengthy tunnel of 'liminal space' (i.e., be in a conscious state of being 'on the threshold of') and possibly be in a 'state of flux'... for much of the journey" (Harlow, Scott, & Cowie, 2011, p. 436).

As a cadet comes to identify more with an engineering community, they are also likely to develop a sense of the bounded nature of engineering knowledge, sometimes amplified when it seems to be at odds with non-engineers' perceptions of how engineers should do their work. Cadets drew upon a growing repertoire of knowledge and skills to make judgments in order to solve semi-defined problems. Often the vocational thresholds they encountered were ones that required judgement to be developed beyond the technical realm into a growing recognition of engineering and project teamwork as socio-scientific (Patil & Eijkman, 2012). This entails understanding that science and technology knowledge must be knowledge-in-practice, and are inextricably intertwined with social and cultural issues.

5.   Facilitating vocational threshold crossings

We have argued that certain kinds of experiences lead to transformational learning that changes not just what learners know and can do, but who they are. Based on the idea of threshold concepts, these vocational thresholds involve learning from *experiences* (usually in the workplace) where learner-practitioners integrate knowledge, skills, and dispositions that were previously not explicitly visible and not understood as connected. These experiences may also be troubling or be events from which learner-practitioners are unlikely to turn back—that is, they cannot necessarily un-know something, un-do a skill, or un-be a certain way. However, they may well continue to revisit and rethink their experiences, creating more layers of meaning over time. In this way, they can continue to build knowledge, skills and disposition for vocational identity.

An experience or accumulation of experiences is not enough on its own to trigger the crossing of vocational thresholds. Nor can experiences themselves be planned, as many of our learner-practitioner accounts showed. Experiences are an inherently personal response to an event or situation, much like the way each student in a classroom has the same teacher and explicit instruction but can have quite different experiences and learn different things. Not only are the interactions that contribute to helping learner-practitioners move over a threshold somewhat beyond planning, the experience of them cannot follow a blueprint.

However, our learner-practitioners are not simply having experiences (in the workplace); they are also engaged in systemic, practice-based learning with people in learning support roles. While each of our fields has its own set of practice-based learning arrangements, the structured and unstructured elements within each set are designed to produce a certain complementarity in supporting development of vocational capability. In this section we explore the way in which these elements, and particularly the work of those in on-job learning support roles, can facilitate the crossing of vocational thresholds. We refer specifically to:

- GP teachers (some of whom were also medical educators) who provide teaching and support to registrars in GP medicine
- employers and foremen who provide training to apprentices and evaluation of the evidence of their learning, together with training advisors who support and assess apprentices in carpentry
- designated organisation mentors providing broad support, and project team leaders providing technical development support to cadets in engineering technician work.

Ideal significant learning experiences

As we did with learner-practitioners, we asked people in on-job learning support roles across the three fields to describe what they considered to be a particularly significant learning experience. Their responses resonated with those of the GP registrars, carpentry apprentices and engineering technician cadets: significant learning occurs through experiences that are transformative of perspectives and perceptions.

These experiences reveal the "whole game" and its authentic relevance (Perkins, 2009), including previously invisible dimensions in their roles. Mentors, team leaders, training advisors, employers, and GP teachers provided insight into opportunities where learner-practitioners might develop "proactive knowledge" or certain mind-sets, specifically useful for creative deployment of knowledge to a wide range of situations (Perkins, 2008)—situations that are wider and more unpredictable than would initially have been grasped by learner-practitioners.

General practice learning support perspectives

The seven GP teachers we interviewed referred to significant learning experiences as holistic in nature and important for fostering good general practice temperament. They described these experiences as deriving directly from relationships with patients. The GP teachers highlighted understanding patients as people with physical, emotional, social and spiritual contexts (Baz, Andrew, GP teachers). One described the value of seeing an experienced GP approaching the patient as a whole person, while also demonstrating the holistic flow of consultation: "Being able to watch a really experienced GP, you can get in that privileged position of being a fly on the wall, not under stress, and you can take it in and experience consultation" (Charlotte, GP teacher).

Several others described the significant learning potential in having particularly painful or difficult experiences with patients. They saw these as providing a window on practice that exposed the bigger picture of a GP's role and the considerable emotional labour involved in necessarily "giving oneself" to each patient. Their views were congruent with registrars' experiences.

> Patient care from a horrible diagnosis until death ... we've found that that encapsulates one of the best learning experiences that a registrar could have. (Kath, GP teacher)

> The first patient complaint is always a significant experience ... Often [registrars] learn not to trust their judgement, to be over-cautious, to fear patients ... [But] there's nothing wrong with phoning a patient the next day and saying, "I've had another thought and I was wrong to do that" ... The idea is to reflect on your *feelings*, not just what happened ... [because] you have to see the complaining patient again one day. (Jamila, GP teacher)

> A difficult patient with many complex issues—physical and psychological. The registrar [thinks]: how do I deal with this? Has this person got something going on or not? It's difficult to build rapport and interact. They are having to adjust in a whole different sphere—respecting the person even though they get bad vibes from the start ... They might

be washed out afterwards but they still have to see another 5–10 other patients. (Gabriel, GP teacher)

Carpentry learning support perspectives

Carpentry trainers (employers and foremen) and training advisors also described the kind of experiences that led to establishing an expert practitioner's wider field of vision. In carpentry this manifests as development of a certain kind of independence, where building standards—encompassing craft and aesthetic values as well as teamwork, industry-wide knowledge, and technical skills—are internalised. Like a number of the apprentices we interviewed, employers, foremen, and training advisors referred to the identification and correction of mistakes as a key aspect of developing this mind-set (Ray, building employer; Jim, building employer).

> The most valuable learning experience is making a fuck up. You don't need to tell them off because they know what they've done, and they hate wasting materials. A tradesman has a heap of tools, he really has a joy in what he does, [and] he loves the finished product. (Richard, building employer)

The utilisation of mistakes for learning was often closely connected in interview narratives to the theme of independent judgement and confidently taking charge of work. This could come with the experience of teaching an apprentice more junior than themselves (Lee). Typically it came through giving an apprentice full responsibility for an important part of a project. One foreman described this as occurring for himself after he completed his apprenticeship—"I learnt more in my first year as a qualified builder. You go from being 'the boy' to being the guy in charge" (Brad, building foreman).

> The most powerful learning experience an apprentice could have is to be put in charge, to be left [alone] on site and given a bit of responsibility. (Simon, building employer)

> If you can send them to do a job on their own, and they can finish it, I think that's quite an achievement for them and they feel quite chuffed. It takes a few years before you're able to do that. Some apprentices do not even get there until later ... I found that when I did my apprenticeship, I did not learn how to do jobs on my own until I *had* to ... It's too easy to pass it off, ask someone else. (Ray, building employer)

One employer noted that this responsibility, particularly where it coincided with seeing a job right through could be "quite an emotional experience" for an apprentice (Simon), echoing apprentice Pete's pride in being "trusted with something important" when his employer and foreman handed over a specific, challenging building job to Pete (Section 3).

