Capturing the complexity of workplace knowledge – a case study of recognition of prior learning in an automated production environment

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DECLARATION

I, Colette Naomi Tennison, hereby declare that the work on which this thesis is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.

Signature: ……. Date: 12 June 2024

ABSTRACT

Braverman (1974) and others argue that the automation of the workplace results in deskilling and a reduction in the knowledge requirements for occupations. Recognition of prior learning (RPL) aims to recognise candidates' prior knowledge and skills learned in non-formal and informal contexts, including the workplace. The concern is that if Braverman's thesis is correct, the RPL process might be certifying 'push-button operators' who do not have the required underpinning knowledge and skills for the occupation. However, the knowledge that operators in an automated production environment draw on in their work may be more complex than what the literature around deskilling suggests. This is hinted at in studies and literature about workplace learning such as those by Billett (2000, 2006) and others.

The purpose of this research was to identify the types of knowledge surfaced through an RPL programme conducted in an automated production environment in order to explore the nature of this workplace knowledge and to further develop a conceptual language for describing and analysing the knowledge present. This qualitative research project was based on a case study approach drawing on Participatory Action Research and Educational Design Research Methodology. It drew on an RPL programme conducted for machine operators on a high-speed beverage packaging line and focused on the knowledge surfaced by the tools used to assess the candidates during the RPL programme.

The analysis in this thesis draws on Gamble's (2016) study of work which is based on the social realist tradition and provides a conceptual framework for examining knowledge present in work contexts. This is further expanded through Winch's (2012) conceptualisation of skill as well the literature on craft and tacit knowledge, together with Guile and Unwin's (2019) concept of expertise. In order to clearly understand the complexity of the knowledge surfaced in this case study, it was necessary to use various analytical lenses to 'pull apart' the range of knowledge types and categories of knowledge present.

The findings of this research point to the complexity of knowledge that is drawn upon by machine operators on an automated production line. This complexity highlights the depth of knowledge required to develop the expertise and professional judgement needed to function in the workplace. Having analysed the knowledge types present separately, they were drawn together in an attempt to create a more holistic picture of what constitutes workplace expertise. The concepts of craft-like and tacit knowledge, together with expertise, allowed for the development of a language of description to address the 'discursive gap' (Ensor and Hoadley, 2004) between the analytical lens and the empirical data. This conceptualisation was further developed in the final chapter of the thesis as it provided

insights into what a holistic picture of occupational expertise could look like in an automated production environment.

The thesis concludes that the complexity of workplace knowledge surfaced through the RPL programme indicates that the RPL candidates were not just 'push-button operators'. Theoretical conclusions drawn in the final chapter point to the contribution of the thesis in developing a more holistic conception of expertise that accounts for the complexity of workplace knowledge. The final chapter also points to the importance of RPL programmes that can surface forms of knowledge from a variety of contexts and reflects on the contributions of this research for RPL practice. Finally, the chapter offers suggestions for how considerations around the development of craft-like and tacit knowledge, as well as professional judgement, should be taken into account when developing vocational curricula.

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ACRONYMS AND ABBREVIATIONS

CIP	Clean-In-Place
DHET	Department of Higher Education and Training
ETDP	Education, Training, and Development Practices
ETQA	Education and Training Quality Assurance
FoodBev SETA	Food and Beverage Manufacturing Sector Education and Training Authority
NQF	National Qualifications Framework
OQSF	Occupational Qualifications Sub-Framework
QCTO	Quality Council for Trades and Occupations
QFR	Quick Fix Routine
RPL	Recognition of Prior Learning
SAQA	South African Qualifications Authority
SETA	Sector Education and Training Authority

We must learn to honor excellence (indeed to demand it) in every socially accepted human activity, however humble the activity, and to scorn shoddiness, however exalted the activity… An excellent plumber is infinitely more admirable than an incompetent philosopher. The society which scorns excellence in plumbing because plumbing is a humble activity and tolerates shoddiness in philosophy because it is an exalted activity will have neither good plumbing nor good philosophy. Neither its pipes nor its theories will hold water. (Gardner, 1961, p. 86)

CHAPTER 1: INTRODUCTION

This research is based on a case study of a recognition of prior learning (RPL) programme conducted for machine operators on a high-speed beverage packaging line. The RPL programme provided candidates who had many years of experience as packaging machine operators, but who did not have a qualification, with the opportunity to achieve the relevant qualification. The candidates were taken through an RPL programme designed and run by an accredited training provider in the food and beverage manufacturing sector. At the end of the programme, the candidates achieved a National Certificate: Food and Beverage Packaging Operations. This qualification was registered at Level 3 on the South African National Qualifications Framework (NQF) and was quality assured by the Food and Beverage Manufacturing Sector Education and Training Authority (FoodBev SETA).

When the RPL programme's model was originally proposed to the FoodBev SETA by one of their accredited training providers for the qualification, their quality assurance manager posed a critical question – "but aren't we just accrediting push button operators?" This research initially set out to provide an answer to this question but, in so doing, the research surfaced a much richer picture of the knowledge surfaced by the RPL programme. Cooper, Ralphs, and Harris state in the conclusion to their article on RPL:

> To date, we do not have a rigorous, theoretical language with which to study and conceptualise the different forms of 'specialised experiential knowledge' that we argue present a useful platform for RPL. This remains an important task for future research. (2017, pp. 210–211)

The research aimed to identify the types of knowledge surfaced through the RPL programme to explore the nature of this workplace knowledge. An RPL programme conducted for machine operators on a high-speed beverage packaging line was used as a case study to answer the research question: "What forms of workplace knowledge used in an automated production process can an RPL programme surface and how might such knowledge be categorised and conceptualised?" Analysis of the forms of knowledge surfaced by the data supported the argument that machine operators in an automated production process have a much broader range of knowledge than is suggested by the notion of a 'push button operator'. This research required the development of a conceptual language for describing and analysing the knowledge present, which contributes to the research need identified by Cooper, Ralphs, and Harris (2017). Drawing on a conceptual framework based on a social realist view of knowledge, the findings of the research that are presented in Chapters 5 and 6, and drawn together in the conclusions of Chapter 7, further develop this conceptual framework and extend the

language of description, thereby contributing to a conceptualisation of workplace knowledge that better engages with its complexity.

This chapter provides an introduction to the South African vocational education context and some of the related debates on outcomes-based education. It then provides the background of the RPL programme used as the case study for this research and discusses how RPL has been implemented and researched both internationally and in South Africa. Finally, this chapter introduces the debate on deskilling that was first raised by Braverman (1974) and which continues to be used in discussions on the increasing automation of the workplace and the impact of the 4th Industrial Revolution on the deskilling of workers.

The South African vocational education context

In the South African educational context, all qualifications are registered on the National Qualifications Framework (NQF). According to Lloyd, "NQFs have a defined and definite space as Governments are increasingly seeing NQFs as educational reform mechanisms, promoting access, transparency, mobility, recognition and validation of all forms of learning, and lifelong learning" (Lloyd, 2013, p. 9). The role of the NQF is to provide the structure for all qualifications offered in the South African education system, including higher education, school-based education, and occupational qualifications.

The NQF is governed by the South African Qualifications Authority (SAQA) who are responsible for the registration of qualifications on the NQF. At the implementation level, the responsibility for the quality assurance of occupational qualifications registered on the Occupational Qualifications Sub-Framework (OQSF) of the NQF rests with the Quality Council for Trades and Occupations (QCTO), who are ultimately responsible for the quality of education provided in the occupational[1] sector. The occupational education system is in transition from the previous approach where the responsibility for skills development in the occupational sector rested with individual Sector Education and Training Authorities (SETAs) and qualifications were based on unit standards, to one where the QCTO has oversight of the sector and qualification development is based on a modular approach.

A Ministerial Determination was issued in 2020 that stipulated that the end date for registration of all pre-2009 qualifications, which includes all the SETA unit standard-based qualifications, was 30 June

[1] In the South African context, the term *occupational* refers to what, in other countries, would be termed *vocational*.

2023 (Department of Higher Education and Training, 2020). Currently, the SETAs remain responsible for overseeing the funding aspect of the skills development process. The education and training quality assurance (ETQA) function for the so-called 'historically registered qualifications[2]' still rests with the SETAs, although it is overseen by the QCTO. Unit standard-based qualifications were structured based on individual units of learning (i.e. unit standards) that encompassed sets of learning outcomes for a particular section of the envisaged qualification and fell into one of three categories:

1. Fundamental unit standards related to Mathematics and Communication
2. Core unit standards that were compulsory for the qualification
3. Elective unit standards that could be selected in specified combinations depending on the learners' context

The unit standards for a specific qualification, as registered on the NQF, were listed on the SAQA qualification document for each qualification. However, the unit-standard based qualifications are being replaced by a different approach to qualification development that focuses on modules divided into 'knowledge' and 'application' (that could include separate practical and workplace experience modules) components (QCTO, 2021a).

While these new qualifications also have a qualification document published by SAQA, they also have a detailed 'Curriculum Document' and 'External Assessment Specifications' which provide a detailed breakdown of every module's learning outcomes, as well as the assessment requirements for achieving the qualification. The new occupational qualifications are quality assured directly by the QCTO. Although the structure and nomenclature of the two types of qualifications differ, both unit standard-based qualifications and the new occupational qualifications are based on learning outcomes.

Learning outcomes and outcomes-based qualification frameworks are used in the education systems of a number of different countries, including the United Kingdom (UK), Australia, and New Zealand whose policies influenced the South African NQF (Allais, 2014). National qualifications frameworks have been widely implemented internationally, as well as being used for comparability between countries – the European Union, for example, has implemented a Qualifications Framework that aims to link together the national qualifications frameworks of member countries (European Union, no date). However, national qualifications frameworks have also been widely critiqued, particularly due to their use of learning outcomes as basis for the development of qualifications and curricula.

[2] The term 'historically registered qualification' is used by the QCTO to refer to the unit standards-based qualifications developed by the SETAs prior to the introduction of the QCTO's occupational qualifications in 2012 (QCTO, no date b, no date a).

One of the most voiced critiques on the use of learning outcomes in vocational education internationally is based on the argument that there are different knowledge types present in occupations, and that this needs to be considered when designing vocational qualifications and curricula (Billett, 2003; Gamble, 2006, 2016a; Young, 2006, 2013; Wheelahan, 2015, 2019). As Billett explains:

> In Western countries, such as the United Kingdom (UK), Germany and Australia, curriculum frameworks for vocational education remain premised on behavioural accounts of the goals and process of learning. Outcomes- focused or behavioural curriculum accounts commonly guide instruction and the assessment of measurable outcomes. Governments, governmental agencies (e.g. Organization for Economic Cooperation and Development) and industry often favour these arrangements. Such outcomes are seen as offering surety in the management of education, teachers and student learning. (Billett, 2003, p. 7)

These learning outcomes, it is argued, are focused only on procedural knowledge and do not include the disciplinary knowledge bases for the occupations that they are preparing learners to enter, other than in the limited form of what, in South African occupational qualifications and their corresponding curricula, is referred to as the 'essential embedded knowledge' that underpins each learning outcome (Billett, 2003; Gamble, 2006; Young, 2006; Allais, 2014).

A further critique of learning outcomes based qualifications is that "the procedural description required by this format [of learning outcomes based qualification] not only has no place for the specification of a formal knowledge component (other than stating that such knowledge should be in place), it also compels those wishing to be assessed against such a unit standard to present in words that which they may know in ways other than what can be expressed in words" (Gamble, 2004b, p. 14). This, then, becomes the challenge for the RPL tools in the RPL programme that this research case study is based on. If they are developed using a qualification based on learning outcomes, which Gamble critiques as requiring the presentation of procedural descriptions in words, how is it possible for tacit knowledge — knowledge that, by its very nature cannot be easily languaged — to be surfaced?

Background to this research

The case study for this research is an RPL programme aimed at awarding experienced machine operators an historically registered qualification, the NQF 3 National Certificate: Food and Beverage Packaging Operations, based on their prior knowledge and experience. The FoodBev SETA which oversees the historically registered qualifications in the food and beverages manufacturing sector had as part of its vision at the time of the development of the RPL programme, the aim of contributing to "the redress of past inequalities in education and training" (FoodBev SETA, 2015).

The idea of RPL as a tool for transformation and redress is something that has been part of the South African education and training context for many years (Aitchison, 2004; Cooper, 2006; Cooper, Ralphs, and Harris, 2017). Despite this, the uptake of RPL within the food and beverages manufacturing sector had been limited, with several attempts at implementation that had ended unsuccessfully (personal correspondence). The reasons for this were varied but based on my observations, they included the inability to develop a model and related tools that overcome the barriers experienced by those attempting to gain qualifications in this sector via the RPL route.

In an attempt to address the above, a FoodBev SETA accredited training provider, in consultation with one of the larger companies in the food and beverages manufacturing sector, attempted to develop a model which met the needs and requirements for RPL against a packaging qualification registered on the National Qualifications Framework (NQF) and quality assured by the FoodBev SETA. The opportunity to participate in a pilot project to implement RPL in the FoodBev SETA environment in 2016 arose as a result of my work with training providers in the sector. One of the training providers, with whom I had worked extensively, approached me for assistance in putting together a pilot programme based on the model that they had developed. Participation in the implementation of this pilot project provided an opportunity to engage in research on RPL in a largely unexplored sector.

As an Education, Training, and Development (ETD) Practitioner, I worked on the RPL Programme in several capacities. While the training provider was responsible for the development of the overall model for the programme, I gave input on the model's approach to addressing the 'Fundamental' (Mathematics and Communication) unit standards and facilitated the contact sessions for that section of the programme. As part of my work with the training provider, I was also a moderator for the programme and was responsible for quality assurance of some of the assessments, including the Candidates' Workplace Observations.

Being a participant in this RPL programme allowed me to access the assessment evidence produced by the candidates, and this became the basis for my research. However, the distance between my research and participant roles was always at the forefront and I was able to ensure that the research component remained separate from the programme. I was not involved in any competence judgements for the candidates and only conducted interviews after the programme was closed out and the certificates awarded.

The purpose of this research was to study the implementation of a specific workplace RPL programme. The RPL programme attempted to create a more holistic and integrated approach to RPL that would improve the candidates' internal transfer of knowledge from the workplace to the educational

context. From a theoretical perspective, this research aimed to conceptualise and classify the forms of workplace knowledge used in an automated production process. In order to do this, it was necessary to develop a language of description to capture the complexity of the knowledge surfaced in the RPL programme.

Recognition of prior learning (RPL)

Harris and Wihak define recognition of prior learning (RPL) as "the practice of reviewing, assessing and acknowledging the knowledge and skills that adults have gained outside the formal education system" (2014, p. 13). The focus of RPL, as suggested by the definition above, has tended to be on recognising non-formal and informal learning. Johnson and Majewska (2022) trace the history of the differentiation between formal, non-formal, and informal learning in the literature around schooling, identifying that

> There appears to be a consensus around the meanings of formal and informal learning. Formal learning broadly aligns with organised, institutionalised learning models (such as learning seen in schools), whilst informal learning describes the everyday learning that people experience throughout their lives, and which can go easily unrecognised. Non-formal learning is less clearly understood. (Johnson and Majewska, 2022, p. 4)

Later in their report, Johnson and Majewska quote Coombs and Ahmed to provide a definition of non-formal learning as "any organized, systematic, educational activity carried on outside the framework of the formal system to provide selected types of learning to particular subgroups in the population, adults as well as children" (Coombs and Ahmed, 1974, p. 8 in Johnson and Majewska, 2022, p. 13). Although based on the schooling sector, these definitions provide a useful basis for understanding these terms in the field of RPL, particularly since non-formal and informal learning are sites of most of the prior learning that RPL aims to recognise.

While the term Recognition of Prior Learning (RPL) is used in the South African context, the same concept is present in many countries under different names such as Accreditation of Prior Experiential Learning (APEL), Validation of Prior Learning (VPL), Prior Learning Assessment and Recognition (PLAR), Prior Learning Assessment (PLA), or Validation of Non-Formal and Informal Learning (VNFIL) (Harris, 1999; Harris and Wihak, 2014; Pokorny, 2023; Travers, 2023; Villalba and Bjørnåvold, 2023). Villalba and Bjørnåvold suggest that "all expressions share the underlying objective of making learning acquired in different contexts … visible and providing that learning with value (currency) that the individual can make use of" (2023, p. 1). RPL has been adopted internationally across a range of countries and regions such as Australia, Bangladesh, Canada, the European Union, Ireland, Sweden, the United States of America, and South Africa (Cooper, 2006; Diedrich, 2013; Harris and Wihak, 2014;

Donlevy *et al.*, 2016; Cooper, Ralphs and Harris, 2017; Maurer, 2021, 2023a; De Paor, 2023; Travers, 2023; Villalba and Bjørnåvold, 2023).

Conceptualising RPL as a practice

As Harris points out, RPL is "both a philosophy and a method" (Harris and Andersson, 2006, p. 8) in that it is both about the ideals that underpin it as well as the way in which it is implemented to reach those ideals. The origins of RPL come from a humanistic approach that prioritises access to postsecondary education and social inclusion (Harris, 2004; Cooper, Ralphs, and Harris, 2017). In the UK and North America, RPL developed in policy along with the concept of learning outcomes in the 1970s and 1980s (Cooper, Ralphs, and Harris, 2017). As Travers writes, RPL's equity purpose was historically foregrounded:

> Prior learning assessment has a rich history of applying processes for recognizing and validating learning acquired outside traditional formal education and training practices. It has increased the ability to provide greater access to education and employment for many people who would have been otherwise left behind. (2023, p. 15)

In most countries, however, that approach has been superseded by conceptualisations of RPL for lifelong learning and labour mobility (Diedrich, 2013; Harris and Wihak, 2014; Donlevy *et al.*, 2016; De Paor, 2023; Villalba and Bjørnåvold, 2023), although Travers (2023) does suggest that it remains an equity issue in some contexts in the United States of America (USA).

Harris (1999) presents four models for RPL; the 'Procrustean' or 'credit exchange' RPL model, the Learning and Development model, the Radical RPL model, and the 'Trojan Horse' model which attempts to make connections between experiential knowledge and more formal ways of knowing (Cooper, 2016). Cooper highlights critiques that have been made of certain models, pointing out that the Procrustean, or 'credit exchange', RPL model has been critiqued for resulting in the commodification of informal learning. Michelson has also critiqued the developmental model "for privileging individualised and rationalise ways of knowing over contextualised and collective practices" (Cooper, 2016, pp. 27–28). Furthermore, Harris (1999) argues that the Procrustean RPL model upholds the status quo in terms of what knowledge counts, as does the Learning and Development RPL model. Similarly, Travers describes the way in which RPL, in the USA's context,

> seeks to capture and recognize non-formal and informal learning in such a way that it can be used for education and employment. This recognized learning is rarely credentialed on its own, but more often is integrated into existing credentials. This can limit what and how knowledge and skills are formally recognized and can leave much learning unacknowledged. (Travers, 2023, p. 2)

Harris (1999) presents her latter two models for consideration around possible RPL models that may allow for greater social inclusion, although she does point out that the Radical RPL model is open to some of the same critiques as the first two models. The final model that Harris suggests, the Trojan Horse model, is what she proposes as a model that takes into account the relationship between experience, everyday knowledge, and formal knowledge, considers the integration of theory and practice, and overall is more open to examining the power relations that underpin decisions about knowledge and what counts as knowledge (Harris, 1999). It is critical to remain cognisant of the power relations that are constructed in the RPL process (Diedrich, 2013), as knowledge production in RPL involves power relations around what counts as 'socially valuable knowledge' and who decides this (Cooper, Ralphs, and Harris, 2017).

While emphasising the contestation around what counts as 'socially valuable knowledge', Cooper and Harris draw on critiques of outcomes-based education to make the point that "experiential knowledge cannot necessarily or easily be calibrated against formal knowledge, nor is it automatically a good platform for the acquisition of codified knowledge" (2013, p. 3). From the perspective of theoretical approaches to knowledge, there has been substantial theorising of formal knowledge, but so far, limited theorising of experiential knowledge – something that is evident in the literature discussed in Chapter 2. This disjuncture between the theorising of formal and experiential knowledge, Cooper and Harris argue, is why RPL should be considered a 'specialised pedagogy' to ensure that access to, and implementation of, RPL becomes possible. Experiential knowledge is essential to determining the kinds of 'specialised pedagogy' needed to enable navigating between these two very distinct forms of knowledge.

The concept of RPL as a pedagogical practice is distinct from the more popular approach of RPL as an assessment process only. The notion of 'prior learning assessment' being central to the role of RPL has also been critiqued by Travers (2023) as being too focused on assessment while failing to recognise other types of prior learning that may not directly contribute to the achievement of credentials but is still valuable in developing knowledge and skills. Similarly to Harris above, she argues for a learner-centred model for recognising prior learning: "… [a] fuller understanding of learning recognition must encompass all the ways we recognize, validate, and credential that someone has knowledge and skills, regardless of the source and application of those knowledge and skills" (Travers, 2023, p. 5). This speaks, again, to the argument that RPL should extend beyond just a process of recognising prior learning that relates to measurable outcomes and should rather form its own pedagogical approach (Michelson, 1996a; Harris, 1999; Cooper, 2006; Evans et al., 2010; Cooper, Ralphs, and Harris, 2017).

Historically, RPL has drawn extensively on experiential learning theory and, in particular, Kolb's (1984) experiential learning cycle that emphasises the need to recognise and reflect on experience gained in non-formal and informal contexts (Cooper and Harris, 2013). The use of experiential learning for RPL has been problematised, however (Fenwick, 2001; Harris and Andersson, 2006; Diedrich, 2013). Diedrich, in his review of the literature on validation, points to the critiques that have been raised regarding the use of experiential learning as the main tool for recognising non-formal and informal learning, such as that it can be used to uphold the dominant views of knowledge and privilege the knowledge of the institution rather than the individual's experience (Fenwick, 2001). Diedrich also points to the need to challenge "the conventional views of experiential learning and the particular readings of knowledge, pedagogy, learning, identity and power, which these views privilege" (2013, p. 549). He also draws on Michelson's (1996a) argument that it is critical to consider the situatedness of knowledge and learning in the validation process.

RPL policy and implementation internationally

As mentioned previously, internationally, RPL forms part of the need to embrace the concept of lifelong learning as well as address issues of labour mobility. Although the concept of labour mobility suggests geographical mobility, it can also refer to mobility in other contexts such as between education types (e.g. between vocational and higher education), and mobility between employment sectors (Donlevy *et al.*, 2016). Although the focus of RPL has shifted, Maurer suggests that it has not strayed too far from its original ideals as

> In the context of increasing rates of migration and cross-sectoral and cross-occupational mobility in today's labour markets, RPL is considered an important way to improve equitable access to employment and income. (Maurer, 2023a, p. 1)

Not everyone echoes this view, with Harris observing that

> There are dissonances between the work done and what implementers of RPL think they are trying to achieve – between rhetoric and reality. RPL does not always live up to the redress and equity claims made in its name (Harris, 2000, p. 2).

The implementation of RPL is sometimes viewed as only reinforcing inequity by failing to recognise forms of knowledge that do not meet expectations. The questions around what counts as knowledge, and who determines this, are central to RPL (Frick and Albertyn, 2011; Singh, 2011). As Cooper *et al.* argue: "recognition of knowledge produced and acquired outside of the conventions of the academy is both complex and contested" (2017, p. 200).

Despite the broader debates, recent international research on RPL focuses on its implementation in various contexts, as well as the policy frameworks that support or block its implementation in different

countries. Villalba and Bjørnåvold (2023) trace the history of RPL policy and implementation in the European Union (EU) context and identified challenges such as

- the need to embrace the increasing complexity of RPL contexts and implementation,
- the need to ensure that there is standardisation in assessments and tools,
- and the need to review how credentialling occurs using certification and digitalisation.

They suggest that there is a need for critical research and an increase in critical reviews and evaluation of RPL both in Europe and globally. The slow growth of implementation of RPL internationally has also been identified as a challenge with various explanations for why this is the case, despite countries developing policies that support its implementation (Maurer, 2023b; Villalba and Bjørnåvold, 2023). In fact, the lack of policy implementation is considered such a significant challenge internationally, that the organisers of the 3rd Validation of Prior Learning Biennale made it the theme of their conference held in 2019 (Duvekot *et al.*, 2020).

This lack of policy implementation in RPL has resulted in decreased uptake of RPL, a trend which is also evident in the South African context and was one of the original motivations for undertaking this research. Despite national policies being in place for RPL, implementation of RPL in South Africa has been slow. The case study of an RPL programme used for this research was considered a pilot implementation in its sector, with the research intended to provide support for future roll-outs by demonstrating the value of the RPL programme for recognising the candidate's extensive workplace knowledge and experience.

RPL as a concept has, however, been implemented in various contexts including higher education and VET, and for a variety of purposes (Maurer, 2023b). Travers (2023) writes about the use of RPL in the context of developing a credentialling framework in the USA which, although a different context, provides some possibilities for how to address the credentialling challenge raised by Villalba and Bjørnåvold. She also proposes a change to the approach from 'Prior Learning Assessment' to a broader model on 'Learning Recognition' in order to accommodate the inclusion of a broader scope of learning for recognition. The use of an assessment-based approach to RPL, or 'credit exchange' model (Harris, 1999), that Travers argues against tends to be the most commonly used model for RPL internationally, and particularly in Vocational Education and Training (VET) (Maurer, 2023a; Pokorny, 2023; Villalba and Bjørnåvold, 2023).

Recent articles on RPL focus on its implementation and evaluation of implementation in particular contexts, such as De Paor's (2023) evaluation of an RPL project in Ireland. However, internationally, there has only been limited work following on from the key theorising of RPL that was done by authors such as Harris, Cooper, and Ralphs in the South African context (see Cooper and Harris, 2013; Cooper

and Ralphs, 2016; Cooper, Ralphs, and Harris, 2017). Some further theorising of RPL has been done by Pokorny (2023), whose work seeks to expand on the theoretical foundation for RPL by looking at how Actor-Network-Theory can be used to develop a 'specialised pedagogy' for RPL in the context of postgraduate higher education. However, the original development of RPL as a 'specialised pedagogy' comes out of work done in the South African context, which differs slightly from international perspectives in its focus.

RPL policy and implementation in South Africa

In the South African context, RPL has been envisaged as tool for transformation and redress as part of the broader concept of lifelong learning in the education and training system (Aitchison, 2004). Similarly to its development in the UK and North America, RPL in the South African context can be linked to the rise of the learning outcomes approach and the conceptualisation of lifelong learning within the constructs of the National Qualifications Framework (NQF) (Aitchison, 2004; Cooper, Ralphs, and Harris, 2017).

The RPL programme that this case study is based on was designed to provide machine operators, who had been working on a high-speed beverage packaging line but who had not had the opportunity to gain the same qualification as new machine operators were required to have (the NQF 3 National Certificate: Food and Beverage Packaging Operations[3]), the opportunity to achieve the qualification without undertaking the full learning programme. This is in line with the South African ideals of RPL as a tool for transformation and redress where, as Cooper explains, "RPL is viewed as a central mechanism with which to address past discrimination and disadvantage, and to bring about greater equity and redress" (2006, p. 211). This is spelled out in the Department of Higher Education and Training's (DHET) *White Paper for Post-School Education and Training* (2013). This focus is still seen as so critical in the South African context that the Department of Higher Education and Training (DHET) in South Africa has implemented a *National Coordination of Recognition of Prior Learning (RPL) Policy* (2016).

The new policy aims to be "a strategic policy which places RPL firmly on the national education and training agenda and holds SAQA and the QCs accountable to perform their roles in relation to RPL as stated in the NQF Act" (DHET, 2016). Thus it is evident that RPL remains high on the agenda in the South African post-school education system, with a particular focus on its use as a tool for

[3] This qualification is registered by the South African Qualifications Authority (SAQA) on the South African 10-level NQF.

transformation, although as Reddy writes in her Foreword to the 2019 SAQA Bulletin on Inclusivity: "while there have been large-scale national and international initiatives to enhance inclusivity, there is still work to do" (2019, p. i).

Breier and Ralphs (2009) do, however, point out the "underlying contradiction inherent in the concept of RPL as defined in the regulations. RPL was intended to assist those who had missed out on formal education, yet it required candidates to compare their learning with formal outcomes, which are usually attained only through formal education" (Breier and Ralphs, 2009, p. 483). In her Introduction to *RPL: Power, Pedagogy and Possibility*, Harris highlights some of the understandings gained through the project, one of which is the "dissonances between the work done and what implementers of RPL think they are trying to achieve… RPL does not always live up to the redress and equity claims made in its name" (Harris, 2000, p. 2).

RPL in South Africa has been applied successfully to the higher education context, in professional bodies, and in other sectors of the vocational context (see, for example, Cooper and Ralphs, 2016; Naudé, 2016, 2022; Deller, 2019). This research aims to extend the body of knowledge around RPL to the manufacturing sector and, thereby, add to the current body of knowledge as well as extend opportunities for new areas of application to a greater range of the vocational context. Current literature that deals directly with RPL in a workplace context has not been as extensive as in other contexts in South Africa. Wihak's (2014) overview of research in the field of RPL quotes Breier's (2011) analysis that in South Africa, "research has been mostly qualitative, mainly in university departments and it has focused quite strongly on the challenges of implementation" (Wihak, 2014, p. 33). This study, therefore, aims to provide insight into the use of RPL in a vocational context, specifically focusing on the types of knowledge involved in RPL against a vocational qualification.

In terms of policy implementation, although it has not been as extensive as the DHET and SAQA had envisaged, there has been implementation of RPL in various South African contexts. The 2019 SAQA Bulletin focused on 'Inclusivity' and published a collection of articles exploring RPL research and implementation in South Africa. It provided insight into ways in which RPL has been successfully implemented, showcasing implementation across higher education, VET, and workplaces. In terms of implementation, the majority of RPL implementation in South Africa against qualifications has been in the VET sector (Bolton *et al.*, 2020). From a research perspective, the most significant work on theorising RPL is the book edited by Cooper and Ralphs (2016), *RPL as Specialised Pedagogy: Crossing the Lines.* Their work examined RPL in the context of higher education (both undergraduate and postgraduate), worker education, and vocational education in South Africa.

RPL in VET and workplace contexts

An analysis of the application of RPL indicates that it takes place in a variety of contexts, including higher education, VET, and workplaces. Wihak's (2014) analysis, drawing on work done by Cameron in 2011, suggested that a fair proportion of the research conducted in the field of RPL had been done in the VET sector. Furthermore, Maurer suggests that, due to development cooperation, RPL "has become not only an important topic in the global VET discourse, but also a key element of VET policy in many lower and middle income countries (LMIC)" (Maurer, 2021, p. 470).

He also argues that RPL has increasingly become an integral part of the "global VET policy toolkit" (McGrath, 2012, p. 625; in Maurer, 2023). However, although it may be being implemented, research on the role of RPL in VET does not appear to be very extensive in South Africa as much of the RPL research reported on is focused on accessing higher education (see, for example, Harris, 2004; Singh, 2011), or how VET can be used to access higher education through credit transfer (see, for example, Needham and Papier, 2018; Groener and Andrews, 2019; Aploon-Zokufa and Needham, 2023).

Research on RPL in the context of VET and workplaces does appear to be more limited than in other educational contexts in South Africa, although Deller's (2016) work (as part of the SAQA RPL Research Project and published in the book *RPL as Specialised Pedagogy*) is key in contributing to the theorising of RPL and draws directly from the vocational context. She continues to work on RPL in vocational contexts in South Africa and has expanded from her original context in the insurance sector (Deller, 2007) to implementing RPL in the financial and agricultural sectors (Deller, 2019).

The focus of her later publications, however, was on the successful implementation of RPL rather than a theoretical contribution. In her analysis of RPL conducted in the VET sector in South Africa, based on historically registered qualifications, she identified that the majority of RPL being implemented was based on Harris' (1999) 'credit exchange' model (Deller, 2016). Other research conducted in the VET RPL context was done by Erasmus (2019), who explored the possibilities for using RPL for experienced Early Childhood Development (ECD) Practitioners who were completing an NQF 4 Learnership in ECD.

The workplace has long been recognised as a site of learning (Eraut, 2004; Rintala, Nokelainen, and Pylväs, 2019), and informal learning particularly. As Rintala *et al.* state: "Informal learning is an important means by which employees update their knowledge and skills and adapt to changing situations, such as new technologies in organizations" (2019, p. 730). The need for research into workplace-based RPL is substantial. Cameron (2014), in her analysis of the relationship between RPL and workforce development, points to the lack of research into the relationship between the two. The

process of researching the practical application of RPL within the workplace, as in the case of this study, provides both the opportunity to impact current practice as well as increase the understanding of the relationship between RPL and the workplace.

Harris and Wihak (2014) distinguish between RPL in educational contexts and RPL in workplace contexts and note that there are different variables and practices involved. In order to delineate these contexts, there is a need to define the context of this research within the realm of workplace-based education and training. Writing about RPL in the context of further education and training in Ireland, De Paor argues that "RPL becomes a tool where education and training providers work in partnership with whole organizations in recognizing and relating individual knowledge to organizational knowledge" (2023, p. 2). While the linking of individual knowledge to organisational knowledge can be part of what constitutes RPL, it remains important to heed the cautions discussed previously regarding the commodification of an individual's knowledge and experience for use only as a source of human capital development. As Avis suggests: "Frequently, analyses of workplace learning assume an overly optimistic hue" (Avis, 2014, p. 48), when the role of RPL is viewed as transformational but, in reality, results in the commodification of workers' experience.

One of the challenges for workplace-based RPL is linked to the power structures that dictate the role of education in the workplace. Writing over a decade ago, Foley was already pointing out that adult education had been restructured and "governments have transformed education from a citizen's right into an instrument of economic policy" (Foley, 2001, p. 80). When people are viewed as "instruments of production" (Foley, 2001, p. 80) and education increases their value, it is necessary to consider whether the use of RPL merely feeds into the system a further means of adding value for the employer, instead of the benefits envisioned for employees. A central critique is that "the development and training of workers is only necessary when the return on investment directly benefits the organisation's ability to increase their profits" (Livingstone, 2013 in Tennison, 2014, p. 14).

From the perspective of RPL, the challenge lies in its tendency to objectify experience. The difficulty in seeking meaning in an employee's experience for the purposes of RPL is that it "turns experience into a lifeless commodity whose only use is to be exchanged for credits in the educational marketplace" (Usher, 1993, p. 174). The challenge then arises to develop a "discourse of experiential learning that can link and align what is organisationally desirable (more productivity, flexible working, increased efficiency and profitability) with what is personally desirable (greater self-fulfilment)" (Garrick and Usher, 2000 in Armsby, Costley and Garnett, 2006, p. 372).