Engineering learning support perspectives

The engineering mentors and team leaders we interviewed also placed emphasis on the power of a holistic understanding, often in the context of society and community. This took the form of cadets comprehending the nature and extent of an entire project, what their own role was within it, and the aspects of their contribution that were important. One mentor described the powerful

nature of her cadet seeing the whole process involved in a job, dealing first hand with the information part, which then went to the (professional) engineers for design, before coming back to the information team again and finally having a visible impact in the community (Pamela, engineering mentor).

Like the cadets' insights about their experiences, mentors emphasised the idea of seeing engineering's impact in the world. They saw themselves helping cadets to develop an engineer's mind-set that could cope with conflict and setbacks within project teams and in relation to public opinion:

> [The significant learning is] that the work he does is valuable and makes a difference in the real world. There is something tangible at the end of the day. He's making a contribution to the community. There are some projects that start and then don't go anywhere so these can be challenging. But there are lots of projects where you can see the whole project from start to finish. (Brian, engineering mentor)

> A lot of it is thankless and it doesn't get all the glory but it is still really important. Engineering contributes a lot to communities—housing, drinking water, sanitation, roads. People don't think about it until it doesn't work. [So the significant learning is] enjoying your work and knowing you're contributing something valuable to society. (Alice, engineering mentor)

Practice as a basis for learning

People in learning support roles understood their contribution as an interface or boundary-crossing one, drawing directly from their own and from learner-practitioners' experiences to build the *dispositional* dimension of capability. They specifically saw their role as quite different from being about teaching theory.

Learning from practice in GP medicine

"Turning theory into people"

While there is specific subject matter that registrars must know (tested by exam), there is a measure of flexibility about the order this is learnt, including choice about optional areas of focus. Registrars and GP teachers use every day work as a springboard to determining what is learnt and when, and to ensure that documented knowledge is meaningful by having a very close relationship with what actually happens at work.

Each GP teacher had weekly, one-on-one sessions with a registrar. GP teachers variously described their role as being about "turning theory into people" (Kath, GP teacher) and focusing on "soft learning that translates theory into practice" (Amy, GP teacher). One described having a deliberate approach of ignoring any formal instruction he has had on teaching and "theory of teaching", preferring instead to use his own, extensive experience to help registrars "build

confidence, especially as they battle with the uncertainty ... I try to reinforce that doing your best is the best you can do" (Gabriel, GP teacher).

> I see my role as motivational not educational ... I help [registrars] see that the relationship between doctor and patient contains more than just a disease, diagnosis, and treatment. Med. school teaches students this. Hospital tends to ... Learning group seminars are geared towards the knowledge side. That's why I don't see my role as being that. (Baz, GP teacher)

> I'm into role modelling, not just formal teaching. [A role model colleague] is good at saying 'I don't know' and acknowledging the limits of his knowledge, asking 'How could *we* find this out?' For a GP, any guideline is really a *guideline* ... There is no guideline for the specific patient [you have]. (Charlotte, GP teacher)

GP teachers acknowledge that focusing on practice rather than theory is sometimes easier said than done. Registrars can feel anxious and try to deal with this anxiety by accumulating more clinical knowledge. GP teachers know that registrars typically experience a dramatic difference between the apparent certainty of hospital work and the obvious uncertainty of general practice, and are anxious about their existing knowledge and proficiency. But they also know that a focus solely on accumulating clinical knowledge is a counter-productive one for registrars. It can lead to an exhausting and never-ending race to accumulate pieces of knowledge which are always changing, tending to reinforce a conflation of all-knowing-ness and expertise. GP teachers therefore consider actual practice to be the key; clinical knowledge accumulates and coheres around this as the need emerges.

> We just keep telling them to focus on learning around the patients they're actually seeing so that the learning is relevant and retained. (Amy, GP teacher)

> GPEP1 registrars say, "Tell me your approach to asthma or back pain". It's hard to respond to that in isolation. So I prefer it to be case-based because explaining my approach to back pain is like something at med. school. It's not what you see and do every day. But first year [registrars] seem locked into that didactic thing. They want more formal, structured stuff. I try to move them on from that. I say: you've had med. school and now this is *applied* learning. You need to take what you've learnt from six years of med. school, plus your seminars, and learn from what you *do*. (Jamila, GP teacher)

GP teaching sessions and learning groups

We observed the privileging of practice in teaching sessions and learning groups. Within these sessions we could see examples of what Grossman et al (2009) describe as:

• representations of practice which make visible certain practices though not necessarily practitioners' thought processes and reasoning (e.g., watching a video of an experienced GP carry out a consultation)
• deconstruction of practice by breaking down practice into parts (e.g., using a step-by-step method to write a referral)

- approximations of practice where learner-practitioners have opportunities to engage in deliberate practice (e.g., engaging in a consultation role play or practising skin rash identification).

The three learning groups we observed focused almost entirely on dispositional matters, arising from cases which were usually introduced by watching a video-recorded consultation or having group members contribute ideas about their most uncomfortable areas of practice. The groups attended to such things as: managing dual identities (e.g., doctor and family member); the ethics of screening children for diseases; and dealing with angry or overly-attached patients.

Typically the one-on-one teaching sessions involved a mix of patient case reviews and role plays. Case reviews might focus on checking diagnoses or treatment plans—everything from depression to drug side-effects to infections. They sometimes involved the GP teacher and registrar looking up information together, on the fly. Role plays often derived from cases, serving as explicit practice for certain scenarios that would occur, or already had occurred but were unsatisfactory. We also observed a combined teaching session that included multiple teachers and registrars, which used a high-energy, fun activity on advising patients about condoms. This helped with knowledge about condom effectiveness and with taking an "unembarrassable" stance in front of patients.

Case reviews led quite naturally into activities such as role plays or practice sessions (e.g., palpating a sore wrist) as well as lively discussions about aspects of how to "be" a good GP. Discussions focused on things like: aggressiveness in patients; confidentiality issues; discussing sexual matters without discomfort or judgement; dislike of certain patients; the role of GP notes in referrals and insurance; and breaking bad news. As we noted in Section 2, the most pressing issues were relational ones where there was no straightforward application of clinical knowledge and the registrar had to develop certain attitudes, values and inclinations.

We observed one session where the learning purpose as understood by the registrar and the teacher was clearly at odds. A new teacher struggled to manage the anxieties of a new registrar. The registrar wanted the teacher to check the correctness of her diagnosis or treatment plan for each case reviewed. "So what should I do?" she repeatedly asked. The GP teacher kept sidestepping this question and instead probed for the registrar's decision-making rationale. In her interview the teacher confided being torn between her and her registrar's different priorities:

> I wanted to get through all her clinical questions. Then I worried about how much [time there was] to go into other stuff. She wants to know what to do; she wants the answers ... The frustrating thing is if I give the answer, she won't know the principle. (Charlotte, GP teacher)

Collegiality for capability

Given that GP teachers regarded their role as specifically not about teaching theory, it is not surprising that they described their availability to registrars as their greatest contribution. They

cited having "an open door" (Charlotte), being available "24/7 for whatever the registrar needs" (Kath), and sitting in on the registrars' consultations and having them sit in on his (Baz).

This provision of time might be most usefully understood in terms of collegiality. GP teachers modelled collegiality for registrars, not so much as something they could give but as a disposition they could help registrars develop. In some clinics, this was modelled by all the GPs, not just the designated teacher. The support was both a just-in-time backup and a background confirmation of a place in a wider group of healthcare professionals. Registrars understood this as helping them balance autonomy—so they could avoid isolation—and connectedness—so they could move from dependence on a teacher or one right answer.