In South Africa, although the SAQA and QCTO policies very clearly make provision for RPL (SAQA, 2019; QCTO, 2021b), the implementation process is not stipulated. As a result, RPL is often seen by companies, training providers, and quality assurance bodies as a more difficult and time-consuming process than completing the qualification via the traditional approach (personal correspondence). This is, possibly, in part due to the misconception that workplace RPL should follow the approaches used by the higher education sector. Making use of the higher education approach to RPL in a workplace context is, however, not a viable option due to the dissimilar needs of the two contexts.

Harris and Wihak make the clear distinction between the needs of each context indicating that, while the requirements for RPL in the educational context are alignment with "learning outcomes, level descriptors and/or programme content" (Harris and Wihak, 2014, p. 14), the variables for implementing RPL in the workplace context are more extensive and differ from the educational context. They suggest that RPL in a workplace context "needs to connect to industry classification systems and benchmarks, skills bands, pay scales, and industry- or company-specific in-house training, as well as articulating the learning outcomes of education programmes and associated qualifications if need be" (Harris and Wihak, 2014, p. 14).

The need for a different approach to RPL practice was one of the reasons that the training provider decided to pilot the implementation model in the RPL programme used for the case study in this research. By using the RPL programme as my case study, I aimed to study the forms of workplace knowledge surfaced by the RPL programme and thereby provide a basis for future roll-outs of the RPL programme. As Deller points out, the "benefits [of RPL for employers and employees] will only be realised if workplace RPL is implemented within the paradigm of workplace pedagogical practice" (Deller, 2007, p. 2). It is this differentiation between RPL as it is construed in the educational context and RPL in a workplace context that must be taken into consideration in the design of an RPL programme. This difference has therefore been critical to the development of the model used in the RPL programme for the case study in this research.

Millar and Miller argue that "structures or processes for helping workers identify their informal learning linked to outcomes, competencies or job descriptions is seriously lacking" (Millar and Miller, 2014, p. 2). This is particularly challenging when considering the complexities of non-formal and informal learning and knowledge production, which may include a tacit dimension as well (Johnson and Majewska, 2022).

Reflecting on the RPL programme that forms the basis for the case study in this research, it appears to fit neatly into Harris' (1999) 'credit exchange' RPL model as it directly focused on RPL for credit.

However, the aim of this research was to conceptualise and categorise the forms of workplace knowledge surfaced in the RPL programme that may have been missed through a direct mapping of the candidates' non-formal and informal learning to outcomes. Secondly the aim was also to move towards what Cooper proposes as "an RPL process that acknowledges and seeks to work creatively with the inevitable tensions that arise between complex forms of 'everyday' knowledge and those of the academy, opens up the possibility of new, richer and better forms of knowledge" (Cooper, 2006, p. 237).

However, as discussed in the next section, perspectives on forms of workplace knowledge differ due to how workplaces are organised and how changes in technology impact the knowledge and skill requirements of workers, as well as the nature of expertise (Rintala, Nokelainen and Pylväs, 2019).

The deskilling debate

There have been extensive debates on the impact of the organisation of work and the debates on the impact of automation in relation to the so-called 'deskilling' of workers. The increasing automation of workplaces is considered to have a detrimental impact on the knowledge and skills of workers. The continuous development of new technologies, as well as digitalisation, is leading to changes in the skills required in some occupations, as well as resulting in significant transformation of workplaces (Kanwar, Balasubramanian and Carr, 2019; Spöttl and Windelband, 2021).

In examining the trends and impact of the 4th Industrial Revolution (4IR) on work, Kim (2019) emphasises the changes that the emergence of new technologies will have on the way that people work, including the possibility of completely automated factories that do not even require operators. Kim suggests that while in the 3rd Industrial Revolution humans interacted with computers and machines, 4IR will remove humans from the equation and, in so doing, result in jobs becoming obsolete. 4IR, or 'Industry 4.0' may be defined as

> the current trend towards automation and data exchange in manufacturing technologies which are based on digital technology. It includes 'Cyber-Physical Systems' (CPS), the Internet of Things (IoT) and cloud computing, and has an impact on all economic sectors. (Spöttl and Windelband, 2021, p. 29)

The reduction of the need for skilled labour and an overall reduction in jobs has been identified as one of the key challenges of the 4th Industrial Revolution, although it is possible that this will be countered by a rise in other types of jobs created as result of the 4IR (Kim, 2019). Spöttl and Windelband identify two main areas of change as a result of Industry 4.0:

1. Changes in the content of work processes for applied technologies, accomplished tasks, work organisation and other factors.

2. Micro-structural changes of work and work processes resulting in vanishing and emerging occupations and professions. (2021, p. 32)

The changing nature of jobs, and resultant need for 'reskilling' and 'upskilling' has already been identified by those conducting skills planning (see, for example, the FoodBev SETA Skills Atlas research conducted in 2023 (FoodBev SETA, 2023)).

The debate about the impact of changes to the organisation of work, as well as the impact of automation are not new. In 1974, Braverman made the argument that automation results in deskilling and the degradation of labour (1974). More recently however, globalisation, and the development of the so-called 'knowledge economy' have also led to further changes in the organisation of work. The development of the knowledge economy was premised on the transition from the production of tangible goods to the production of knowledge (Castells, 2001), which in turn resulted in changes in work organisation. Linked to the changes in the organisation of work is the rise of the idea that companies should be engaged in organisational development strategies that lead to the development of knowledge for the benefit of the organisation. This concept is best captured in Peter Senge's (2006) seminal work *The fifth discipline*, which conceptualises the 'learning organisation'.

Eraut suggests that "the concepts of a knowledge-based economy and a learning organization derive from recognition of the complexities and uncertainties of the modern world" (2004, p. 271). However, building on the significant changes in work as a result of globalisation and the knowledge economy, Previtali and Fagiani argue that Braverman's claims still stand and that "in the capitalism of the twenty-first century, the tendency toward deskilling and degradation of labour does not only still prevail but also expands and deepens, supported by policies of flexibilisation and deregulation of labour" (2015, p. 77).

The impact of automation on the organisation of work has been documented since the beginning of mechanisation in the 1st Industrial Revolution with the rise of steam and water-powered machinery (Ackrill, 1987 in Tennison, 2014). Similar to the argument that automation leads to deskilling, the argument has also been made that, as a result of automation, there is a reduction in the complexity of knowledge required by those operating the machines (Gamble, 2016b) as well as the forms of knowledge that are employed (Hordern, 2014).

However, there are critiques of this argument that suggest that "rather than being routine and simple, the demands of work are often highly complex, demanding and far from routine" (Billett, 2000 in Billett, 2003, p. 7). Furthermore, Kim (2019) draws on research done by consulting company McKinsey

which suggests that only certain activities will be replaced and not entire occupations, as there are always going to be certain specialised tasks that cannot be done by machines. It is also not possible for machines to replace the role of humans in dealing with jobs that involve unpredictability. This is similar to what Billett (2000), drawing on Berryman (1993), suggests in his conceptualisation of a 'smart workforce'. He also points to a possible increase in decision-making required as a result.

Gamble's (2016b) study of *Work and Qualifications Futures for Artisans and Technicians* provides a useful conceptualisation of the relationship between risk and certainty in a work environment. Drawing on Pye (1968), she proposes that the "complexity of work is captured by two opposing concepts: *certainty* and *risk*" where the "difference lies in the degree of predetermination of the end result" (Gamble, 2016b, p. 4 italics in original). She further proposes that these two concepts can be viewed as opposite ends of a continuum with work of certainty being highly routinised with 'predictable problem-solving' while work of risk involves 'independent judgement' and 'complex problem-solving' (Gamble, 2016b, p. 5).

Different work environments can be described based on their position on the continuum. Collins makes the observation that "The ideal profession has a skill that occupies a mid-point in a continuum between complete predictability and complete unpredictability of results" (1979, p. 133). In considering this conceptualisation of work, as well as the changes to the organisation of work discussed above, the development of professional judgement (see Winch, 2020) and the necessary expertise to work in this new environment (Billett, 2000) cannot be ignored.

The case study in this research is set in the context of a high-speed beverage packaging line that is considered a highly automated manufacturing environment. Previous arguments about the impact of changes in the organisation of work suggest that machine operators may not have the anticipated knowledge and skills to meet the requirements of the qualification – hence the question that started this research: "aren't we just accrediting push-button operators?" However, it could also be argued that:

> The changing nature of workplaces into sites of knowledge production has an impact on RPL assessment; that is, traditional assessment practices have to accommodate a learner who is not an empty vessel, but one who enters the RPL assessment process with knowledge already gained and practiced, and who is a full participant in the assessment process. (Naudé, 2016, p. 6)

The impact of the workplace on developing professional judgement and expertise is an integral part of this research and forms a basis for the research question: "What forms of workplace knowledge

used in an automated production process can an RPL programme surface and how might such knowledge be categorised and conceptualised?"

Conclusion

In this chapter I have discussed the background to this research, including the South African vocational education context that this RPL case study is located in. I have also examined how RPL is theorised and implemented both in South Africa and internationally, as well as the perceived impact of automation in workplaces and its influence on how workers' knowledge and skills are recognised.

In the conceptual chapters that follow, I will be discussing the social realist perspective and its usefulness in differentiating between forms of knowledge, as well as expanding on the nature of expertise and professional judgement. Chapter 2 focuses on the way that knowledge is theorised by the key traditions in adult education, including experiential learning. In Chapter 3 I extend the conceptualisations of the various forms of knowledge discussed in Chapter 2 into the concepts of skill, expertise, and professional judgement. The concepts presented in Chapters 2 and 3 form the foundation for the analytical framework I will use to address my research question: "What forms of workplace knowledge used in an automated production process can an RPL programme surface and how might such knowledge be categorised and conceptualised?" In order to answer this question I also posed three sub-questions, namely:

1. What kinds of workplace knowledge used in an automated production environment can be surfaced through an RPL Programme?
2. How are such forms of knowledge surfaced, i.e. which tools in the RPL Programme are able to surface what forms of knowledge?
3. What languages of description can conceptualise such workplace and occupational knowledge?

Chapter 4 of this thesis presents the methodology and analytical framework that I used to attempt to answer the research question and sub-questions.

Chapters 5 and 6 of the thesis describe the data and findings of this research. Chapter 5 focuses on the data and findings from the analysis of the data based on Gamble's (2016b) four quadrants presented in Chapter 2, while Chapter 6 presents the data and findings from the analysis of the data using the analytical lenses focused on skill and expertise. Chapter 6 also presents findings related to disposition and values, as well as professional judgement, before drawing the various sections together in the findings related to occupational expertise.

In the final chapter of the thesis, Chapter 7, I draw on the findings from Chapters 5 and 6 and discuss some of the possible implications of this research for RPL. I also propose conceptualisations of

knowledge forms and occupational expertise that support a language of description for talking about workplace knowledge and conclude by proposing some considerations for vocational curricula that arose from the research.

CHAPTER 2: TOWARDS AN UNDERSTANDING OF KNOWLEDGE

Introduction

While the focus of this study is on a recognition of prior learning (RPL) case study, the research question requires a broader examination of several distinct bodies of literature. In seeking to examine the types of workplace and occupational knowledge surfaced through the RPL programme, it became necessary to clearly define how knowledge is conceptualised in some of the key adult education traditions that hold relevance for the field of recognition of prior learning. The first part of this chapter provides an overview of how knowledge is viewed in these traditions, before situating this study in a social realist approach to understanding knowledge.

The chapter then goes on to discuss in more detail the concepts of craft knowledge and tacit knowledge. It draws on both the previously discussed bodies of knowledge and their conceptualisations of craft knowledge and tacit knowledge, as well as incorporating literature that elaborates on specific elements of tacit knowledge such as sensory tacit knowledge.

Debates around knowledge, learning, and pedagogy

The interplay between knowledge, learning, and pedagogy is a central theme in debates in education and vocational education specifically. The different interpretations of these concepts give rise to the varying traditions of adult education that will be discussed below. While the focus of this section is on developing an understanding of knowledge and how it is conceptualised by the different schools, this cannot be done without considering their perspectives on how this knowledge is learned and transmitted. This is particularly the case for theories where knowledge is considered to be *produced* through the process of learning and transmission, such as in the situated theory of Lave and Wenger (1991).

It must also be acknowledged that each of these traditions has very specific approaches to conceptualising the power dynamics involved in adult education. While it is not the direct focus of this research, decisions about what knowledge should be included or excluded from a curriculum, and what counts as knowledge for the purposes of RPL, are not uncontested. As Billet states:

> What is intended to be learned in schools or workplaces, and in what ways (i.e. how teachers or co-workers decide what they will teach or guide, and in what ways), and/or how students or workers elect to participate in and learn from what is enacted, are both shaped by the exercise of power and influence and the contestation of those who are subject to them (2006, p. 32).

Furthermore, as Cooper points out: “There are intense debates in the sociology of education and knowledge around how to categorise different forms of knowledge” (2005, p. 29). This study sits at a somewhat precarious intersection between some of these contesting theories as it must acknowledge the approach to knowledge, learning and pedagogy employed by the RPL case study that this research focused on, while reaching for concepts from other approaches to provide a conceptual framework which can accommodate a more nuanced analysis of the knowledge types identified in the RPL programme.

Experiential learning tradition

The role of an individual’s experience in learning has become a widely researched and practiced tradition in adult education. Historically, RPL has drawn extensively on experiential learning theory and in particular, Kolb’s (1984) experiential learning cycle that emphasises the need to recognise and reflect on experience gained in non-formal and informal contexts (Cooper and Harris, 2013). In some countries this is even reflected in the name given to RPL, where it is also known as Accreditation of Prior Experiential Learning (APEL) or Recognition of Prior Experiential Learning (Johnson and Majewska, 2022).

Morris (2020) traces the history of experiential learning to Dewey, who wrote that “all genuine education comes about through experience” (Dewey, 1938/1963, p. 25 in Morris, 2020, p. 1064) and points to the development of the tradition of ‘experiential learning’ through Kolb’s (1984) work that draws on scholars such as Dewey, Lewin, and Piaget. Experiential learning is based on a constructivist approach where knowledge is constructed by the individual through “cognitive reflection on concrete experience” (Fenwick, 2001, p. vii) and where “a learner is believed to construct, through reflection, a personal understanding of relevant structures of meaning derived from his or her action in the world” (Fenwick, 2001, p. 10). It is in the combination of experience with reflection that learning occurs (Kolb, 1984; Miettinen, 2000; Fenwick, 2001).

Experiential learning approaches have been in existence for several decades, with various approaches arising from the original concept of *learning from reflection on experience,* later expanded to *learning from critical reflection on experience* (Kolb, 1984; Boud and Walker, 1990; Mezirow, 1990, 2003; Schön, 1996; Brookfield, 1998; Boud and Garrick, 1999; Boud, 2001). There are some distinctions between experiential learning theorists, including a later focus in the theoretical literature that moved from just ‘reflection’ to ‘critical reflection’ (Brookfield, 1998; Morris, 2020), and then on to ‘transformative learning’ (Mezirow, 1990, 2003).

Fenwick defines experiential learning as "a process of human cognition" with the classifying category being "the dimension of experience" (Fenwick, 2001, p. 2). It is important to note that experiential learning has "been used to make sense of learning and knowledge production across multiple sites both within and outside of formal education" (Cooper, 2005, p. 41). Marsick and Watkins (2001) and Eraut's (2004) work on informal and incidental learning are examples of where adults learn new skills or develop understanding of complex situations. It is what Fenwick describes as the "ongoing meaning-making" that comes through informal learning, such as "incidental learning [that] occurs almost unconsciously" (Fenwick, 2001, p. 12). This is echoed in Billett's (1999) description of the way in which workplaces provide opportunities for learning of new skills and developing problem-solving abilities, and similarly in the work of Matthews and Candy (1999).

The role of an educator in experiential learning is not focused on the direct transfer of knowledge, and Fenwick (2001) identifies four roles that educators can play. In terms of the role of the educator in a recognition of prior learning process, and therefore of particular relevance to these discussions of knowledge, are the roles of facilitator and assessor. These roles are particularly pertinent in the recognition of prior learning process as it is the facilitator and assessor who must validate whether the knowledge produced through experience meets the specified requirements. These roles, however, also bring to the fore some critiques of experiential learning, namely that it can be used to uphold dominant views of knowledge and result in an individual's experiential learning being "shaped… to fit institutional standards and understandings of knowledge" (Fenwick, 2001, p. 3), and that it turns the individual's experience and resulting knowledge into a commodity for economic purposes as a form of 'human capital' (Butler, 1999; Garrick, 1999).

Experiential learning has also been critiqued on several further accounts. It has been critiqued for its tendency towards binaries, such as between experience and knowledge, rather than viewing learning as a complex whole (Miettinen, 2000; Fenwick, 2001; Pokorny, 2023). It has also been critiqued for its view that the individual's experience is the only source of knowledge construction rather than allowing for the possibility that there may also be other equally valid sources of knowledge (Garrick, 1999; Fenwick, 2001; Cooper and Harris, 2013). In a similar vein to the last critique, experiential learning has been critiqued for its focus on experience without considering the context in which the experience arises (Fenwick, 2001; Morris, 2020), although this is not true for all theorists. Marsick and Watkins (2001), for example, include context as an integral part of their Informal and Incidental Learning Process, as does Boud in much of his work (see, for example, Boud and Walker, 1990; and Boud and Garrick, 1999).