> I am surprised actually. I thought they might plonk you out by yourself. And you are. But support is right next door. (Bo, GP registrar, interview 1)

> [My teacher] has a good attitude about me having a go ... I appreciate the freedom he gives me. I explore the boundaries of my practice but knowing he is extremely open to me approaching him for advice or help. (Danni, GP registrar, interview 1)

> There is always somebody on hand for immediate questions. We are advised not to wait outside and waste time; you knock and go in. Otherwise you could spend your life waiting. (Liza, GP registrar, interview 1)

> Everyone in the practice is good, very collegial ... we are a team of people managing a group of patients. At the other place, you are one of X number of doctors with individual patients. (Ellen, GP registrar, interview 1)

Collegiality also benefits the experienced GP teachers who describe themselves as benefiting from registrars' fresher knowledge and ideas (Baz, GP teacher) and being continuous learners.

> The most important attribute as a teacher is the willingness to learn. And willingness to share failures, difficult things, and learn from registrars. (Jamila, GP teacher)

Collegiality helps registrars become part of a community of practice—not just an optional extra but vital to helping GPs counterbalance the tendencies to become isolated, overwhelmed, and sick, as noted by registrars in Section 2.

Learning from practice in carpentry

Taking charge

Similar to GP medicine, there is a carpentry "curriculum" made up of learning outcomes. Both the learning and assessment towards these outcomes is driven entirely by the everyday work of the apprentice. Summative assessment of progress is organised around "naturally occurring evidence" arising from the work undertaken. The apprentice and training advisor conduct a "walkaround", inspecting and discussing the apprentice's work on-site, reviewing any portfolio or workbook evidence, and talking through the apprentice's work process, reasoning and decision-making in relation to the work product. The employer's conversations with the training advisor in advance

of, and subsequent to, the assessment visit, together with evidence from other visits, provide verification of evidence and additional perspectives on the apprentice's competence (Vaughan, with, Gardiner, & Eyre, 2012).

> Most of the time, [it's like] apprentices don't even realise they are being assessed for something. Some of it is explicit and some it is not ... I've seen [the apprentice] on four or five jobs doing those tasks, and you've had good feedback. The guy just has to explain how he did something. (Dave, training advisor)

In their interviews, employers described their training role in terms of helping apprentices develop the practical skills and the attitudes required to both complete the apprenticeship and become capable, valuable contributors to the carpentry workforce. Many mentioned the value of having apprentices work alongside older, more experienced colleagues as a way of helping young apprentices develop the attitudes and behaviours—or dispositions—necessary in the industry:

> They've got to be beside older people, learning how to behave and what to do. (Sam, employer)

Sometimes this extended into taking a pastoral care role, keeping an eye on what was going on in the apprentice's life. The complexity of the role, being employer, colleague and trainer for the apprentices, was summed up by one: "Mentor, mate, disciplinarian. Not easy with a bunch of guys with different needs" (Jim, employer).

Many of the training advisors described a mentoring aspect to their role too, where they aimed to develop relationships with apprentice and act as a role model. More than one training advisor described the satisfaction they saw in helping young people to achieve. Travis, a training advisor, felt he was helping apprentices to "grow up to be proper human beings that behave responsibly ... and have a good trade behind them".

> I make it clear to them that we're not the building police. We're here to help them, and see them get their qualification, and be a good tradesperson. (Harry, training advisor)

This sentiment is in keeping with the idea of apprenticeship as a pedagogical project of opportunities for self-expression, identity-building, and increased responsibility in the adult world (Halpern, 2009).

Integrating theory and practice

Employers and foremen suggested the ideal was for apprentices to learn the theory associated with the particular practical work they were engaged in at the time. Training advisors described the same ideal. They saw part of their role as recommending which theory units an apprentice should work through next, based on the work they were doing on site. This makes it easier for apprentices to see the relevance and practical application of what is in "the books". Generally employers worked with training advisors to achieve this alignment, using the training plan and discussions with the training advisor to become aware of the kinds of work experiences the

apprentice needed, and allocating tasks accordingly. This was similar to the "just-in-time" approach used by GP teachers.

Some training advisors acted as a kind of intermediary between the employer/evaluator and the apprentice, for example advocating for the apprentice to get the kinds of experiences they needed when the apprentice was not able to do this themselves. Training advisors also encouraged apprentices to take responsibility for their own learning, particularly in relation to apprentices negotiating with their employers to get the kinds of work experiences they needed. This could be intimidating for an apprentice; however, they needed to overcome this hesitancy and negotiate for what they needed:

> Yeah, it can be hard for guys to ask for this. It's like asking for a pay rise, well not quite as hard as asking for a pay rise, but hard. (Dave, training advisor)

This flexible, team-based, work-driven approach was intended to integrate learning and assessment with what apprentices are actually doing every day, and with building their vocational identity as carpenters. This approach had been the result of an extensive review of apprentices' learning materials.

In 2009, the BCITO had identified a lack of alignment between the assessment process and the learning environment in a highly prescriptive approach, based on the premise that each apprentice would follow the same path through the qualification, regardless of their knowledge and skill levels on entry. The manuals detailed what needed to be done to complete the qualification, unit standard by unit standard (there were more than 90). Practical work was assessed through a prescribed process detailed in manuals, supplemented by sets of oral questions and a work diary. Apprentices worked on the theory manuals off site and usually at home, tending to complete the theory worksheets long before they were in a position to actually do that work on-site. Many struggled with completing this decontextualised "book work".

Starting in 2012, a more compact Apprentice Pack was rolled out to new apprentices. The new system tackled the previous "frogmarch" through the unit standards, by establishing clear relationships between supportive learning environments and purposeful assessment of learner progress (Vaughan, Kear, & MacKenzie, 2014). Decontextualised unit standards and manuals (e.g., 24378 Perform Building Calculations) were replaced with colour-coded resources based around distinct but interrelated groups of knowledge and skills—for example, yellow-coded "Site preparation" and red-coded "Framing" each involving both theoretical and practical knowledge. The Apprentice Pack also contained a new, flexible Record of Work to help apprentices compile evidence of their learning, encouraging them to take photos, draw diagrams and plans, annotate and/or keep a daily diary (Kear, with, Vaughan, & Gardiner, 2012; Vaughan et al., 2012).

However, the apprentices and employers in the Knowing Practice project were signed up with the old "box of books" rather than the new pack. It is perhaps not surprising, then, that employers and foremen continue to talk in terms of "the theory" and "the practical" as though they were separate activities. Interviews with employers and foremen made it clear they thought that learning the

theoretical underpinning knowledge was the responsibility of the apprentice with support from the apprentice's training advisor. They saw their role as "the practical" one. They therefore also expressed sympathy for apprentices having to do what they saw as "homework" in their own time.

> The box of books requires a guy who's worked a nine-hour day to go home and do work and a lot of the apprentices don't cope with that. (Richard, employer)

> It's homework. They like to do things with their hands, so sitting down with books is a challenge. (Lee, foreman)

Many cited their own experiences struggling with "the theory" presented in books. Some described helping apprentices by discussing theory during lunchbreaks or having a "session" with several apprentices to ensure they understand how their practical work is linked to the theory. Around half of them suggested that apprentices needed help with what is regarded as a distasteful activity. While some found appeal in the idea of a block course with a conventional classroom, a teacher/tutor, and other "students" (peers for the apprentice), they saw this as an option specifically for apprentices who were struggling (employers Ken, Michael, Simon, Joseph). This seems to contradict ideas about supporting apprentices to develop self-discipline and independence, and several employers pointed out that block courses were rigid and did not necessarily offer value beyond what employers could or should do themselves (employers Pita, Richard, Al, Richie).

Employer and foremen views provide an interesting insight into the long association of "book work" with school, and of school with a lack of appreciation for those with an affinity for "hands-on" learning. Most of the carpentry apprentices we interviewed made specific reference to liking to learn "with their hands" and "do practical things". School gave few opportunities for this and, where it had, little esteem to it in comparison with "academic" subjects. This situation in schools has been changing to some extent, along with trades-related media campaigns targeting career advice (Vaughan, 2012; Vaughan & O'Neil, 2010) but the employers and the apprentices in Knowing Practice will not benefit from that as the changes will be too late for them.

It seems that employers and foreman (and apprentices) continue to understand "the theory" as being whatever is contained in the written material that apprentices have. It is therefore "other" to what carpenters and builders do in their everyday work—even though employers and foreman quite naturally provide theory to apprentices in the form of explanations of principles and reasoning behind what, and how, things are on-site. As one foreman, Col, put it: "The foreman should *teach*, not just give orders".

Learning through practice in engineering

Aligning learning opportunities

Coordinating everyday work with formal studies is a challenge for engineering technician cadets. Progress towards completion of the NZDE is driven through the curriculum as delivered by the

ITP in regular (usually weekly) classes which cadets attend. Progress in learning on the job is driven largely by the demands of the organisation's projects.

Although the ideal would be to have alignment between the two, this was not always realistic. Similarly opportunities to be engaged in interesting work, from which cadets were learning entirely new skills, had to be balanced with ensuring the less interesting—but necessary—aspects of tasks were also completed. Mentor, Alice and cadet, Mike, discussed these different types of work in terms of "holding the stick" (referring to monotonous or routine work) or "being on the smart end of the stick" (engaged in demanding thinking about a task). At Company B, Alice talked about the value of providing Mike with opportunities to apply the technical surveying skills he was studying in his work, so that these skills become ingrained. However, she also suggested that it could be equally valuable for a cadet to be shown the practical application first, and learn the underlying theory later. One team leader referred to workload management as "a constant struggle ... particularly hard at the end of projects because of the risk and because we also need time to show them what to do" (James, team leader). One mentor was more relaxed about some lack of connection—at least in the minds of cadets—because it would be temporary:

> They may not be practising the theoretical subject they are doing at the time, but there is a pile of parallels. They can start to see how certain principles of what they are doing, fit. Someone told me the other day how an electrical engineer joined them, and they started having to do water engineering. After a while, the engineer found the principles were very similar, to do with flows. (Steve, mentor)

Often, mentors and team leaders described their role as being facilitative, especially helping to ensure a cadet gets a balance of work opportunities. Contributing to this was a cadet's rotation after perhaps a year in a role, from one team (or in some cases, office) to another. Cadets had a role in deciding which team they would like to work in, and in whether or not they wanted to be rotated. Rotating from one role to another was not mandatory, and a cadet could choose to remain in a role for more than one year. While this might be a cadet's preference at one point, there was evidence in our interviews that later they could begin to feel stuck in that role; they become so proficient that it is difficult for them to contemplate starting over in a new team and their team could also be reluctant to let them go when they have become an integral member of the team. A team leader could also be reluctant to lose a cadet who had become an integral part of the team:

> You have them for a year and then they get really useful so you don't want them to go. You have to make a conscious effort. I guess they feel reluctant to move around too, because it's like starting afresh. (Charles, team leader)

Complementary roles supporting cadets

The team leader and the mentor are the key people in a cadet's on-the-job learning and development. One team leader explained the support they give as "Hands on—showing him things, the technical side" (James, team leader). The team leader's focus tended to be on the work in hand and the learning and support that a cadet needed in the short term in order to be successful. A mentor's role, in contrast, was more focused on the medium and long-term picture

of a cadet's career, and developing the dispositions needed in an engineer technician's role. This could include a broader spectrum of considerations, from how a cadet's studies are progressing to his or her work/study/life balance. Although team leaders and mentors had different priorities, there was some overlap in the actions they took to enable cadets' ongoing learning and development, and their growing independence.

The nature of the relationships between mentors or team leaders, and cadets varied and was affected by the structures companies had in place. For example, Company A allocated time for mentoring in mentors' workloads, and mentors were deliberately not cadets' team leaders. The content of their mentoring meetings was confidential to the cadet and their mentor, and there were indications that this enabled very open conversations with a high level of trust.

> [Cadet] knows that I won't go and talk to anyone about our conversation, unless he asks me to. I know he won't go and do the same ... It's a [Company A] ground rule. (Steve, mentor)

We observed some of these regular cadet-mentor meetings. Cadets were encouraged to speak openly and mentors seemed comfortable to share their personal experiences, too, when they illustrated a point they wanted to make. With this relationship as a foundation, and with the shared explicit purpose of fostering the cadet's development, mentors were able to encourage and advise cadets, to listen to them and be more directive when necessary in order to guide cadets towards greater independence and self-management.

In Company B, those in mentor roles were more likely to be working in the same teams as the cadets they mentored, resulting in the lines between mentor and team leader roles being more blurred. Mentor-cadet conversations at this company tended to include a focus on the technical demands of the work in which they were involved. They took place on a daily as-needs basis, although they also had occasional planned meetings devoted to discussing cadets' progress and plans. Confidentiality between mentor and cadet was not such a feature of the relationship when a mentor was also the cadet's team leader or a team colleague. Those in mentor roles at this company did not necessarily have allocated time in their workloads to spend mentoring cadets.

Regardless of the differences in levels of formality, all the mentors aimed to help cadets become integrated into the "big picture" of engineering, helping them understand how they and their work are connected to the community of engineers and the wider community. Several mentors talked about their role in helping cadets to see how the apparently small roles they play contribute to the big picture.

> [I want the cadet] to realise that his work is valuable and it's part of the bigger picture, it's a cog in the wheel, it has meaning and is important to what we do as a business and what we present to the client ... He's making a contribution to the community. (Raj, mentor)

Some mentors also referred to having a role in helping cadets fit into the culture of the organisation. One coached his cadet in a meeting: "You have the right personality. Your natural strength is seeing the team around you. You seem to sense who is stressing or whatever. Other people don't see that" (Dylan & Steve's meeting, Company A). In his mentoring meeting, Mentor

Steve explained to his cadet that "one of the things about fitting in is to take an interest in projects that you are not involved in". Mentor Steve explained in his interview that his role includes showing cadets where their career might lead:

> I work on some technically challenging and quite impressive infrastructure projects. I guess he could see where he might get to ten years from now. It's probably hard for him to see what he might be doing in ten years' time, so that's probably quite helpful ... The perception of a big project would be quite useful. I know I get quite excited by working on a big tunnel project. [The cadet] isn't working on those big projects at the moment, although he might be doing small aspects on a project. (Steve, mentor)

Mentors also supported cadets to try and achieve a broad balance in their lives:

> The challenge for cadets is actually trying to balance their job with studying. Plus holding down a life outside, too. They struggle to focus on the right thing at the right time. A cadet will focus on their job, think that what's in front of them is most important, then they fail their exams, then they find studies boring. Most cadets go through that. (Steve, mentor)

By contrast, a team leader oversees the cadet's work within their team, and is responsible for monitoring the technical details of their work. Much of the feedback a cadet receives is likely to come via the team leader—both informal feedback about their work, and more formal feedback as part of the performance appraisal system.