Drawing on critiques of outcomes-based education, Cooper and Harris make the distinction that "experiential knowledge is not the same as codified, formal knowledge. While the former is often contextually situated, codified knowledge is more abstract and capable of generalisation across contexts" (Cooper and Harris, 2013, p. 3). They argue that making the connection between these two forms of knowledge, particularly in the context of RPL, requires a 'specialised pedagogy', and this cannot be done through reflection alone.

Furthermore, as Morris (2020) points out, it is difficult to define what is meant by the concept of 'concrete experience'. Also problematic is the idea that experience is 'concrete' and distinct from the reflective process. The reflective process extracts and abstracts knowledge from the experiences and fails to address the 'embodiment' of knowledge (Fenwick, 2001; Morris, 2020). The critique around the failure to recognise 'embodied' knowledge in experiential learning is extensively addressed by Michelson (Michelson, 1996b, 1998, 1999, 2020), and is a concept that I will return to later.

From my own experience as a practitioner in the field of education and training, experiential learning has become almost 'second nature' when considering the design of any learning programme. Furthermore, in my experience, it is considered a foundational approach that is instilled into education and training practitioners very early on and forms the basis for a variety of learning interventions. This is particularly true of the field of RPL, where the construction of knowledge from experience is the focus of the process.

However, while experiential learning concepts were used in the design of the RPL programme that this study is based on, Maton argues that this constructivist approach suffers from 'knowledge-blindness', as it emphasises the process of learning rather than what is being learned – i.e. *knowing* rather *knowledge* (Maton, 2013). Thus, for the purpose of this research, it was necessary to turn to other traditions that provided more nuanced ways of examining knowledge to create a language of description that allows for a more detailed analysis of the types of knowledge.

Situated learning tradition

The tradition of 'situated learning' arose in response to "the privileging of the general and the abstract over the particular and the practical in the history of western culture" (Tennant, 1999, p. 170), and was developed by theorists such as Lave and Wenger. As Cooper explains

> Lave and Wenger have criticised the empiricism, the 'abstract individualism' and the 'dualisms' inherent in much 'rationalist' cognitive theory, and proposed alternative perspectives on key phenomena. They have argued that Western 'rationality' cannot be used uncritically as the

> basis of explanation in cognitive science; rationality itself needs to be the object of interrogation and explanation. (2005, p. 45)

The transition in situated learning is from an approach to learning as an individual activity where the knowledge learned is devoid of context, to an approach that "learning is an integral and inseparable aspect of social practice" (Lave and Wenger, 1991, p. 31) and that knowledge is socially constructed. Situated learning occurs through 'legitimate peripheral participation' in 'communities of practice', as seen in the various forms of apprenticeship that Lave and Wenger (1991) use as the sites of study for the development of the concept of communities of practice in their book, *Situated learning: legitimate peripheral participation*. Here the 'telos' or goal is to move from peripheral participation to full participation in the community of practice. Further, what constitutes knowledge, or what Wenger (1998) refers to as 'knowing' in situated learning is directly related to participation in a community of practice and cannot exist outside of the community of practice where "practice is about the experience of meaning" that "arises out of a process of negotiation" (Wenger, 1998, p. 135).

For situated learning, engagement in a shared repertoire of knowledge is a central theme of a community of practice (Gau, 2016). In order to become a competent member of a community of practice, a participant needs, among other things, to have participated in the history of its practice to recognise elements of that practice in the community's repertoire of knowledge (Wenger, 1998). Thus, in this tradition, knowledge is directly related to its context embedded in practice (Tennant, 1999; Fenwick, 2001). However, the critique of this tradition is that situated learning's approach does not make allowances for transfer between contexts in that learning is always contextually bound within a single situated context (Anderson, Reder and Simon, 1996; Tennant, 1999; Fenwick, 2003; Cooper, 2005).

In a similar vein, a further question raised in the critiques of situated learning is whether all knowledge is context-dependent (Anderson, Reder and Simon, 1996). One of the key critiques of situated learning is that, within this approach, there is no apparent space for the learning of more abstract, generalisable, knowledge that is not directly related to specific practices and contexts (Anderson, Reder and Simon, 1996; Billett, 1999; Tennant, 1999). The question that arises from this critique is whether all knowledge is context-dependent or whether knowledge can exist outside of its immediate context.

Salomon and Perkins (1998) also raise a concern around what knowledge and practices are being learned and/or generated according to situated learning, particularly in terms of whether the knowledge and practices are correct. Billett (1999, 2006) suggests that bad habits, negative practices,

or incorrect ‘short cuts’ can also be transferred. Cooper (2005) cites Fenwick, who points out that “truth claims become problematic in Situated Learning theory because knowledge is judged not by what is 'true' or 'false' but simply by what is relevant or useful to a particular situation” (Fenwick, 2003, p. 23 in Cooper, 2005, p. 50).

While it may be possible to study the community of practice within which the candidates on this RPL programme were situated, this goes beyond the scope of this study. Although the RPL programme, and as a result, the data, is deeply embedded in the context of the study, the use of a tradition that examines knowledge and learning within the social context alone is not sufficient for the development of a comprehensive framework in which to categorise knowledge types.

While the situated learning approach is useful for identifying tacit knowledge and the learning that occurs in the workplace, the reduction of knowledge practices to ‘a logic of learning’ that diminishes the focus on what is actually being learned results in research that focuses more on the learning process rather than the forms of knowledge learned (Maton, 2013). Because the situated learning approach does not allow for a differentiation of the forms of knowledge beyond the context in which they are produced, its usefulness as a conceptual framework for this research is limited.

Socio-historical tradition

The socio-historical approach has been used for various studies on recognition of prior learning (see, for example, Diedrich, 2013; Naudé, 2016; Cooper, Ralphs, and Harris, 2017). Cooper, Ralphs, and Harris in their work on theorising RPL make use of cultural-historical activity theory (CHAT) to develop their conceptual framework for analysing RPL practices. Considering the use of CHAT as part of key research on theorising RPL, it is necessary to evaluate its usefulness for this study.

Salomon and Perkins draw on Wertsch (1991) to describe the basic assumption of the socio-cultural paradigm, namely that

> Human mental functioning is inherently situated in social interactional, cultural, institutional, and historical context. Such a tenet contrasts with approaches that assume, implicitly or explicitly, that it is possible to examine mental processes such as thinking or memory independently of the sociocultural setting in which individuals and groups function. (Wertsch (1991) in Salomon and Perkins, 1998, p. 8)

In the experiential learning tradition, knowledge is viewed as constructed by an individual’s experience, whereas in the socio-cultural tradition, knowledge and human activity are seen to be constructed from the cultural and historical contexts in which they began (Billett, 2003).

Socio-cultural theory's primary unit of analysis is human activity based on the individual's social and historical context which shapes their cognition (Scribner, 1985; Billett, 2003). As a result, cognition cannot be separated from its socially mediating context (Salomon and Perkins, 1998). One of the central theories in the socio-historical tradition from which many of the later theories arise is found in Vygotsky's work, in which he "locates the origins of conceptual thought in people's productive interaction with the natural world" (Cooper, 2005, p. 54). While his approach also involves a situated approach similarly to Lave and Wenger (1991), it extends beyond just the social context and argues for the inclusion of the historical context in examining knowledge and learning (Young, 2003; Cooper, 2005). It also posits that knowledge is material in nature, as evidenced by his location of conceptual thought (Cooper, 2005).

Vygotsky makes the distinction between 'scientific' and 'everyday' knowledge when talking about knowledge, although he argues that both types of knowledge must be situated historically (Young, 2003; Cooper, 2005). Furthermore, knowledge is constructed socially rather than by individuals in isolation (Salomon and Perkins, 1998) and is the product of human activity (Young, 2003). While this approach raises a distinction between different forms of knowledge, the focus of this tradition, however, is more on how learning occurs.

The distinction between knowledge types is useful for Vygotsky because it provides a way of examining the learning process and allows for the conceptualisation of the 'zone of proximal development', which is the space in which learning occurs. The zone of proximal development is a dialectical concept which sees an individual as being able to move from their current level of cognitive performance to a higher level of cognitive performance (Salomon and Perkins, 1998). This occurs through a process of mediation which makes use of specific 'tools of mediation' (Daniels, 2004; Roth, 2004; Cooper, 2005; Engeström, 2015b). The learning process involves the interplay between 'scientific' and 'everyday' knowledge as learning happens through constant movement between the one and the other (Guile and Young (1998) in Cooper, 2005).

Young, however, critiques the way in which Vygotsky's dialectical approach deals with knowledge, pointing out that

> By locating it in the history of man's actions in making sense of and transforming the external world, knowledge, as distinct category that refers to causes and explanations that are not tied to specific purposes, disappears (2003, p. 101)

The use of Vygotsky's concept of the 'zone of proximal development' has been used to examine the workplace as a site of learning (see for example Billett, 1999). However, there are critiques around

whether it, and the overall dialectic approach within which it is framed, is capable of providing an account of how knowledge is constructed in the workplace (Garrick, 1999; Young, 2003).

For the purposes of this study where the focus is less on the pedagogical nature of the RPL process and, rather, on the forms of knowledge produced, the socio-historical tradition does not provide a strong enough conceptual framework for surfacing and classifying the types of knowledge produced. Although the categories of 'everyday' and 'scientific' provide a starting point, without more nuanced classifications for knowledge forms, this tradition does not enable the nuances of the workplace and occupational knowledge surface to be sufficiently categorised and analysed.

Vygotsky's work has been used as a basis for the further development of the socio-historical tradition through the work of theorists such as Scribner (1985, 1997) and Engeström's (2000, 2001; 2015) cultural-historical activity theory. Scribner's work examines the relationship between cognition and action in work contexts, focusing on the "social organization of cognition" (1985, p. 199). As such, knowledge is viewed as integral to the work activities and organised through the social context of the work environment. In Scribner's view there is a direct interplay between knowledge and action with action resulting in the "social organisation of knowledge", and this knowledge is then used to guide "goal-directed action" with both processes occurring concurrently in the work context (Scribner, 1985, p. 200). Thus, "*organised social knowledge* is embodied in the physical and symbolic environment of the workplace" (Cooper, 2005, p. 57, emphasis in original). Learning occurs in the social context of the work site as workers engage with the work activities in order to learn the knowledge required to act. However, Scribner is critiqued by Cooper as "tend[ing] to reduce workers' learning to workplace skills development" (Cooper, 2005, p. 56).

Cultural-historical activity theory (CHAT) draws on Vygotsky and the concept of dialectical logic. It examines the interplay between the forces involved in human activity and attempts to trace the development of objects through their historical formation (Cooper, 2005; Engeström, 2015), where an object is "the constantly reproduced purpose of a collective activity system that motivates and defines the horizon of possible goals and actions" (Daniels, 2004, p. 190). The focus of this theory, and its extension as expansive learning theory by Engeström is a "historically evolving collective activity system" as the primary unit of analysis and on the generation of new concepts and practices, together with 'object-oriented activities' (Engeström, 2000; 2015; Daniels, 2004).

Knowledge in cultural-historical activity is produced collectively and understood through the dialectic of concept formation (Cooper, 2005). The knowledge produced encompasses both 'scientific' and 'everyday' knowledge although Engeström, in his theory of expansive learning, focuses on "the

dialectics of ascending from the abstract to the concrete" (2014, p. xx). While reference is made to knowledge and its production through activity, the focus of expansive learning theory is "for interventionist research in concrete human activities undergoing historical transformations" (Engeström, 2015, p. xxxv). Since knowledge is situated within the activity system (as mentioned in Young's (2003) critique of Vygotsky discussed above), it disappears and is not easily identifiable as a distinct category. Salomon and Perkins also make the critique that

> In the situative approach, social knowledge construction develops distributed knowledge, skills, and understandings around the target activity system. What is acquired is rather "holistic," and the hoped-for transfer is to other similar activity system. (Salomon and Perkins, 1998, p. 10)

Because the focus of activity systems is on the process of imparting knowledge and developing the activities in which knowledge is involved, it does not provide for the distinct categories of knowledge needed in this research. As Moore argues in his critique of the view that all knowledge is socially and historically constructed: "the more sociological our approach to knowledge becomes, the less knowledge actually is knowledge" (Moore, 2013, p. 338). Thus, the way in which knowledge is viewed as only socially and historically constructed, without allowing for the categorisation of abstract knowledge outside of a specific context, means that the socio-cultural tradition cannot support a conceptual framework for this study's question around the knowledge types surfaced in the RPL programme. For the purposes of their work, although their research makes use of CHAT, the conceptual framework used by Cooper, Harris, and Ralphs to theorise RPL also draws on the differentiation of knowledge found in the theoretical framework of social realism (Cooper and Harris, 2013; Cooper, 2016; Cooper, Ralphs, and Harris, 2017). The section that follows will address social realism and discuss how it offers a conceptual framework for differentiating between forms of knowledge.

Social realism

In contrast to the situated learning and socio-historical theories, Maton suggests that social realism "demonstrates that exploring knowledge is neither positivist nor conservative, that analyses of 'relations to' and 'relations within' knowledge can be brought together, and that knowledge is not reducible to knowing" (2013, p. 8). Furthermore, Morgan and Lambert, drawing on Moore (2000), identify that there are

> … key differences between [the] two main positions on knowledge – 'social constructivism' and 'social realism', in that whereas the former suggests that knowledge bears the imprint of its conditions of production, the latter recognises that knowledge is a social product, but has emergent properties that allow it to apply in contexts beyond the conditions of its production. (Morgan and Lambert, 2018, p. 34)

These distinctions regarding how knowledge is conceptualised provide a basis for moving toward the use of a social realist approach as it allows for a more detailed theory of knowledge for the purposes of this research. The use of a social realist approach to conceptualise research on recognition of prior learning is not new, as it was introduced in some key work on theorising RPL (see Cooper and Harris, 2013; Cooper and Ralphs, 2016; Cooper, Ralphs, and Harris, 2017). Cooper (2016) highlights in her chapter on the conceptual framework for the book *RPL as Specialised Pedagogy* that a social realist approach has become prevalent in South African RPL research.

Social realism draws on the work of sociologist Émile Durkheim (1912/1964), in particular his concepts of the 'sacred' and the 'profane'. This distinction between two categories of knowledge "provided the social basis for separating practical and everyday problems from the theoretical/intellectual/conceptual problems that historically became secularised to include science and other forms of intellectual activity" (Young and Muller, 2014, p. 47). Vygotsky's differentiation between 'everyday' and 'scientific' knowledge forms the basis for pedagogy, while Durkheim's differentiation between the 'sacred' and 'profane', it is argued, "establish[es] the distinction between specialised and non-specialised forms of knowledge as a basis for the curriculum" (Young and Muller, 2013, p. 235) and has been drawn on extensively for the social realist approach. Social realism allows for the differentiation necessary to distinguish between 'knowledge' and 'knowing' which enables theorists to distinguish between the two (Corbell, 2014).

The differentiation of knowledge types provides the foundation for a stronger theory of knowledge which, from the social realist perspective, allows both for a social basis for knowledge as well as for knowledge to have properties that move beyond the social towards objectivity and an independent reality outside of the original context (Maton, 2013; Small, 2013; Harris, 2014; Rata and Barrett, 2014). However, the distinction between the everyday, which is context dependent, and the scientific, which is more independent of context, does not imply that one is superior to the other. Drawing on Durkheim's approach, the social realists argue that, while not about superiority, differentiation is central to the social realist approach as: "Social realists emphasise the distinctions between knowledge and experience, types of institutions, disciplinary domains, and conceptual knowledge and procedural knowledge" (Corbell, 2014, p. 104).

The differentiation between forms of knowledge is extended through the work of Basil Bernstein, whose work is rooted in the Durkheimian tradition (Gamble, 2004a; Tyler, 2004; Young and Muller, 2014). Bernstein distinguishes between horizontal discourse that refers to 'everyday or common-sense knowledge' and vertical discourse that refers to 'official', or 'school(ed)' knowledge' (1999, p. 159). As Cooper states: "Like Durkheim, Bernstein gives priority to the differentiation of knowledge,

especially the differences between theoretical and everyday knowledge, rather than to its unity" (2005, p. 35). Bernstein's development of the differentiation between forms of knowledge has been used to deepen the theoretical perspective for recognition of prior learning (see Cooper, Ralphs, and Harris, 2017), particularly in terms of understanding the forms of knowledge that are recognised or excluded and how this affects the inclusivity of RPL. In terms of a social realist approach to RPL, "experiential knowledge gained in the workplace or through community engagement [is viewed] as different in character, structure and purpose to formal academic knowledge" (Cooper, Ralphs, and Harris, 2017, p. 199).

Bernstein (1999) extends the differentiation of forms of knowledge further than Durkheim by differentiating between forms of specialised knowledge (vertical discourse). He uses two criteria for differentiating between forms of specialised knowledge. Firstly, internal relations differentiate between hierarchical and horizontal knowledge structures. Hierarchical knowledge is organised so that knowledge builds towards an increasing level of theoretical integration and abstraction, such as in the sciences. Horizontal knowledge structures, however, consist of a series of specialised languages that do not build upon each other but are all at the same level such as in the humanities where, for example, in English literature there are a series of different languages for textual criticism (Bernstein, 1999).