A consideration for the team leader is minimising potential damage that a novice can do: "There's a big risk to projects if people aren't trained—they can accidentally delete something, for example, so we try and limit what they do" (James, team leader). At the same time as having oversight of a cadet's work, team leaders aimed to let the cadet work as independently as possible. Although it was important to provide cadets with support when they needed it, allowing them independence showed they were trusted and therefore also had the potential to help build a cadet's confidence (Geoff, team leader).

Like mentors, team leaders try to provide cadets with a balance of support and an expectation that they will become independent. However, the difference is that team leaders do this in a work-embedded way, whereas mentors embed this in the context of cadets' career pathways. With current and up-coming project work in mind, team leaders match cadets with more experienced colleagues, to provide cadets with readily available support: "We try and put a senior engineer with a junior and mix it up that way, or a senior draftsman with a junior engineer. So it's constant mentoring by different people" (James, team leader). Daniel was typical of the team leaders and mentors we interviewed, in that he aimed to foster cadets' independence: "I don't want to spoon feed people or say this is how you must do it. I'd rather just point them in the right direction and let them find out for themselves" (Daniel, team leader).

Facilitators of crossings

In each field, those in learning support roles were clear that work practice formed the basis for their teaching and mentoring. They were clear that they did not teach in the conventional sense of the word, understanding that they did not so much transmit knowledge and skill but co-construct competence with learner-practitioners (Hodge, 2010). Carpentry employers (and some foremen) were slightly different in that they explicitly taught "content". In recognising the ontological (not just epistemological) demands on learner-practitioners, teachers and mentors aimed to model an integration of theory and practice, and appropriate dispositions as practitioners. GP teachers, employers and foremen, training advisors, mentors and team leaders therefore put great store by establishing good relationships, being generous with their time, and being on hand for just-in-time learning support. They saw this as the best way to help learner-practitioners recognise and understand things that were not always immediately apparent or not yet available as a way to "be".

The broad stance of those in learning support roles is consistent with research into mentoring in "field-based experiences" for early childhood educator students and counselling students, which found that students valued "real relationship" and "open conversation", especially if these were intentional and structured into the experiences (Smith et al., 2012). Smith et al.'s research centred on practicum, as a part of, or integrated into, tertiary institution-based study, rather than on practice-based learning arrangements. However, their work makes an important point relevant to Knowing Practice: the specific mentoring strategy mattered less than actually having a strategy; the intentionality of the latter helped create the "real relationship" that facilitated students to take charge of their learning—an attitude very appropriate to their vocations.

6. Discussion

Vocational thresholds: connectors to a landscape of practice

We developed the idea of vocational thresholds to frame the significant shifts for learner-practitioners that are ontological (about their way of being), as well as epistemological (about what, and how, they know things). Building on Meyer and Land's (2003) idea of threshold concepts, vocational thresholds involve transformational learning experiences, sometimes troublesome of existing beliefs and knowledge, that open up a new set of spaces in which people can not only know, and do, but "be" as practitioners.

The role of experience in crossing vocational thresholds is crucial. Dewey argued for an "organic" connection between education and personal experience while acknowledging that education and experience were of course not the same thing, nor that all experiences are genuinely or equally educative (Dewey, 1938). Similarly, vocational thresholds offer a way to acknowledge that some experiences are more useful than others, or might be artfully reframed, in developing vocational capability.

Our 41 learner-practitioners reported significant learning experiences that we understood as taking them across vocational thresholds because they revealed the "big picture" of practice, often making it unexpectedly visible in an integrated form. Most strikingly, these experiences underlined the importance of developing an appropriate disposition as key to both vocational identity (Klotz, et al. 2014) and practice competence. This is a crucial point: competence was not simply technical; it required registrars, apprentices, and cadets to make "identity investments" (Hollway & Jefferson, 2000) in the practice field, and render themselves answerable to a community of practice. The vocational thresholds in each field therefore made ontological "being" demands on practitioners, as much as epistemological ones.

GP registrars' vocational thresholds cohered around the repositioning of their existing medical knowledge once in a community health context, which gave new impetus to the less visible (and sometimes also less glamorous) aspects of consultation and treatment. Registrars typically experienced a sharp surge in the level of uncertainty in their work, with more individual responsibility for patients and for the duration of entire cycles of healthcare. The ontological challenge they faced was to be both a doctor and a person, someone who could "be real". They had to build trusted relationships with patients and genuinely "be there" for them, while maintaining a level of care for themselves to avoid burnout.

The challenges posed were personal, as well as professional. Really being a GP could no longer be about knowing everything in a clinical sense. Instead, registrars found their expertise had to be

derived from a different kind of knowing—and management—of their own strengths, frailties, and anxieties within the context of patient relationships. Building vocational capability meant crossing a vocational threshold without being too reliant on the theory that had previously been a focus in their development as clinicians.

Carpentry apprentices described transformational learning experiences based on an increasingly sophisticated interplay between their minds, their bodies, and their physical environment of tools and materials. Building became less straightforward as the complexities involved in a building project revealed themselves, steering away from following one right method to literally *sensing* the possibilities. With increasing skilfulness in enacting the mind-body-environment interplay, apprentices were entrusted with more opportunities to solve more complex problems and enjoy the respect of their co-workers and clients.

While technical building prowess was important to apprentices (and of course to their employers and foremen), apprentices referred in particular to the development of attitudes and values such as pride, craftsmanship and independence. The capability to independently identify and correct mistakes was a key aspect of their learning. This capability incorporated technical prowess, a carpenter's "eye" and "nous", and a craftsman-like character. Apprentices' experiences drew attention to the commonplace tendency in education to think about values separately from cognitive processing and technical skill. Yet carpentry apprentices' experiences demonstrated that

> aesthetic and craft values direct behaviour as powerfully as do plans and strategies, leading one to measure, trim, balance, adjust, redo ... The values focus attention and sustain involvement: they affect the choice of tool, material and product and the choice of technique; and they stimulate and guide problem solving, for that fact contributes to problem finding in the flow of work activity (Rose, 2005, p. 204).

Engineering technician cadets described vocational thresholds that shifted their focus of attention. Much of their work involved intense devotion to detail—physical measurement, symbolic notation, computer-aided plan drafting, and precise calculation. Cadets were charged with ensuring accuracy of those details, to which they were deliberately restricted as learners, so they would not be overwhelmed. However, this meant they sometimes struggled to appreciate the place of their work within a project and team. Their significant learning experiences made visible what their measurements and drawings, a small aspect of a project, enabled for the rest of the team and for the project overall. Experiences interacting with other members of the team, or people in mentoring roles, helped cadets lift their gaze, reinforce diligence, and understand their contribution as fundamental rather than trivial. They were not just taking soil samples or using a theodolite. They were *engineering* solutions, making things possible.

Infrastructure work provided a particularly powerful means for this shift to occur because it necessarily involved a different kind of encounter with everyday objects. Cadets working on traffic safety, roading design, and other public works—objects and services they use themselves in ordinary life—were confronted now with a different perspective on those objects and services, with their new skills and budding identity as engineering technicians. As part of the design

process, they were faced with considering how ordinary people would engage with the results of their (and their team's) labour, including that the work could be contested by different groups or had differential impacts in the world.

These experiences not only proved useful to finding meaning in ostensibly small roles, but opened up a much deeper understanding of an engineering disposition. Engineering was now visible as an integration of the social, and the technical-physical. Cadets cited a growing awareness of being an engineer as involving a "communicative imagination"—an ability to appreciate communication as a key component of socially, ecologically and economically responsive engineering practice, rather than simply a soft skill additional to technical ones (Patil & Eijkman, 2012).

Context matters

Vocational thresholds are only intelligible in relation to an understanding of the broader context in which they are crossed. This is because, as we have seen in Knowing Practice, practice-based learning is not so much an old-style master-teaches-novice affair as a community-incalculates-novice affair. An entire "landscape of practice" (Wenger-Trayner & Wenger-Trayner, 2015) is involved.

A key part of this landscape for our learner-practitioners lies with their workplace. We have a broad understanding of the workplace as more than a physical context and as a set of working conditions and arrangements, and shared meanings. The workplace for GP registrars, carpentry apprentices, and engineering cadets is therefore not just the clinic, the building site, and the office or field. It is the relationships and shared practice meanings with immediate colleagues and team-mates, mentors and teachers, and patients and clients. This also includes people in other, overlapping communities of practice—medical specialists, hospital staff, and community care practitioners for GP registrars; subcontractors, construction tradespeople, and materials manufacturers and suppliers for carpentry apprentices; and professional engineers, subcontractors, and architects for engineering cadets.

Having this broad understanding of the workplace as a landscape, and as encompassing sets of relations, helps us understand what sorts of enabling conditions are important for learning. These enabling conditions are "affordances" and "action possibilities posed by objects or features in the environment" (Gee, 2008, p. 81). Our practice-based learning focus shows that, not only is learning only as good as the *opportunity* to develop capabilities and participate in a community of practice, but opportunities are only as good as their affordances—their possibility for *realisation* (Vaughan, O'Neil, & Cameron, 2011).

How a workplace affords opportunities for learners to engage is central to understanding how they function as learning environments (Billett, 2001). The workplace arrangements for GP registrars made possible the enactment of collegiality, as well as the development of collegiality as a disposition. The workplace arrangements for carpentry apprentices provided a model of proud

craftsmanship that apprentices could identify with and grow into. Workplace arrangements for engineering cadets recognised the dual importance of technical and dispositional development with leaders in each role.

These workplace arrangements in our three fields therefore contain what Schön famously referred to as vantage points over the "swampy lowlands" of practice (1991). These vantage points, in the form of critical reflection, have long been recognised as strategically important in promoting high-quality, deep learning and improved practice, particularly for work that is complex in its nature or involves problem-finding and problem-solving (Brockbank & McGill, 2007; Hargreaves & Page, 2013). We could, then, extend the line about opportunities and affordances. Learning is really only as good as the affordances for realisation. Following this, learning may also depend on the quality of opportunity for *reflection* (Coll et al., 2009; Soep, 2006).

Vantage points for reflection and exploration were provided for **GP registrars** through ad hoc discussions with colleagues, especially where clinics had an "open door" policy. In some cases, there were opportunities to observe expert GPs at work through registrars sitting in on consultations. Reflective space was structured into registrars' learning groups and GP teacher sessions, which typically explored what it meant to be a GP through case reviews, role plays and creative, reflective exercises.

For **carpentry apprentices**, there were unstructured, everyday opportunities to "chew the fat" with their immediate co-workers (employer, foreman, other apprentices) and subcontractors from other companies. This often emerged from specific task-based activities which were undertaken at close quarters physically and within the intimate working environment of what are typically micro-sized construction businesses. Carpentry apprentices also had reflective and exploratory space with their training advisors whose visits were deliberately organised as a conversation about learning, incorporating formative, as well as summative, assessment.

Engineering technician cadets gained reflective vantage points through their meetings with mentors, often strategically set up as distinct from project or team meetings, and focused on career development and developing an engineering mind-set. Cadets may also have had some reflective space through discussions with technical leaders or entire teams, particularly debriefings about approaches that have not worked or mistakes that have been made, and how to reorganise work to avoid this in the future. Discussions with peers in ITP-provided classes might also have provided reflective opportunities.

Vantage points provide an important means of shifting an important experience into a vocational threshold zone. The vantage points are facilitated by teachers and mentors, promoting the integrative aspect of vocational thresholds as integration into the field's "community of practice" (Lave & Wenger, 1991). **GP registrars** understood that their GP teachers were not providing the answers but inculcating them into a collegial approach to providing primary healthcare. **Carpentry apprentices** appreciated they were growing into a position as a trusted problem-solver in a wider (building project) enterprise. **Engineering cadets** came to see their interactions with

team-mates in terms of collaboration, each team member bringing something different, specific and important to the project.

The community, operating from authentic practice, helped learner-practitioners reposition and make sense of "the theory". **GP registrars** encountered a challenge to the way they used their theoretical knowledge through some patients' demands for care that seemed to amount to "just being there". **Carpentry apprentices** worked in the other direction, from principled practice (as explained by their employers and foremen, and sometimes training advisors) to an understanding of the theory as the most formal statement of principles. **Engineering cadets** moved back and forth between theory (typically in the classroom) and practice (everyday work), taking insights from each into the "real world" landscape of clients, teams, associated engineering or architectural professionals, and the public. Thus teachers and mentors were important but not because they transmitted knowledge and skills; they were important because they acted as co-constructors of competence (Hodge, 2010). Vantage points were therefore also important in showing registrars, apprentices and cadets that knowledge was not just what was contained in textbooks but what was embodied in the practitioners themselves, who represented the vitality and evolution of practice (Wenger-Trayner & Wenger-Trayner, 2015).

Vocation: a framework for understanding practice

> Occupation is a concrete term for continuity. It includes the development of artistic capacity of any kind, of special scientific ability, of effective citizenship, as well as professional and business occupations, to say nothing of mechanical labour or engagement in gainful pursuits. (Dewey, 1916, p. 33)

Knowing Practice confronts narrow thinking about "vocational education" as "hands on learning" and educational pathways held in comparatively low esteem. The close relationship of vocational education to work and practice has led to the conventional wisdom that it is "easier" than abstract or theoretical learning and for those who do not, or did not, achieve well at school. Unlike theory which is seen as systematic, tested and rigorous, and therefore something to be applied to practice, the context-bound nature of practice is seen as untested (by peer review or experiment) and therefore uncritical (Childs & Wagner, 2011). Yet medicine, one of the high status fields of practice in our society, is included in this project, and it would be hard to think of a pathway more accepted as both rigorous *and* vocational.