Secondly, external relations speak to the differentiation between weak and strong 'grammars' and is "a capacity of the theory to describe, stably and reliably, something other than itself" (Young and Muller, 2014, p. 55). Bernstein (1999) identifies external relations as a criterion that is used to distinguish horizontal knowledge structures and identifies as strong grammar horizontal knowledge structures with languages that are capable of empirical description, for example economics. He does, however, point out that "'strong' and 'weak' must be understood as relative within horizontal knowledge structure" (Bernstein, 1999, p. 164).

Bernstein also makes a classification between types of disciplines. He refers to some academic disciplines, such as philosophy, as 'singulars' because they are drawn from a singular disciplinary knowledge context and have strong boundaries, while he refers to applied academic disciplines, such as medicine, as 'regions' which draw on both academic disciplinary knowledge as well as its application in a field of practice (Bernstein, 2000; Wheelahan, 2019). Wheelahan further explains: "Regions blend different concepts and frameworks from singulars, and the principle of selection and assemblage is to understand problems posed by practice" (Wheelahan, 2019, p. 102). These categorisations of forms of knowledge are the basis for the theories of knowledge in the work of scholars such as Moore, Young, Muller, Gamble, and Wheelahan (see as examples: Muller, 2000, 2009; Moore and Young, 2001;

Young, 2003, 2006, 2008, 2009a, 2013; Gamble, 2004a, 2004b, 2006, 2016b, 2018; Wheelahan, 2007, 2012, 2015, 2019; Moore, 2013b; Young and Muller, 2014).

Through the work of the theorists above, a more detailed theory of knowledge has developed that recognises both the social context of knowledge, as well as "the *emergent* and *objective* properties of knowledge" (Rata and Barrett, 2014, p. 2 emphasis in original). While not privileging one knowledge form over another, it is possible for one type of knowledge to have greater explanatory power than another (Maton, 2013). Bernstein's classifications of knowledge forms allow for knowledge to be removed from the original social context in which it was produced and developed as a form of generalised, conceptual/theoretical knowledge that stands independent of context, through a process of recontextualisation (Bernstein, 2000). Such knowledge is further developed

> …as the product of the codes, rules and practices of those involved in specialist fields of enquiry and the debates about knowledge that have developed within them (Collins, 1998). (Young, 2003, p. 101)

It is possible for knowledge to be produced through either a deductive process, which extrapolates from prior theoretical knowledge, or induction, where there is a process of decontextualising context-dependent knowledge that arose from empirical enquiry into generalisable knowledge (Hordern, 2014). For social realism, knowledge can move beyond the context of its production and attain a form of objectivity that allows for a 'provisional truth' claim to be made, although knowledge remains open to critique as ideas in a discipline develop (Rata and Barrett, 2014).

The way in which power relationships are viewed from a social realist perspective, as with experiential learning and the debates on recognition of prior learning, focuses on what counts as knowledge, or the legitimation of knowledge forms (Lilliedahl, 2015). This is particularly evident in the debates presented by Michael Young (see, for example, Young and Muller, 2013) around the notions of 'powerful knowledge' and 'knowledge of the powerful'. These debates centre around discussions on "who produced and had access to knowledge (knowledge of the powerful), and what specialised knowledge could do for those gaining access to it (powerful knowledge)" (Morgan, Hoadley and Barrett, 2018, p. 2).

Young argues that "powerful knowledge is the product of social conditions or contexts that do not wholly determine it" but "what makes powerful knowledge powerful is its independence or autonomy from the specific contexts of its origin" (Young, 2009, p. 197). The idea that, in order for knowledge to be considered powerful it must be removed from the everyday context of experience in which it was created, does appear to suggest that certain knowledge forms must be privileged over others — in

this instance, that disciplinary or theoretical knowledge is more significant than everyday, contextualised knowledge.

Muller extends the social realist theory of knowledge to the realm of curriculum and asks the question: "how can or should the common-sense knowledge of experience and local culture, indeed of the everyday world, relate to the codified knowledge deemed worthy of inclusion and certification in the formal curriculum?" (Muller, 2000, p. 13) This question is of particular importance in the application of a social realist approach to the context of vocational education and training. Wheelahan argues that in Bernstein's thinking, "Everyday knowledge is also the tacit, context-dependent knowledge of the workplace" (Wheelahan, 2019, p. 100).

Young draws on Muller (2000), who points out that Durkheim's notions of the sacred and profane are never as distinct as they are portrayed and are "always, to some extent, enmeshed in each other" (2006, p. 118). Billett also argues that "workplaces develop more than practical knowledge. Knowledge structures have propositional, procedural, and dispositional dimensions which are not separable in this way" (1999, p. 154). However, although enmeshed in practice, it is still possible to theoretically differentiate between knowledge types during analysis. This enmeshing of knowledge types in the workplace is what makes vocational knowledge so distinct.

In considering vocational knowledge, it is vital to consider the role of context-specific knowledge in occupations in particular, as the combination of this context-specific knowledge with the relevant theoretical knowledge forms the basis for vocational education and training to meet the knowledge demands in occupations (Young, 2006; Muller, 2009; Hordern, 2014; Wheelahan, 2019). The interplay between different knowledge types in the context of vocational knowledge, and by extension vocational curriculum, will be discussed in more detail in the next section.

Cooper, Ralphs, and Harris (2017) argue that 'socially valuable knowledge' as defined in the context of RPL as 'differentiated experiential knowledge' is as needed as Young's 'powerful knowledge' and that the two should not be set up against each other. Similarly, Maton argues that

> when arguing for knowledge to be seen it is easy to valorize the kinds of knowledge most easily seen: explicit, abstract, condensed, hierarchical forms that visibly announce themselves. This tendency can drift towards offering a deficit model of the arts, crafts, humanities and many social sciences, as well as everyday understandings, where knowledge may be less explicit and more concrete, context-dependent, embodied, and axiological. (Maton, 2013, p. 14)

While Maton made the argument to support his own approach of Legitimation Code Theory, the warning is heeded and is the reason why I chose to draw on the work of Jeanne Gamble, whose work on vocational knowledge and occupations will be discussed in the next section.

Conceptualising vocational knowledge

In this section, I will focus more specifically on exploring a social realist approach to conceptualising vocational knowledge, drawing on the work of Jeanne Gamble particularly. While Gamble's work focuses on conceptualising knowledge in work (for example, her 2016b research on *Work and Qualifications Futures for Artisans and Technicians*), it also extends to examinations of vocational knowledge (for example, Gamble, 2018) and curriculum (Gamble, 2006, 2009). Although these are very specific concepts for Gamble, the literature on vocational knowledge and vocational curriculum often refers to the terms in conjunction with one another.

Vocational knowledge is often considered through the lens of vocational curriculum which makes it very challenging to pull these concepts apart. Gamble (2006) also includes a detailed discussion of knowledge in the context of her writing on vocational curriculum. This interplay between vocational knowledge and vocational curriculum is evident later in this section where the discussion on vocational knowledge requires reference to the way that it is conceptualised through vocational curriculum. Gamble (2001, 2004c, 2006, 2009, 2016b, 2016a) draws on Bernstein's sociology of education but makes a conceptual move by lifting it from its previous focus on formal education in schools and, instead, uses it to examine the knowledge structures found in occupations and work. As Hordern states

> For vocational knowledge and the vocational curriculum, which is characterised by knowledge derived from a range of contexts and with varying degrees of conceptuality and contextuality (Muller, 2009), awareness of these distinctions [between theoretical and practical knowledge] and how they may affect how knowledge can be used can be seen as vital. (Hordern, 2014, p. 27)

It is precisely Gamble's development of differentiation between forms of knowledge derived from the workplace and their use in various occupations that makes her work so useful in the development of a conceptual framework for analysing vocational knowledge. Of particular significance is the 2016b study that Gamble led, which studied "work itself, … its organisation and … the diagnostics and problem-solving found in the work of artisans and technicians" (Gamble, 2016b, p. 1). Gamble's analysis of the logic of work provides a foundation for examining vocational knowledge as vocational knowledge, and its inclusion or exclusion in a vocational curriculum, should be directly related to the occupation or work that it is preparing learners for.

Gamble's (2016b) model of knowledge in work contexts expands on her previous work using Bernstein's (1999) concepts of vertical and horizontal discourse (see, for example, Gamble, 2006, 2009). She posits a grid comprised of four different forms of knowledge that should be present to varying degrees in the curriculum required for a particular occupation. As shown in Figure 1, the grid on which these forms of knowledge are mapped classifies them using the distinction between 'specific' and 'general' knowledge on the one side and the distinction between 'procedural' and 'principled' knowledge on the other.

Procedural knowledge as defined by Gamble equates to knowledge that is "sequential or step-by-step logic that relates to a specific work context" (Gamble, 2016b, p. 17). This refers to knowledge that is documented in procedures followed in the workplace or routinised steps followed in the completion of tasks. This is distinct from principled knowledge which is defined as knowledge that is able to "establish connections between parts through reasoning" (Gamble, 2016b, p. 18). Principled knowledge is therefore understood to focus on the abstract or theoretical components of knowledge, and includes a specific *visualised* principle referred to as craft knowledge. Relations between abstract knowledge that is independent of context is considered *scientific* or *theoretical* knowledge (*ibid)*.

Figure 1: Gamble's four quadrants (Extracted from Gamble, 2016b, p. 18)

	Situated knowledge (Specific)	Formal knowledge (General)
Procedures	'How-to' knowledge Work procedures or routines learnt through everyday experience (not written down) K1	Systems knowledge Formally codified knowledge of work rules and procedures (written down) K2
Principles	Craft knowledge Principle visualised through drawings and sketches K3	Scientific knowledge Principles understood in terms of symbols and words K4

Gamble (2009) argues that practical knowledge can only be called knowledge when practice is combined with some form of conceptual or principled knowledge. Similarly, (Hordern, 2019) argues that everyday knowledge is necessary for occupational tasks but may be too specific to particular sites, and it is everyday knowledge combined with the applicable disciplinary knowledge base that allows generalisability to multiple contexts. Both Gamble (2009) and Hordern (2019) argue that a combination of practice and theoretical knowledge is required. Furthermore, Hordern observes that

> For Gamble (2006, p. 93), both the 'particular' (context-dependent) and 'general' (context independent) forms of knowledge incorporate principled 'wholes' and procedural 'parts'. The

> capacity to work with 'generality' is arguably developed with accumulation of knowledge in both spheres (Hordern, 2014, p. 28).

It is the distinctions between the way in which the parts and wholes combine that allows for the differentiation of the four knowledge types depicted in Figure 1. The differentiation between types of knowledge forms the basis for an analytical framework for analysing the knowledge present in work in Gamble's 2016b study. She argues that the relationship between knowledge and practice in occupations is defined by the logic of work and suggests that:

> The logic of work is viewed as *procedural* where problem-solving follows routinised procedures towards a pre-defined end-result. The logic of work is deemed *principled* where problems are novel and unpredictable and 'general principles' of hypothesis, prediction and explanation are drawn upon in non-linear problem-solving that lead to new part-whole combinations (Gamble, 2016a, 2016b). Each logic is supported by specialised kinds of knowledge, making it possible to identify a strong correspondence between the structure of work and the structure of curriculum. (2018, p. 260)

Using the above distinctions between the procedural and principled logics of work, the challenge is to then determine the types of work logic involved in a particular occupation. Identifying the type of work logic could then allow for the analysis of the knowledge types present in that work. Gamble (2009, 2016b) argues that a mix of knowledge forms are present in different occupations, according to the knowledge requirements of the occupation, which then has implications for the type of knowledge selected for inclusion in an associated vocational curriculum.

Evans, referring to work by Loo (2019) and Hordern (2019), suggests that "discipline-based knowledge has a different logic from practice-based and work-based knowledge" (2019, p. 958). Barnett argues that it is necessary to "conceptualise the links between workplace activity and disciplinary knowledge" (2006, p. 147), which is done through a process of recontextualisation. Recontextualisation, defined as "the appropriation and transformation of knowledge for various purposes" (Barnett, 2006, p. 144), consists of a process whereby knowledge is first recontextualised in vertical discourse from research into disciplinary knowledge (Bernstein, 1999).

Barnett (2006) describes two further recontextualisation processes for vocational contexts, first when disciplinary knowledge is recontextualised for vocational purposes, which Barnett refers to as 'reclassificatory recontextualisation', and then 'pedagogic recontextualisation' of vocational knowledge into the vocational curriculum. Pedagogic recontextualisation occurs both for the inclusion of disciplinary knowledge and, separately, situated knowledge into a vocational curriculum. Both forms of knowledge are required in the vocational context, and occupational knowledge or know-how extends beyond disciplinary knowledge to include "a worker's past knowledge (of theoretical and procedural knowledge and experiences), understanding (of work and specific project contexts), skills

(technical and nontechnical), dispositions, and the perceptions of the work settings [in which] the worker operates" (Loo, 2019, p. 1040).

He further suggests that this knowledge could be either tacit or explicit. The process of recontextualisation, as defined by Barnett, includes two key processes: appropriation and transformation. Hordern explains that "'appropriation' … involves the 'selection' of knowledge and 'transformation' involves a process of 'relocating' knowledge, and thus the selection of a context" (2014, p. 36). Selection and transformation are critical to ensure a particular relationship between the knowledge in the vocational curriculum and the occupation's workplace (Hordern, 2019). As a process, it has "concomitant impacts on vocational curricula, teaching and learning" (Hordern, 2014, p. 23). While vocational curriculum is not a direct focus of this research, an understanding of the recontextualisation process provides a useful foundation for considering the relationship between disciplinary and situated occupational knowledge in a vocational context and feeds into the conceptualisation of my language of description for this research.

Hordern argues that there is a need for a 'transformation' process that links the contextual knowledge of practice to disciplinary knowledge in order to develop a vocational curriculum but suggests that "rules of combination for practical knowledge" could also be developed (Guile, 2011, p. 455, in Hordern, 2014, p. 30). Loo suggests that applied occupational knowledge arises from a combination of occupational knowledge and work knowledge (specific to a particular work environment) where they are transformed through a further recontextualisation process that he refers to as the 'occupational recontextualization process' (Loo, 2019, p. 1040). Thereafter, this occupationally recontextualised knowledge can then be applied to work practices.

Similarly to Loo's concept of occupational recontextualisation, Gamble (2016a) argues that the logic of work is the recontextualising principle for vocational education and training. Hordern (2014) draws on Evans et al. (2010) to suggest that recontextualisation can take into account a broader range of concepts and contexts and, as a result, be flexible in its application. He further draws on Young (2006) to suggest that recontextualisation is a way to 'bridge the gap' between theoretical and experiential knowledge (Hordern, 2014, p. 27). Loo (2019), suggests that this process of occupational recontextualisation can be developed into the notion of vocational or occupational practice. Guile defines vocational practice as "the mix of knowledge, skill and judgement that employers are looking for" (Guile, 2011, p. 385). However, it is important that, once again, decisions about what knowledge counts are not based solely on a single perspective as

> Many learners may experience some disjuncture between the knowledge considered valuable in the workplace and that prioritised in the curriculum… Workplaces may exhibit practices and

> prioritise knowledge that would be considered redundant or counterproductive for current vocational formation. The potential for the 'disconnect' above, points to the importance of the dynamics in the 'region' of vocational knowledge to incorporate an engagement with knowledge processes in the workplaces. (Hordern, 2014, p. 32)

Hordern argues that there is a distinction between theories that foreground "practice as a site of vocational learning" and those that "highlight the acquisition of systematic knowledge as the basis for expertise in occupations" (2019, p. 1121), as they conceptualise practice differently as well as having distinct approaches to vocational knowledge and identity. He further argues that the role of disciplinary knowledge that is "developed in disciplines and by rigorous research practices" should not be downplayed, as it is critical for occupations in order to provide the knowledge base necessary for the exercise of "well-founded judgements in the context in which they work" (Hordern, 2019, p. 1126).

However, as argued previously, it is important to consider the distinctiveness of vocational knowledge and the interplay between the forms of knowledge that underpin different occupations. The interplay between forms of knowledge allows for vocational knowledge to adapt to various types of vocational practice, drawing on different knowledge bases in differing quantities (Hordern, 2014). Referring to Muller (2009), Wheelan makes the point that "The body of knowledge underpinning practice varies in complexity, depth, and level of abstractness in different fields" (Wheelahan, 2019, p. 103).

It is in unpacking the types of knowledge that underpin a particular practice, or occupation, that Gamble's work provides the conceptual framework needed to unpack the knowledge surfaced in the RPL process. As Hordern points out: "The tension and articulation … between the 'general' and the 'particular' (Gamble, 2006) in processes of knowledge formation provide a lens through which to explore knowledge transformation" (Hordern, 2014, p. 27). Thus this conceptual framework provides a useful starting point for examining the knowledge surfaced in the RPL case study. While the RPL process was aimed at recognising the candidates' prior workplace knowledge, it aligned this knowledge to a qualification based on learning outcomes in a system that, it has been argued, focuses strongly on procedural knowledge to the detriment of principled knowledge (Billett, 2003; Gamble, 2006, 2016a; Young, 2006, 2013; Wheelahan, 2015, 2019).

Philosophy of education – Ryle and Winch

While Gamble's four quadrants form the basis of the conceptual framework for this research, I also draw on the work of Christopher Winch (2012) in order to broaden the conceptualisation of forms of knowledge. Gamble's broad classifications can only begin to unpack questions around types of occupational knowledge or what Winch (2012) refers to as 'dimensions of expertise'. As Winch points

out, “the generality required of a theory of expertise cannot be achieved in the face of so much complexity and variety of human activity” (Winch, 2012, p. 151).

Winch (2012) draws on the work of Gilbert Ryle (1963). Although rooted in a theory of knowledge, Winch’s work extends to the notions of skill and expertise, and these will be discussed further in the next chapter. He draws on Ryle’s (1963) concepts of knowing *that* and knowing *how*. Ryle argues that there are parallels as well as distinctions between the two. Knowing *that* refers to propositional knowledge or academic subject knowledge, while knowing *how* refers to practical knowledge related to the performance of an activity (Ryle, 1963; Winch, 2012). There is a close relationship between the two types of knowledge, and they should be understood in terms of each other (Winch, 2012); however, they cannot be assimilated into each other and must stand as distinct forms of knowledge (Ryle, 1963). Winch further draws on Ryle’s argument and suggests that, without this distinction, it is not possible to understand the concept of expertise.

In terms of knowledge, Winch argues that there are two aspects related to expertise; propositional knowledge or academic subject knowledge, and practical knowledge that is related to practical activity in terms of an occupation or profession. For Winch, practical knowledge is understood broadly as a sense of knowing how rather than knowing that.

> ’Practical knowledge’ … includes consideration of the moral aspect of knowing how to act, as well as what is known as practical judgement in the broader sense of being able to act rationally in practical contexts and includes consideration of ‘competence’, ‘skill’ and related terms. (Winch, 2012, p. 1)

He further argues that even though “knowledge how is rightly considered to be the special province of vocational and professional education, it would be a grave mistake to think that knowledge that has no role to play in it” (Winch, 2012, p. 6).

Any notion of expertise, particularly in the realm of practical knowledge, should also incorporate what Winch (2012) refers to as two kinds of propositional knowledge, termed in German as *Kenntnis* (related to context-dependent propositional knowledge) and *Wissen* (defined as systematic propositional knowledge). This is similar to Gamble’s (2004b, 2009) argument that everyday context-dependent knowledge and scientific context-independent knowledge can both be broken down by a further distinction between principled and procedural knowledge in each knowledge type. These are not the only types of knowledge to be considered, however. For Winch, expertise moves beyond merely knowing about the subject (‘knowing that’) or ‘knowing how’ but, for occupations, extends to include the concept of skill.

Although Winch considers skill to be central to the understanding of knowing how, skill as a concept requires much broader conceptualisation. Within 'knowing how' is the knowledge of how to do something that is "in normal circumstances, the ability that an individual has to do that thing" (Winch, 2012, p. 40). However, the ability to do something is not a sufficient definition of skill. Winch goes on to point out that a skill is not merely ability but also includes the notion of normative appraisal, related to "the degree to which an activity can be performed well or badly" (Winch, 2012, p. 41). Similarly, Ryle (1963) points out that descriptions of people's knowing how relate to whether they perform them well, using descriptions such as correctly, efficiently, or successfully. This relates their performance to intelligence; however it extends beyond just satisfying criteria to also applying them through regulating people's actions.

As already mentioned, skill includes the notion of normative appraisal. Winch further argues that "the exercise of skill involves technique, perceptual ability, certain moral qualities, habits and propositional knowledge" (Winch, 2012, p. 44). These suggest that, in order to conceptualise skill, it is necessary to consider concepts such as technique, disposition and values, and the role of judgement. These in turn, when combined with the concept of skill, point towards the need to conceptualise the notion of expertise.

Thus it is not sufficient to merely delineate the four classifications of knowledge types, as defined by Gamble (2016b) and discussed in the prior section on vocational knowledge. It is also necessary to examine the types of knowledge using a deeper understanding of how seemingly disparate knowledge classifications such as knowledge how and knowledge that are inter-related and feed into each other. Drawing on these classifications of knowledge or dimensions of expertise, allowed me to develop a broader framework in which to position the knowledge surfaced through this study, as well as providing a wider vocabulary for discussing knowledge in this context.

Furthermore, the concepts of skill, expertise, and judgement require a more extensive conceptualisation to develop a clearer understanding of how these relate to the forms of vocational knowledge discussed previously. These will be developed in the next chapter. However, before doing so, it is necessary to expand on two particular forms of vocational knowledge — craft knowledge and tacit knowledge. These will be discussed in the next section.

Craft and tacit knowledge

The previous section on vocational knowledge makes the argument for its distinctiveness and provides the broad conceptual framework for this research. However, drawing from these conceptions of

knowledge types, this section focuses on two particular types of knowledge in order to explore them in more detail. The first part of the section deals with the conceptualisation of craft knowledge, drawing on Gamble (2004a, 2004b, 2016b), while the second focuses on developing an understanding of tacit knowledge.

Craft knowledge

Gamble's (2004a, 2004b) work conceptualised the use of craft knowledge in the context of apprentice cabinet makers. She began her study of craft knowledge by drawing on Bernstein's (1996) definition, which positions it as a vertical knowledge discourse with a horizontal knowledge structure. She explains that

> Craft seems to belong in horizontal discourse. Even though it is a specialized practice it is clearly context dependent in both its transmission and its realization. One cannot acquire a craft other than by 'doing'. However, craft's positioning in vertical discourse signals the presence of a recontextualizing principle that comes from outside a specific object or context. In that sense craft meanings must be context independent. This is the puzzle that places craft as 'knowledge structure' in need of investigation. (Gamble, 2004a, p. 190)

This understanding is the foundation for her later positioning of craft in her four-quadrant model of knowledge in work (Gamble, 2016b), as presented in the section on vocational knowledge.

Based on the above definition of craft knowledge, it is classified as a form of vertical discourse (Bernstein, 1999), implying that it constitutes a particular form of context-independent or principled knowledge. Gamble identifies craft knowledge as "*a particular form of embodied, principled knowledge*, thus allocating to craft a feature that is shared with other kinds of principled knowledge, namely that its procedures can only be understood if 'interpreted' through a principle" (Gamble, 2004b, p. 176, emphasis in original). This leads to her later (2016b) classification of craft knowledge as specific, principled knowledge.

The definition of craft knowledge centres on the relationship between 'part and whole', and, for Gamble, is based on Pye's (1968) conceptualisation of how design relates to workmanship. Gamble argues that the part-whole relationship is understood through visualisation that

> signifies a relationship between part and whole, which carries within it the notion of the 'ideal'. The adept 'sees' both what is there and what is not there. There is always an awareness of a proportional whole, even though the craftsperson may be working on separate parts of the item. This knowledge is made manifest through rough drawing and not through words. (Gamble, 2004a, p. 196)

Gamble (2004b) combines Pye's conceptualisation of the relationship between design and workmanship, which she suggests is the relationship between part and whole, with Polanyi's

(1958/1967) concept of focal and subsidiary awareness to make apparent the role that tacit knowledge plays in craft knowledge. As a form of embodied knowledge, Gamble argues that craft knowledge can “be grasped only through visualization, [and] can never be expressed in words" (2004a, p. 196). Drawing these together, Gamble (2004b) argues that, for a craft worker, the capacity for visualisation is held in the body as internalised competence and is what constitutes the tacit element in craft. She further specifies that craft knowledge is not merely about skill but involves a particular form of context-independent knowledge which is visualised as a relationship between part and whole and expressed in an embodied way.

This embodiment of principles finds it final expression in the object that arises from the visualisation of the relationship between parts and whole — in Gamble’s (2004b) case study of cabinetmakers, this is a table produced from a set of drawings. The internalised competence that develops from this embodiment of principled knowledge in craft suggests the coming together of “labour of the head” (principled knowledge) and “labour of the hand” (embodiment) (Gamble, 2004a, p. 191). This points to the importance of the “personal unity of hand and head exemplified in craft” (Gamble, 2004b, p. 177).

The discussion of craft knowledge in this section has, thus far, focused on the conceptualisation of craft knowledge in its original site of development — that of artisans and craftmanship. However, for the purposes of this research, it is necessary to consider whether Gamble’s (2016b) conceptualisation of craft knowledge as specific, principled knowledge can be extended to other contexts. Her analysis in the 2016 study suggests that the principle of visualisation, and therefore specific, principled knowledge, is present to varying degrees in different occupations. However, she argues in her previous work that because craft knowledge is based on principles, if it is reduced to procedural knowledge, the parts and whole visualisation principle ceases to operate (Gamble, 2004a). This, Gamble argues, is what occurs in mass production processes. Similarly, Hordern argues that

> Those who are able to engage in physical creation independently are perhaps the only workers able to maintain the part-whole relation in context-dependent knowledge in the contemporary industrialised world, finding some manner of resisting the fordist procedularisation of physical labour. Others are caught in an interconnected network of procedures and actions, with limited purchase on the overall creative vision. (Hordern, 2014, p. 29)

The argument that proceduralisation and routinisation of work through automation causes reduction in workers’ conceptualisation of the parts and whole relationship which in turn leads to a loss of the visualisation principle, is directly relevant to this research. It poses the question as to whether there is any place for craft knowledge in the automated work environment. Indeed, Gamble contrasts

visualisation in the craft environment with Zuboff's (1988) description of workers transitioning from a less automated to a more automated process and their difficulties with visualising the process, stating that

> Visualisation, as it emerges from [Gamble's] analysis, is not the same as the process described by Zuboff (1988) — where workers in factories, which have become fully automated, need a mental image to relate the electronic symbol on the computer screen to their real-world experience of the process as it is happening in the plant. Generating an inward image to act as referent for an abstracted process is an act of substitution for that which can no longer be held in the body. Visualisation is not the bringing forth of an 'action context' that is not present. It signifies that which is present but not visible. (Gamble, 2004b, p. 152)

This suggests that craft knowledge and the principle of visualisation is unlikely to be evident in the data from this research. However, as craft knowledge also forms part of Gamble's classifications of knowledge in work, it is important to consider its place in the conceptualisation of vocational knowledge, as well as what it says about the position and transmission of tacit knowledge in this conceptual framework.

According to Gamble (2004b), the transmission of craft's tacit knowledge cannot occur through direct pedagogy but rather occurs in more incidental ways through proximity. Similarly, Horden explains that the transmission of the capacity for visualisation is a tacit process that occurs between a 'master' and their apprentices through "immersion in context" (2014, p. 28). The development of a capacity for visualisation occurs through the apprentice's exposure to the 'whole' production process rather than just individual procedural parts (Gamble, 2004a, 2006; Hordern, 2014).

Studies on apprenticeships and the transmission of craft knowledge are central to the work of Lave and Wenger (1991) and their theory of situated learning. However, Lave and Wenger's (1991) approach to learning as a 'situated activity' (social practice theory), in Gamble's view "does not illuminate the 'tacit'" as it "emphasise[s] the use of language and the making explicit of the 'tacit'" (2004b, p. 8). This refers to situated practice's key features of shared narratives between 'old timers' and newcomers and reflection on what was learned. Furthermore, in terms of craft knowledge, Gamble critiques social practice theory as it "offers no theory of formal transmission and has no way of explaining how knowledge transcends specific context embeddedness" (Gamble, 2004b, p. 18).

The *tacitness* of craft knowledge and its transmission lies in the principle of visualisation (Gamble, 2004b). The relationship between parts and whole is, using Polanyi's (1958/1967) term, a subsidiary awareness to the focal awareness of the visualisation principle. In the context of tacit knowledge, the distinction between focal awareness and subsidiary awareness can be explained through the

difference in the way that someone engages with a hammer and a nail while driving in the nail. Polanyi describes the scenario as follows:

> When we use a hammer to drive in a nail, we attend to both nail and hammer, *but in a different way.* We *watch* the effects of our strokes on the nail and try to wield the hammer so as to hit the nail most effectively. When we bring down the hammer we do not feel that its handle has struck our palm but that its head has struck the nail. Yet in a sense we are certainly alert to the feelings in our palm and the fingers that hold the hammer… I have a *subsidiary awareness* of the feeling in the palm of my hand which is merged into my *focal awareness* of my driving in the nail. (Polanyi, 1958/1967, p. 55, emphasis in original)

This relationship between subsidiary and focal awareness, or between parts and whole, for Gamble is "why it is that craft knowledge lies outside of language and is often described as a mystery" (Gamble, 2004b, p. 156). For analytical purposes, the challenge then is to attempt to capture this context-independent yet embodied 'mystery' which cannot be languaged in a way that allows for its classification.

Although Gamble makes use of Bernstein's (1999) classifications in her conceptual framework, she does problematise the use of Bernstein's discourse as a means for considering 'tacit' knowledge because the link that he makes between thought and language "is problematic for the representation of tacit knowledge" (2004b, p. 167). While this section focuses on craft knowledge specifically, a broader conceptualisation and subsequent classification of tacit knowledge will be addressed further in the next section.

Tacit knowledge

Polanyi, considered the 'father' of tacit knowledge, stated that "*we can know more than we can tell*" (1958/1967, p. 4, italics original). Although he was referring more to the nature of scientific knowledge than craft knowledge (Gamble, 2004b), this statement has become foundational to the understanding of tacit knowledge.

The role of the workplace as a site of learning in VET is significant in that it provides for the transfer both of explicit practical knowledge through language by engagement with experienced occupational practitioners as well as tacit knowledge through proximity and observation of the vocational practices. Loo suggests that the tacit forms of know-how "include occupational experiences, experiences from colleagues, and skill sets" (2019, p. 1048). Cook and Brown provide an example of how individual flute makers engage with the flute parts using "judgement of hand and eye" (i.e. through a craft knowledge visualisation process) but also pass on knowledge through discussion (Cook and Brown, 1999, pp. 395–396).

Research on tacit knowledge, particularly as it relates to the notion of craftsmanship and artisans, often draws on ethnographic studies of particular occupations or contexts (See as examples: Orr, 1990; Lave and Wenger, 1991; Cook and Brown, 1999; Gamble, 2004b; O'Connor, 2005; Hendon, 2006; Marchand, 2008; Thurnell-Read, 2014; Maslen, 2015; Olsson and Lloyd, 2017; Bijsterveld, 2018). As discussed in the previous section on craft knowledge, craft knowledge is considered to be tacitly transmitted through the proximity of the apprentice to the 'master' as described in Lave and Wenger's (1991) notion of 'legitimate peripheral participation'. However, Gamble (2004b) argues that situated learning theory does not provide the tools to illuminate either the tacit knowledge or its transmission in this context.

One of the types of knowledge not immediately evident in, although underpinned by, Gamble's (2016b) classifications of knowledge in work, is tacit knowledge. As Gamble explains in her doctoral thesis, *Tacit Knowledge in Craft Pedagogy: a sociological analysis,* that

> The term 'tacit' is often used to refer to implicit knowledge that is not clearly expressed; yet, by its own definition, tacit knowledge constitutes a unique class of phenomenon, namely that which is not presentable in language. It is thus a difficult concept to grasp and an even more difficult concept to represent in words. (Gamble, 2004b, p. 1)

Tacit knowledge, according to Gamble (2004b) can be framed as context-independent knowledge, also referred to as the principled knowledge discussed previously. As a result of this, Gamble poses two critical questions: "If tacit knowledge is context independent knowledge, how can this be illuminated? Secondly, there is a pedagogy question. If tacit knowledge is context independent knowledge, how is it transmitted" (Gamble, 2004b, p. 16)? In beginning to develop an explanation of how tacit knowledge is defined, Winch proposes that tacit knowledge is not limited to merely principled knowledge but that "[p]ropositional knowledge, practical knowledge and knowledge by acquaintance can all be tacit in certain circumstances" (Winch, 2012, p. 117). This broadens the realm of tacit knowledge to encompass all possible types of knowledge. The question remains, however, as to how to construct a conceptual framework that allows for the identification and classification of tacit knowledge.

As argued above, Winch (2012) considers tacit to be part of several types of knowledge rather than confined only to the classification of craft knowledge, a position similarly echoed by Eraut (2004, p. 253) in his examination of informal learning: "Thus I do not consider tacit knowledge to be a single type of knowledge, but rather an attribute of several types of knowledge". Winch argues further that

> …although being tacit is an important property of [knowledge], it is neither mysterious nor does it make all practical knowledge, let alone expert practical knowledge, ineffable or inarticulable, nor is its acquisition beyond the reach of formal or semiformal educational processes. (Winch, 2012, pp. 117–118)

Polanyi argues that "tacit knowledge can be discovered, without our being able to identify what it is what we have come to know" (Polanyi, 1969, p. 142) through examining how parts that form the subsidiary awareness of an object are integrated into the perception of the focal awareness of the object. This is explained in one way by Polanyi's example of learning a skill such as riding a bicycle where "we learn how to ride a bicycle without being able to tell in the end how we do it" (Polanyi, 1969, p. 142). As the subsidiary awareness of how the body compensates for balance is integrated into the focal awareness of riding the bicycle, it cannot be conceptualised outside of the focal awareness, and this is what Polanyi identifies as the concept of 'tacit knowing' (1969, p. 140). In considering tacit knowledge then, perhaps it may require an analysis of the results of its application rather than searching for it directly — to draw on the biblical turn of phrase: you cannot see the wind, yet you can see its effects[4].

For this study it was unclear how tacit knowledge would be surfaced through the RPL programme, as the qualification against which the candidates are being accredited is based on explicit learning outcomes. Gamble makes the argument that

> outcomes-based or standards-based curriculum formulations, currently in force in South Africa and elsewhere, cannot allow for the 'tacit' in any other way than by assuming that local or practically acquired knowledge incorporates the 'tacit'; or, alternatively, that tacit knowledge can be made explicit and specified as assessment criteria. (Gamble, 2004b, pp. 2–3)

Although tacit knowledge may be present as a property of some of the forms of knowledge, particularly the practical and propositional knowledge (Winch, 2012) that are surfaced in the RPL programme, identifying, and classifying these forms of tacit knowledge in the context of a qualification based on explicit evaluative criteria may be very difficult, if not impossible (Gamble, 2004b). However, as contemplated above, it may perhaps be possible to develop an understanding of the 'effects' of tacit knowledge that point to its presence.