A key tenet of this project aligned with Dewey's sense of "vocation" as a direction for life, with ensuing intellectual and moral growth, made up of each individual's personal motivations and interests (things that bring fulfilment) and occupational activities or continued practice in areas that are valued and shaped by society (Dewey, 1916). Following Dewey's broader notion of vocation allows a shift in focus away from vocation as a kind of endpoint towards vocation as a context for continuous development of practice. We therefore used it more like a framework that connects an individual's knowledge, skills, attributes and dispositions with a deep understanding

of their occupational practice, in ways that define their identity in their vocation, and guide action in their practice (Wheelahan, 2007).

These ideas are what have allowed us to incorporate quite different fields of practice within the one project, spanning different parts of the tertiary education sector and several levels of credentialing in the New Zealand Qualifications Framework.[2] This focus on situated learning through the lens of vocational thresholds tells us something important about learning more generally: competence is being a person who *inhabits* a landscape (Wenger-Trayner & Wenger-Trayner, 2015). This is learning that goes beyond knowledge acquisition and skill advancement, to make identity development central, rather than an optional extra.

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[2] We acknowledge that the esteem of each occupation varies *within* its industry or field, as much as it varies outside of them. For example, doctors are held in comparatively high esteem in society but within the medical field, GPs are often held in lower esteem; builders are held in comparatively lower esteem in society but within the building and construction industries are held in high esteem.

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Appendix 1:   Knowing Practice pathways

Becoming a GP

The RNZCGP's General Practice Education Programme (GPEP) offers qualified doctors a 3-year fulltime equivalent "vocational immersion" training path to become vocationally registered in the specialty of general practice. It leads to Fellowship with the RNZCGP, and is the main means for gaining specialised training and for ongoing professional standards maintenance.[3] Doctors already have general scope registration following the 6-year Bachelor of Medicine and Bachelor of Surgery (MBChB) and two post-graduate years of pre-vocational training in hospitals as an intern.

First year GPEP registrars are employed by the RNZCGP and undertake two consecutive attachments of 26 weeks each in different primary health care clinics, one of which is rural if possible. Attachments are explicitly presented in GPEP literature as an opportunity to "translate" prior medical knowledge into a community context. The RNZCGP matches registrars to clinics on the basis of preferences, learning goals and personalities. Year 2 and 3 registrars are employed directly by a medical practice, with their previous clinical attachment experiences guiding decisions about the kind of clinic or community in which they wish to work.

Year 1 registrars see patients on their own but they see fewer of them and in longer than usual timeslots—20–30 minutes each (Royal New Zealand College of General Practitioners, 2012). During the year their caseload builds up until the registrar is seeing patients in standard 15 minute timeslots. They work under the clinical supervision of a designated *GP teacher*—another GP who works in that clinic.

Year 1 registrars also engage in a number of structured learning activities and sessions. They have a weekly session with a designated GP teacher, typically reviewing cases and discussing issues arising from consultations. Together they may also review videos of consultations the registrar has done or role play scenarios to help the registrar practise their management of difficult situations with patients. In some cases there may be sessions that combine multiple GP teachers and registrars across clinics within a corporate practice. GPs may still offer teaching sessions for Year 2 and 3 registrars but this is their decision rather than a requirement of the RNZCGP.

Year 1 registrars also attend "day release" seminars, generally on a weekly basis. These days typically begin with a session several hours long in small groups of peers with a medical educator (called a *reflective practice group*, *learning group* or *small group*). This group is used for reflection on personal and practice issues, role playing scenarios, reviewing video consultations, and presenting to the group on specific clinical matters. Learning group sessions are followed by

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[3]   There are two other possibilities for gaining vocational registration as a GP: the Recognition of Prior Learning pathway for experienced doctors who have been working as GPs (often overseas) and need only limited areas of vocational training to reach Fellowship standard; and the Experiential Interim Pathway for experienced doctors working as GPs who practice at a level expected of a vocationally registered GP. However, this research is concerned with the main GPEP pathway.

several hours of lecture-style presentations from other medical specialists with a clinical knowledge focus.

Registrars must complete a research project or a *medical audit* to gather objective evidence of an aspect of general practice (e.g., how many patients return for follow-up appointments as requested by GPs). GPEP2 and 3 registrars complete several audits and a multi-source feedback exercise.

The RNZCGP contracts GP teachers to provide teaching services of 1.5 hours of face-to-face time each week. The practice must be prepared to provide a physical space in the clinic for the registrar. In return, GP teachers earn some of the Maintenance of Professional Standards (MOPS) credits for re-certification as a vocationally registered GP. During each attachment, Year 1 registrars have an in-practice visit by a medical educator to be observed in patient consultations and a teaching session, and to be part of a discussion with the registrar and GP teacher about the registrar's progress and future direction.

Year 2 and 3 registrars are supported by "rotational supervisors" who visit clinics to observe them at work. They also attend 6–8 learning group sessions a year. A medical educator visits once each year, sitting in on consultations for a day and providing feedback about performance. Year 1 registrars are assessed through an end-of-year GPEP Clinical and Written Examinations, comprising a session of simulated clinical consultations and a written session on knowledge and skills. On successful completion of this assessment, the registrar becomes a senior registrar and a Member of the RNZCGP—the first step on the path towards Fellowship.

Several society-wide trends are currently impacting on the general practice workforce. Demographic changes in society, as well as an aging GP workforce, are exerting greater pressure on primary healthcare. Measures are being discussed and trialled to increase exposure to the GP career option at medical school and post-graduate level, and provide more efficient GPEP training by expanding the range of learning delivery models available.

Becoming a carpenter

The Building and Construction Industry Training Organisation (BCITO) is responsible for developing and managing industry qualifications for the building and construction sector. Carpenters work with materials such as timber, concrete and steel to construct buildings from scratch and to alter, repair and renovate them. They work on residential, commercial and industrial buildings. Becoming a qualified carpenter is a crucial first step towards becoming a fully-fledged builder in New Zealand.

The BCITO is responsible for leading qualifications development and brokering training in the building and construction industries. It manages training for over 90% of the carpentry apprentices in New Zealand (the remainder train partly through the Institute of Technology and Polytechnic sector). While the BCITO does not provide training, it does provide learning support to apprentices who are trained on the job by their employer or someone designated by the employer (for example, an experienced foreman).

Entry to the BCITO managed carpentry apprenticeship is by way of employment with a builder willing to train and support the apprentice. Some apprentices start their apprenticeship straight from secondary school but most take it up a little later, often after some experience in the building industry. It is not uncommon for apprentices to be trained by their father or within a family business.

The Training Agreement, signed by the BCITO, the apprentice, and the employer sets out a plan for the apprenticeship. It typically takes 3–4 years to complete a National Certificate in Carpentry, Level 4. Completion of the carpentry apprenticeship can be part of a pathway to becoming a Licensed Building Practitioner, to further training, or to management or ownership of construction or building companies. Industry expectations are for carpenters who are "well-rounded" generalists. This means that apprentices learn all aspects of the building process, rather than specialising in one particular area such as roofing or framing (as they do in some other countries such as Australia).