Orr (1990) in his ethnographic study of photocopier technicians describes how, as part of the design of new machines, tacit knowledge is transferred by studying the older machines to determine how best to design new machines. The result of the acquisition of this tacit knowledge, therefore, is evident in the innovation process. Gamble refers to Sabel (1995), who "argues that tacit knowledge is what renders the individual inventive in everyday matters" (Gamble, 2004b, p. 3). Likewise Daniels draws on Victor and Boynton (1998), who align craft workers' ability to invent solutions with the tacit

[4] See John chapter 2 verse 8: 'The wind blows wherever it pleases. You hear its sound, but you cannot tell where it comes from or where it is going' (*Holy Bible: New International Version*, 2011).

knowledge linked to "experience, technique, and tools", and argues that this is also "the kind of knowledge that teachers who regard themselves as "intuitive" would develop and use" (Daniels, 2004, p. 191). Muller, in considering innovation in manufacturing, makes the point that

> Knowledge as tacit competence is as crucial to the quest for successful innovation as is knowledge as 'result' (which would include research results such as experimental algorithms, patents, trade marks and other forms of intellectual property). The latter is inert (often expensively so) without the former, and the former can only become productive by means of some measure of 'articulation' with inarticulate skilled innovatedness [i.e. the innovation that derives from tacit expertise] via explicitly designed institutional arrangements. The Japanese Quality Circles are an example of such an arrangement.
>
> All forms of practice have a tacit dimension, including, and perhaps especially, experimental and applied science. It is increasingly recognized that it is the training in research and problem-solving skills that has long-term market-value, rather than rapidly obsolescent content knowledge. (Muller, 2000, pp. 32–33)

Considering the examples presented here, I posited that it may be possible to identify instances, if they were present, where the RPL programme candidates were involved in forms of innovation that relied on the application of their previously acquired tacit knowledge.

In considering that tacit knowledge may be a property of various forms of knowledge, it is important that the conceptualisation of tacit knowledge does not fall prey to prioritising one type of knowledge over another, as previously discussed. The discussions of both craft knowledge and tacit knowledge raise questions about the distinctions made between "labour of the head" and "labour of the hand" (Gamble, 2004a, p. 191) — i.e. the distinction previously made by Ryle (1963) between 'knowing *that*' and 'knowing *how*'. The inclusion of tacit knowledge, particularly in practical knowledge by Winch (2012), together with Gamble's (2004b) argument that craft knowledge resides in an embodied form, provide a foundation for exploring how tacit knowledge can conceptualised through the body.

The idea that the body has a role to play in knowledge production and acquisition is in contrast to the strong Western notion of the duality between mind and body, most commonly understood as Cartesian dualism. Cook and Brown (1999) argue that the Cartesian tradition has privileged explicit knowledge, considering tacit knowledge to be too obscure and inaccessible to be of practical use. Thus craft knowledge, as embodied knowledge in tacit form, tends to be ignored in the realm of formal education and the awarding of qualifications.

Feminist theorists, amongst others, have been vocal in their critique of the notion that the mind and body should be viewed as separate, instead arguing for the recognition of the role of the body in identifying knowledge — i.e. the importance of recognising embodied knowledge in traditions such as experiential learning, and RPL in particular (Michelson, 1996a, 1996b, 1998, 1999, 2020). These

theories comprise more than simply an argument that knowledge produced or held by the body should be recognised but extend to further arguments for the recognition of emotions and the embodiment of gendered knowledge (Michelson, 1996b, 1998). However, for the purposes of this research, the focus is on how tacit knowledge can be conceptualised through embodiment. The particular focus of the next section is on the role of the senses as a way of acquiring knowledge, as well as a way of reflecting particular types of tacit knowledge in action.

Sensory tacit knowledge

Gamble's (2004b) conceptualisation of tacit knowledge in craft occupations has already been discussed in detail in the previous sections. The conceptualisation of sensory tacit knowledge draws on Collins' (2010) discussion of what he calls 'somatic tacit' knowledge. Somatic tacit refers to tacit knowledge held in the body. Collins draws on Polanyi's (1958/1967) explanation of riding a bicycle where the person riding it knows how to stay upright by manoeuvring the handlebars and shifting their balance but is unable to explain exactly how they do it. Shalem and Slonimsky, drawing on Collins' ((2010) work, suggest that 'somatic tacit knowledge' as a "form of 'know-how' is, indeed, attained through embodied experience" (Shalem and Slonimsky, 2014, p. 205).

Sensory tacit, in part, refers to the idea that tacit knowledge is held in the body but focuses more specifically on the senses as source of knowledge (Maslen, 2015) and the role of the senses in combining this knowledge input with somatic tacit knowledge in a way that contributes to the development of expertise and professional judgement. The need to conceptualise sensory tacit knowledge as part of the conceptual framework for this study arose from what I identified as a 'discursive gap' (Ensor and Hoadley, 2004) between the broader conceptualisation of tacit knowledge discussed previously, and the empirical evidence of the case study. I perceived a need to broaden the language of description for this research, which in turn led to the inclusion of the concept of sensory tacit as part of this conceptual framework.

Identifying a similar need to conceptualise sensory tacit as part of the sociomaterial dimension of expertise, Guile and Unwin suggest that there are "specific fields of VET that involve high levels of sensory competence, such as carpentry, catering, handcrafted ceramics, or glassblowing" (Guile and Unwin, 2019, p. 30). Billett also points to the development of "intrapsychological attributes (i.e., *sensory*, perceptual, and neural) that arise and manifest as a product of experiencing and maturation" that is 'person-dependent' (Billett, 2019, p. 44). I therefore identified a need to conceptualise sensory tacit knowledge to further the development of a conceptual framework for this research as it also fed into the subsequent conceptualisation of expertise. Broad and Lahiff argue that to understand

expertise, it is essential to consider the 'visceral,' as "the body, rather than the mind, can be seen to guide expert practice with the development of a 'sixth sense' in using equipment or tools to make adjustments to suit the process" (2019, p. 437).

As suggested by the term sensory tacit, this conception refers to tacit knowledge related to the senses of the human body. The role of the senses in producing and interpreting knowledge is not a new construct (Maslen, 2015), and even Polanyi refers to the "peculiar combination of skilful doing and knowing [that] is present in the working of our sense organs" (1969, p. 126). Bijsterveld, in her book *Sonic skills: Listening for knowledge in science, medicine and engineering (1920s-Present)* draws on work by Lissa Roberts (1995) who suggests that

> it was only in their published writings that eighteenth-century chemists sidelined touch, hearing, smell, and taste. While carrying out their experimental work, they still enlisted their senses to interpret what had happened, carefully attuning their bodies to their instruments. (2018, p. 10)

Collins (2001) also discusses the role of tacit knowledge in scientific experimentation. There is evidence of the role of tacit knowledge, and particularly sensory tacit, in other professions such as medicine and engineering as well (Bijsterveld, 2018). Maslen, in examining the literature on the rise of communication technologies, points out that these scholars argue for "the capacity for the senses to mediate thought and action, that is, that the senses are a foundational knowledge" (2015, p. 55).

While it is certainly possible for sensory tacit to apply to all five senses, for the purposes of this study only three of the senses will be included based on their relevance to the research. The three included for the purposes of this conceptual framework are:

- hearing, referred to as auditory tacit knowledge,
- seeing, referred to as visual tacit knowledge, and
- feeling, referred to as tactile tacit knowledge.

Each of these will be unpacked individually in the section that follows.

Auditory tacit knowledge

Auditory tacit knowledge draws on the concept of 'sonic skills' (Krebs and Van Drie, 2014; Bijsterveld, 2018). For Krebs and Van Drie, they "are defined as listening skills and other skills (including technical and musical skills) needed to employ the tools for listening" (Krebs and Van Drie, 2014, p. 93). Bijsterveld (2018) uses the term 'sonic skills' to refer to the skill of 'listening for knowledge' — that is listening to obtain information or knowledge of the environment through what is heard. She argues that

> Listening for knowledge is also embedded in more everyday practices. Since the early nineteenth century, doctors have used stethoscopes to listen to their patients' hearts and lungs as a way of investigating their health. Engineers in the automotive industry and mechanics in garages use automotive stethoscopes to listen to the functioning of car engines or the car's other moving parts. (Bijsterveld, 2018, p. 3)

The term used for listening for knowledge in medicine is 'auscultation' and forms part of medical curricula worldwide (Bijsterveld, 2018) through aural learning in clinical practice environments (Maslen, 2015). Maslen writes about how medical students learn to hear and recognise certain heart and lung sounds using a stethoscope, as well as develop an awareness of the 'soundscape' even without the stethoscope to reach a diagnosis. This process of making a diagnosis, Cook (1982) argues, involves the doctor drawing on their tacit knowledge and expertise to make a judgement that results in the diagnosis. While professional judgement will be discussed in the next chapter, it is worth noting the interplay between the sensory knowledge source and the sensory tacit knowledge used to make a diagnosis.

Similarly, auto mechanics have historically made use of sensory tacit knowledge to identify problems with an engine based on how it sounds. Bijsterveld points out that, as early as 1925, there is a published article about automobile engineers measuring the frequency of automobile sound using a metal rod between their teeth (Snook, 1925, in Bijsterveld, 2018). Krebs and Van Drie (2014) write specifically about the parallels between medical physicians and auto mechanics in their use of stethoscopes. Bijsterveld refers to Krebs (2012) work on auto mechanics' listening skills, stating that "those working in car repair shops and the automotive industry consider the mechanic's stethoscope an essential tool, the use of which is an acknowledged learning-by-doing aspect of practical training" (Krebs, 2012 in Bijsterveld, 2018, p. 6).

The use of auditory tacit, or 'sonic skills', occurs in a wide variety of contexts, both in professions such as medicine and occupations. Orr (1990), whose ethnography of photocopier technicians has been referred to previously, also writes about how the experienced technicians were able to use their auditory tacit knowledge to identify what was happening on a machine. Bijsterveld (2018) also makes the observation, based on Orr's work as well her own previous work, that

> This is why the technicians Orr studied hated noisy customer sites: the noise hampered their auditory focus on the machines. For similar reasons, factory workers long resisted the use of ear plugs, which deprived them of auditory cues about how well the machines on the shop floor were working. (Bijsterveld, 2018, p. 13, references removed)

Thus the role of auditory tacit knowledge appears to span environments ranging from professions to craft occupations, and even to the realm of more automated work environments.

Tactile tacit knowledge

The concept of tactile tacit knowledge is closest to Collins' (2010) concept of somatic tacit knowledge. Referring again to Gamble's (2004a, 2004b) work, it could also be connected to her concept of embodied knowledge that forms part of craft knowledge. Embodied knowledge in this context refers to knowledge held in the body but applied specifically to the ability to engage with the environment through the sense of touch/feeling. The meaning of the term 'embodied knowledge' is, however, not unambiguous as it has been used to construe various ways in which different forms of knowledge are carried in the body, particularly in fields such as Feminist Theory as discussed previously (see, for example, Michelson, 1996b, 1998, 1999).

There are also other definitions of embodied knowledge in fields such as theatre and psychology, but I have chosen to narrow the definition as it applies to this research to avoid clouding the focus of the conceptual framework. To avoid confusion, I have also chosen to use the term 'tactile tacit knowledge' rather than 'embodied knowledge' in referring to this form of knowledge as it relates to this specific research study.

In considering what constitutes 'embodied knowledge' as a form of sensory tacit knowledge, Maslen (2015) refers to Hockey's autoethnography of long-distance running where they speak about how the body engages with its surroundings to take in knowledge about their performance based on how it feels. Furthermore, Cook explains how flute makers can feel the tension of the keys and know that it is correct without having to measure, arguing that "knowledge of feel is tacit knowledge" (1982, p. 138). He likens this to Polanyi's (1958/1967) explanation of riding a bicycle, making a clear distinction between the type of knowledge required to tell someone what to do (i.e. explicit knowledge) and the type of knowledge required to actually ride the bicycle (tacit knowledge), which the rider cannot fully explain. Cook makes the argument that while "they are both knowledge <u>about</u> the same things, …they are not both knowledge <u>of</u> the same things. They are not equivalent" (1982, p. 140, emphasis in original).

While skill will be discussed in the following chapter, the concept of skill as it relates to development of embodied knowledge provides a useful conceptualisation for tactile tacit knowledge. Coetzee (2011) describes how Polanyi's (1958/1967) use of the concepts of focal and subsidiary awareness led him to an understanding of how skilled practices are embodied:

> Polanyi argues that in coming to use a tool expertly, we shift our sense of the boundaries between ourselves and the tool (or, put more broadly, in coming to perform a skill we shift the boundary between ourselves and the practice). While we rely on a tool or a probe, these are not used as external objects… This shifting of the boundary between ourselves and the

> tool involves a focal awareness on the whole task and a subsidiary awareness on the parts comprising it, which develops over time and with practice…. (Coetzee, 2011, p.8)

She relates this to Gamble's (2004c) argument about embodied knowledge in craft knowledge being about the relationship between parts and the whole. Coetzee suggests that developing tacit knowledge is about integration, where the parts and whole become integrated in such a way that the individual is later unable to explain how exactly they fit together and "As this tacit knowing is developed a skill will come to feel as though it were something habitual or routinised" (Coetzee, 2011, p.8).

In her description of learning the craft of glassblowing, O'Connor (2005) traces how she learned the various parts of the process and describes how these were brought together in the task of blowing a goblet. She also describes the way in which she had subsidiary awareness of the tools she used, such as the blowpipe, while her focal awareness was of the task of blowing the goblet. As the skills that O'Connor developed for using the tools became more embodied, her tactile tacit knowledge increased, and she was able to move her focus to the overall process of blowing the goblet.

Tactile tacit knowledge draws on the concepts of somatic tacit knowledge, as well as the idea that knowledge can be held in the body. It is encapsulated in the way in which an individual interacts with their specific context, and, in some instances, this tacit knowing may also be encompassed in certain skills (Coetzee, 2011), such as in the example of glassblowing (O'Connor, 2005). Another example is Guile and Unwin's description of 'embodied expertise' such as "when trainee carpenters are encouraged to keep running their hands along a piece of wood or chefs are encouraged to "feel" the moment when a sauce starts to thicken" (Guile and Unwin, 2019, p. 31).

Although the examples of tactile tacit provided tend to draw from craft occupations, tactile tacit conceptualised as the body interacting with tools in a specific environment suggests that it may be present in other occupational contexts or workplaces. Furthermore, as Cook's (1982) example of flute makers indicates, this tactile tacit knowledge may also contribute to the worker's expertise and professional judgement.

Visual tacit knowledge

The final form of sensory tacit to be considered for the purposes of this research is visual tacit. In tracing the history of the senses as knowledge, Maslen observes that: "Early conceptualizations of the senses as knowledge … have tended to focus on the primacy of vision" (2015, p. 54). Visual tacit knowledge is evidenced by the concept of the 'trained eye', particularly in terms of its use in craft occupations.

In Gamble's 2004 study of cabinetmakers, she describes how the master craftsman[5] could just look at a piece of work and know whether it was wrong or right. Similarly Cook (1982), in his study of flute makers, describes how the master craftsman could look at a flute and make a judgement about whether it is of the correct standard for the company. He also discusses how the company introduced objective measurements for certain flute components but still deferred to the judgement of the master flute maker on whether the final flute 'looked right'.

In a different context, Johnson et al. (2019) describe a case study of the use of visual inspection in the manufacturing of aerospace components as an example of tacit knowledge. Visual inspection in manufacturing can refer either to the inspection of machines as part of maintenance or, as in this instance, the inspection of finished products. Johnson et al. (2019) argue that "tacit skills are particularly needed when visual inspection standards lack specification or the task requires greater subjective interpretation" (Johnson *et al.*, 2019, p. 1). This implies that the visual tacit knowledge of workers is need for making judgements on the quality of products, similar to Cook's (1982) description of how the trained eye of master craftsman in deciding whether a flute meets the company standards.

Thus, visual tacit can be conceptualised as the ability of an experienced worker or craftsman to draw on their tacit knowledge of what 'right' looks like to make a judgement about whether a product is correct. The development of a 'trained eye' ties in directly to the development of the ability to make judgements based on the worker's tacit knowledge.

Conclusion

Through this chapter, an attempt has been made to construct a foundation for the conceptual framework of this research. Drawing on a social realist perspective that allows for differentiation between everyday, experiential knowledge and more formal, codified forms of knowledge (Cooper and Harris, 2013), this research aims to analyse the knowledge surfaced in the RPL programme and, thereby, attempt to develop a clearer understanding of knowledge forms in the workplace.

The chapter discusses some of the theoretical traditions that are most prevalent in the research literature on RPL as well as VET. By considering each of these traditions and their corresponding theory of knowledge, a case was made for the use of a social realist perspective on knowledge. This allowed, through the work of Gamble (2006, 2009, 2016b) particularly, the development of a conceptual framework for vocational knowledge that supports the categorisation of the different forms of

[5] The use of the terms 'master' and 'craftsman' by both Gamble and Cook is not meant to imply gender and is solely used as a historical term (see Gamble, 2006, footnote 6).

knowledge that may be surfaced through an RPL programme. This framework was then extended through the inclusion of perspectives from the philosophy of education drawing on the work of Winch (2012) and Ryle (1963) to further conceptualise forms of knowledge through the concepts of 'knowing that' and knowing how'. The conceptual framework is further enhanced with specific constructs for the inclusion of craft knowledge and tacit knowledge by drawing out the visualisation principle from craft knowledge and the concept of sensory tacit knowledge, respectively.