The BCITO's approach to managing the apprenticeship is a partnership one, cohering around an "assessment team" that includes specific and complementary roles in supporting the apprentice's learning. The employer provides the apprentice's training and ensures that the apprentice has access to the kinds of work and experience required to develop competence. Some employers have greater flexibility than others. Those who have several building projects on the go at once are able to shift apprentices from one job to another to give them the experiences they need. Other employers might share apprentices for short periods, for the same purpose. From an employer's perspective, an apprentice's learning needs must be balanced against their business considerations. The employer is also an evaluator of the evidence the apprentice presents for assessment to the training advisor. Depending on the size of the building firm and the size of the building "gang" on a site, the evaluator role can also be taken by a site supervisor/foreman[4]. The apprentice's learning may also be supported by a supervisor/foreman and other trades-people working alongside the apprentice.

The BCITO training advisor meets with the apprentice on-site at least four times a year. They ensure that the training is going to plan and assess the apprentice's competency. The training advisor views and discusses evidence of the apprentice's learning onsite with the apprentice, and discusses it with the employer or a nominated evaluator such as a foreman. The training advisor also maintains the apprentice's training plan which records workplace visits, what has been assessed, evidence that supported the assessment decisions, and discussions with the apprentice and employer.

The apprentice is responsible for keeping a written and/or visual record of the work they do onsite and this forms part of the evidence of their learning. Apprentices' main responsibility, though, is to learn as much as they can about the trade by working onsite with more experienced colleagues and studying the materials provided, which include a set of workbooks with modules aligned to

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[4] BCITO records to July 2015 show that 94% of carpentry apprentices were employed in firms with fewer than five employees.

and complementing the practical aspects of the apprentice's work onsite. Since 2009 the learning materials provided by the BCITO have been progressively updated and rolled out to apprentices. In addition to on-job learning and self-directed study of the BCITO materials, an apprentice may attend night classes. These may offer support for "book work" or be aligned with a particular learning area, such as scaffolding. Some apprentices also access specialist literacy and/or numeracy support.

In May 2015 the BCITO reviewed the National Certificate in Carpentry and replaced it with a New Zealand Certificate in Carpentry. The qualification content of the National Certificate is set out in unit standards that specify outcomes to be achieved. The new New Zealand Certificate qualification is less prescriptive; content has been streamlined and strengthened around six key carpentry specifications (fundamentals, preliminary work, support structures, frames and structures, exterior envelope, and interior linings and finishings). Under the unit standards-based system, some unit standards were optional, meaning that an apprenticeship could be completed without any experience, for example, in working with metal roof claddings. Under the new system, all apprentices will need to be assessed as capable in all areas. However, apprentices are able to enrol in the previous version until December 2016 with a completion date of 31 December 2020.

Against a backdrop of a building boom in Auckland and Christchurch, the number of carpentry apprentices is growing. To match the apprentices with training advisors, it is sometimes necessary to re-allocate training advisors, meaning new relationships must be established.

Becoming an engineering technician

Engineering technicians solve well-defined engineering problems using a combination of practical know-how and analytic techniques. The role is positioned to complement the work of professional engineers. The range of their work includes installing, testing, calibrating, fault-finding and monitoring equipment and systems. They may also supervise tradespeople, and select equipment and components to meet given specifications, and assemble them into customised systems.

Within the broad field of engineering, there are three main specialisations: electrical, mechanical and civil engineering. For this study, we focus on civil engineering, which is concerned with the design, construction, operation and maintenance of structures (e.g., buildings, bridges) and infrastructure (e.g., roading, sewerage), and is the basis for further specialisation in structural, mining, geotechnical and transportation engineering. The Canterbury rebuild is generating demand for engineering skills. In 2012, *Futureintech* was introduced to promote pathways into engineering, technology and science careers. More recently, the *Engineering Education to Employment* (*Engineering E2E*) programme was also launched to increase enrolments in engineering qualifications at ITPs (Futureintech, 2014).

Engineering technician cadetships are offered by firms associated with the Institute of Professional Engineers of New Zealand's (IPENZ) Futureintech initiative. Cadetships vary in

form, depending on the firm, but they incorporate employment in the firm and part-time study towards a New Zealand Diploma in Engineering (NZDE) offered by an ITP (institutes of technology and polytechnics). The NZDE is characterised as theoretical knowledge and is the equivalent of two years' full-time study, typically taking cadets five to six years to complete. Entry is by way of 48 NCEA credits at Level 2 of the NZQF, with at least 12 of these in mathematics. Cadetships may be advertised through schools and some cadets sign up straight from there. Cadetships are also taken up by people changing career paths and those who might have already completed the NZ Certificate in Engineering or a National Diploma in Engineering. Cadets usually attend weekly face-to-face lectures, although some programmes are offered by distance, and some papers are offered by "block course" (a few days to a few weeks at a time). Papers are assessed with assignments, tests and final exams.

Workplaces offering civil engineering cadetships tend to be larger global companies, for example, MWH Global, Opus and Downer. Companies generally encourage cadets into a voluntary mentoring scheme, which pairs cadets with someone more experienced from their company who can provide advice and support on a regular basis. While IPENZ provides broad *Mentoring Guidelines* (2011), practices vary from very formal, signed agreements between mentor and mentee to informal, verbal agreements about how the mentoring relationship will work.

Mentoring meetings are designed to support the professional development of the cadet; they tend to be less focused on the technical aspects of the job as cadets usually learn technical skills from other team members/leaders. The length of the mentoring relationship varies, depending on the individual context, with some companies changing mentors every year or so. Cadets who choose not to take part in the mentoring programme often have a team leader or manager with whom they meet to discuss their learning and performance.

Cadets and mentors are matched based on their skills and personalities. They sometimes work in the same work team but many companies prefer them to be in different teams (they may also be in different offices/locations), facilitating confidentiality and avoiding potential confusion between performance management (overseen by a manager) and the mentoring role.

A cadet's team leader is likely to interact with the cadet on a daily basis, so will build a detailed picture of how the cadet is developing. They are responsible for planning the cadet's development and professional learning and for monitoring his/her progress. This is often a formal performance management process that involves the team leader and cadet setting goals for the medium term to support the cadet's long-term plans. Progress towards these goals is reviewed during the year, with a major review after 12 months.

After gaining their NZDE, engineering technicians may go on to enrol for the New Zealand Diploma in Engineering Practice (NZDEP), an applied skills qualification designed to supplement and integrate academic learning in the NZDE with practical knowledge and experience. It involves around three years of work-based assessments and can be taken in parallel with the NZDE. Cadets may work as civil engineering technicians or draughtspeople. Technicians may continue their study beyond the NZDE and/or NZDEP by cross-crediting courses to a Bachelor of

Engineering Technology (completed over three or four semesters) or a Bachelor of Engineering (three years of full-time study).

On completion of the diploma, cadets may apply for an Associate Membership at IPENZ and can register as Certified Engineering Technicians. IPENZ also administers the competence registers for engineers. An engineer technician can apply to become registered as a certified engineer technician (CertETn) by demonstrating their competent independent practice in relation to IPENZ's standard for engineer technicians. To apply, they need to submit an online portfolio of evidence of their competence. This can be done at any time; there are not set dates for assessment. Registration as a CertETn does not require membership of IPENZ.