However, Gamble's broad classifications and the conceptions of craft and tacit knowledge discussed above can only begin to unpack the questions around types of occupational knowledge. To extend the conceptualisation of workplace knowledge, the next chapter delves further into conceptualisations of skill and expertise.

CHAPTER 3: CONCEPTUALISING SKILL AND EXPERTISE

Introduction

This chapter focuses on the concepts of skill and expertise. It uses the work of Winch (2012) as a starting point to consider the concept of skill and how it may be defined, before considering some of the other theoretical literature on what constitutes skill. This section is followed by a discussion on the notion of expertise, drawing again on Winch (2012) but also extending to a broader conceptualisation of skill using the work of Guile and Unwin (2019), in an attempt to develop an understanding of what constitutes expertise in the vocational context. The final section of this chapter explores the idea of professional judgement as it arises from the prior discussions on expertise and skill. It examines the development of professional judgement as well as the involvement of tacit knowledge, as discussed in the previous chapter, in this process.

Winch's 'Dimensions of Expertise'

This section builds on the previous chapter, in particular on the concepts of knowing how and knowing that as elaborated on in the section on the philosophy of education. The basis for Winch's conception of skill is addressed in the previous chapter as part of his theory of knowledge, but I will return to some of the key points in order to attempt to define the concept of skill. However, as Maree states, "there is no simple or unique understanding and use of the concept 'skill' in established literature" (2007, p. 587). The definition of skill is complex and varied, depending on the discipline from which it is being promulgated.

As a starting point, it is worth taking note of the critique by Corbell regarding the way in which 'knowledge and skills' have been reduced to a single term with a resulting loss of meaning for knowledge as it becomes conflated with skills (Corbell, 2014). Gamble also highlights the "tensions between an emphasis on 'skill' or 'practice' and an emphasis on knowledge" (Gamble, 2014, p. 180) in the vocational sector. Although the starting definition of skill using Winch (2012) is based on it being a component of knowing how, he also argues that skill is not an adequate concept to provide a framework for thinking about knowing how. Drawing on Ryle (1963), Addis and Winch point out the "difficulties of characterising all know-how, and by implication professional expertise, in terms of skills" (2017, p. 557). Knowing how, therefore, is not just about skill but also includes knowledge.

Returning to the discussion in the previous chapter on 'knowing that' and 'knowing how', Winch (2012) considers skill as part of knowing how and defines it as the ability of an individual to do

something in normal circumstances. However, the ability to do something is generally tied to the notion of normative appraisal in terms of how well or badly an individual performs the activity (Winch, 2012). Winch also makes a further distinction between skill and technique, the latter focusing on a particular way of carrying out a particular task as opposed to the more general ability of the former (Winch, 2012), although both involve normative appraisal. Returning to Winch's conceptualisation of skill: while the exercise of skill involves technique and normative appraisal, there are further elements that should be included in its conceptualisation, such as "perceptual ability, certain moral qualities, habits and propositional knowledge" (Winch, 2012, p. 44).

The 'moral dimension' of skill

No discussion of skill can be complete without alluding to the dispositions or values present. McGrath makes the argument that "skill is a notion that has only limited meaning without reference to knowledge, values and attitudes" (2004, p. 2). Linked to the normative appraisal of a skill and the exercise of judgement is the need to examine the role of disposition and values in 'knowing how'. The role of judgement and moral values in 'knowing how' adds a further dimension to the understanding of expertise and what it might take for someone to demonstrate their knowledge and skill. Although the exercise of judgement can be related to the exercise of skill in terms of an individual's ability to make judgements about how well or poorly they perform a skill, it also relates to the individual's decision-making about which skill to implement in a particular situation. It is therefore also closely related to the concept of expertise, an aspect that will be discussed in more detail later in this chapter.

Perkins, Jay, and Tishman provide a basic yet useful understanding of dispositions, explaining that

> Dispositions are behavioral tendencies: the tendency to cheat or play straight, the tendency to be bold or cautious, the tendency to give thinking time, to consider broader perspectives, to seek evidence vigorously, and so on. (1993, p. 2)

They also argue against a binary view that places skill and dispositions in opposition to each other. This bears similarities to Winch's (2012) conceptualisation of linking skill with dispositions and values rather than considering them as a separate dimension of expertise, although Perkins, Jay and Tishman approach dispositions from a cognitive psychology perspective and have a different overall conception of skill.

Fuller and Unwin (2011) refer to the historical development of apprenticeships and describe how curricula for apprentices extended beyond just the skills required to include a strong moral component. Billett, drawing on Perkins, Jay, and Tishman (1993), argues that vocational knowledge includes dispositional characteristics and that these dispositions can be viewed as

> …individuals' tendencies to put their capabilities into action. For example, they determine how individuals conceptualise tasks and the values they place on the deployment of procedures as well as whether they engage in effortful activity or not. (Billett, 1999, p. 155)

Thus the role of judgement and moral values in 'knowing how' adds a further dimension to the understanding of expertise and what it might take for someone to demonstrate their knowledge and skill. In the discussion of expertise later in this chapter, Guide and Unwin (2019) refer to particular values that are included in the features of expertise that they identify, suggesting that they are integral to what constitutes expertise as well.

Further defining skill

Returning to Winch's (2012) argument that the exercise of skill includes propositional knowledge, it is important to take into account how knowledge does form part of skill. This also aligns to Ryle's (1963) argument that 'knowledge that' and 'knowledge how' are distinct but also interrelated. The notion that forms of knowledge are enmeshed is also argued by Young (2006), referring to Durkheim's sacred and profane knowledge. Gamble also argues that skill is the "ability to apply knowledge and use know-how to complete tasks and solve problems" and that it is not possible to "talk about skill without reference to the knowledge base on which skilled performance draws" (Gamble, 2016b, p. 6). Thus, although skill is conceptualised as the ability to do something, either well or badly, incorporating the development of techniques, the use of judgement, and the application of certain moral values, it remains tied to certain forms of both procedural and propositional knowledge.

Eraut, focusing specifically on the workplace, suggests that the term skill can be used on two levels. The first relates to "actions believed to be based on procedural memory alone" (2004, p. 264) with the possible addition of some contextual understanding for judgement purposes. He refers to this as 'Task Performance', but the description suggests that it is likely to be consistent with the exercise of skill and technique based on some form of tacit knowledge. Coetzee provides a useful conceptualisation of this level of skill, stating that

> Developing expertise in any occupation requires an act of integration, where the practitioner comes to understand the pattern making up the whole, and as tacit knowing is developed a skill will come to feel as though it were something habitual or routinised; while at the same time developing a basis for discretionary judgement that comes into play when unpredictable events or consequences come into play. (2011, p. 64)

This skill level can therefore be conceptualised as resting strongly on a procedural knowledge base that, in some instances, may include tacit knowledge and tactile tacit knowledge as these skills and techniques become infused into the body's muscle memory.

The second level of skill “relates to processes, which are constructed from a mixture of procedural knowledge and other forms of knowledge” (Eraut, 2004, p. 264). Cook and Brown argue for a conceptualisation of “knowing that is action” and that “there is more epistemic work being done in what we know how to do than can be accounted for solely in terms of the knowledge we possess” (Cook and Brown, 1999, p. 382). They use the following example of knowing as action:

> "Robert is fixing cars" points not only to knowledge he possesses but also to things he is doing. To give an account of what Robert knows, we claim, calls for an understanding of the epistemic work done, which needs to include both the knowledge he possesses and the actions he carries out. (Cook and Brown, 1999, p. 382)

This type of skill may require a broader knowledge base that draws on both knowing that, or principled knowledge, and knowing how, or procedural knowledge.

In developing a conceptual framework for understanding the interplay between ‘knowing how’ and ‘knowing that’ as possible knowledge bases for skill, I found it useful to think of them on a continuum between two poles. Cook and Brown argue that knowledge is possessed, but knowing is part of action where “knowing is to interact with and honor the world using knowledge as a tool” (Cook and Brown, 1999, p. 382). Thus the one pole of the continuum represents ‘knowing that’, which is based solely on theoretical or principled knowledge and is not likely to be useful as a knowledge base for skill on its own, while the side of ‘knowing how’, or procedural knowledge, relates most closely to the exercise of skill and technique in its most routinised form. As a continuum, there is also a point where ‘knowing that’ and ‘knowing how’ move towards each other and, to some extent, overlap each other. This is the point at which the forms of knowledge become enmeshed in one another, and it is more difficult to differentiate between knowledge types.

For the purposes of this research, it was useful for me to draw on a broad conceptualisation of skill that encompasses an understanding of its knowledge bases as well as what is entailed in the exercise of skill — namely, the relationship between skill and technique, the role of normative appraisal, and the inclusion of certain dispositions and values. Skill, however, also has a role to play in the conceptualisation of expertise and professional judgement which will be discussed in the rest of this chapter.

Expertise

While skill is a useful concept for understanding the activities in the workplace, it has been argued that there is a need to move towards “an expertise-based approach to VET as opposed to a skills-based approach” (Guile and Unwin, 2019, p. 24). Guile and Unwin suggest that “the concept of

expertise embodies both the practical and theoretical components involved in the performance of work of all kinds" (2019, p. 29). This conceptualisation of expertise drawing on both knowledge and practice was a useful starting point from which I was able to explore the concept of expertise for a vocational context.

Winch (2012) proposes that there are three ways of understanding expertise; the first is the academic conception of expertise as a growing familiarity with, and grasp of, a subject. This definition is drawn upon in the design of national qualifications frameworks, where growth is linked to the increasing use of systematic knowledge. The second conception of expertise relates to the traditional craft form of expertise where there is no formal qualifications or hierarchy of expertise but rather some form of apprenticeship and an acknowledgement of those who are more skilled.

The third conception of expertise is related to the scope of the activity, which is seen not just as a collection of tasks but also includes sequencing and integration of tasks, together with the coordination of a given occupation with other related occupations. This third conception relies on the concept of vertical competence, which is a product of "the impact of systematic knowledge on know-how and involvement of formal education institutions in accreditation of suitability for occupations and jobs" (Winch, 2012, p. 162). Vertical competence describes occupational progression through the attainment of systematic knowledge as well as career progression by moving up through the occupational hierarchy.

These three ways of understanding expertise allow for clear distinctions to be made between various types of expertise, as Winch differentiates between 'subject experts' and expertise related to a practical activity, "which involves mastery of an occupation, profession or activity" (Winch, 2012, p. 1). The first relates to "declarative or propositional knowledge" and the second to "practical knowledge, ability or skill" (Winch, 2012, p. 1). Winch argues that there is a close relationship between these two types of knowledge and that they must be understood in terms of the relationship between them. This draws on Ryle's (1963) argument that 'knowledge that' and 'knowledge how' are, at the same time, differentiated yet also interrelated. Similarly, Hordern (2019) suggests that expertise relies on the capability to infer and understand the relationship between propositional knowledge and its disciplinary knowledge bases. However, "understanding what is meant by vocational knowledge is imperative to understanding the development of expertise" (Broad and Lahiff, 2019, p. 436).

This notion of the 'interrelatedness' of knowledge types has already been discussed to some extent in the previous section about the knowledge bases that underpin the exercise of skill. However, within the conceptualisation of expertise, this interrelatedness extends beyond just the interplay of

knowledge types in the exercise of skill. It also refers to the interrelatedness of subject matter expertise and practical expertise, as it relates to an occupation or vocational context. Eraut, drawing on Schmidt and Boshuizen (1993), argues that

> the research literature on expertise consistently finds that *the distinguishing feature of experts is not how much they know but their ability to use their knowledge*, because that knowledge has been implicitly organized as a result of considerable experience for rapid, efficient and effective use. (Eraut, 2004, p. 254, reference removed, italics added)

The conceptualisation of expertise as related to the ability to use knowledge in practice, as described above, is found in various disciplines that examine expertise.

In considering expertise, disciplines such as cognitive psychology, education, and management and organisation studies all have their own conceptualisations of how expertise is developed (see, for example, Kuhn, 1962/1970; Schmidt and Boshuizen, 1993; Ericsson and Lehmann, 1996; Dreyfus and Dreyfus, 2005; Senge, 2006; Cianciolo et al., 2012; and Ribeiro, 2013). For the purposes of this research, however, I chose to focus on conceptualising expertise in the workplace and for occupations. Hordern, drawing on Dreyfus and Dreyfus (2005) suggests that

> It has been argued that practitioners develop the most important aspects of their expertise in workplace contexts and that fluent practice does not rely much on declarative knowledge, including in quite complex specialized expert practices. (2019, p. 1123)

The importance of the workplace and vocational practice particularly, in the development of expertise is argued from various theoretical perspectives. Drawing on a situated learning perspective and the work of Scribner (1985, 1997), Tennant proposes that "expertise is built upon the knowledge and skill gained through sustained practice and experience" (Tennant, 1999, p. 171). Billett (1999, 2006) and Eraut (2004) also argue for the importance of recognising the workplace as a site of learning and, therefore, the development of expertise.

The role of the workplace in developing expertise is, therefore, considered essential. However, as Guile and Unwin (2019) argue, the focus of much of the work done on expertise is decontextualised. It is focused on the development of expertise in an individual person, or personal expertise as it is referred to by Broad and Lahiff (2019), without reference to the context of development, including the context of work. Both Broad and Lahiff (2019) and Guile and Unwin (2019) suggest that the decontextualised approach is addressed through the situated learning approach of Lave and Wenger (1991) and their concept of 'legitimate peripheral participation', as well as in the work on the sociomaterial approach to learning. Guile and Unwin drawing on these approaches suggest the following features of expertise, which are that expertise may be

1) *Individual:* Concept of specialized knowledge and capability, judgment, ability to work unsupervised.
2) *Collective*: Residing in teams, relational, co-produced, distributed.
3) *Cross-occupational:* Connected to the above, but emerging as an independent category from new forms of work practice, production, and work organization and assisted by technologies as boundary-crossing tools (e.g., computers and 3D printing).
4) *Sociomaterial*: Emerging from the temporal interaction of social and material phenomena.
5) *Practice-based*: Involving individual and collective honing of skills. It does not necessarily mean there is an achievable point, although expert status may be awarded.
6) *Definable and measurable*: Through formalized mechanisms such as qualifications and professional registration, or through customer endorsement.

(2019, pp. 29–30, italics in original)

These features of expertise provide a useful conceptualisation of the broader picture of expertise beyond just the expertise in the individual, as it is construed by theorists such as Dreyfus and Dreyfus (2005). In their five-stage model of skill acquisition which positions the expert as being at the pinnacle of achievement, and a step above a 'proficient performer', they add:

> The proficient performer, immersed in the world of his or her skillful activity, sees what needs to be done but decides how to do it [by exercising their professional judgement]. The expert not only sees what needs to be achieved; thanks to his or her vast repertoire of situational discriminations, he or she also sees immediately how to achieve this goal [using their knowledge of the skills and procedures required to make a decision on how to proceed]. Thus, the ability to make more subtle and refined discriminations is what distinguishes the expert from the proficient performer. Among many situations, all seen as similar with respect to plan or perspective, the expert has learned to distinguish those situations requiring one reaction from those demanding another. That is, with enough experience in a variety of situations, all seen from the same perspective but requiring different tactical decisions, the brain of the expert gradually decomposes this class of situations into subclasses, each of which requires a specific response. This allows the immediate intuitive situational response that is characteristic of expertise. (Dreyfus, 2004, pp. 179–180)

Broad and Lahiff (2019), in their work on the development of expertise in vocational teachers, describe the development of both personal expertise and the collective feature of expertise. They also point to the tacit element in the vocational knowledge that the teachers require to teach vocational curricula and draw on Collins's (2007) conceptualisation of 'collective tacit' to suggest that even the tacit elements of expertise can have a collective element. For Collins (2007), collective tacit refers not just to tacit knowledge that is held collectively but also to the way in which certain social norms are transferred tacitly between members of a social group.

The tacit element of expertise forms part of other features of expertise as well. Referring to the sociomaterial feature of expertise:

> There may be an implicit understanding of the sociomaterial dimension in specific fields of VET that involve high levels of sensory competence, such as carpentry, catering, handcrafted ceramics, or glassblowing. (Guile and Unwin, 2019, p. 30)

This connection between expertise and the concept of sensory tacit knowledge, as discussed in the previous chapter, suggests that the development of expertise occurs in contexts where there is exposure to the sociomaterial elements of the occupation, as in the workplace. Coetzee (2011) identifies the notion of 'procedural expertise' that is developed through routinised actions and is related to the specific procedures that must be followed in an occupation which also suggests a tacit element to the way in which skill is exercised as part of expertise. Thus it is also tied to expertise in the form of vocational practice.

Fuller and Unwin propose that "there is a set of skills and related vocational knowledge that combine in the form of vocational practice to enable the individual to perform at a specific level in the workplace" and that it is an environment, such as a workplace, that provides the opportunity to develop both the vocational practice and collective features of expertise, "through practice with others, including the development of tacit knowledge and skill" (Fuller and Unwin, 2011, p. 37). Fuller and Unwin's explanation points to the interrelatedness of some of the features of expertise, particularly the individual, collective, and practice features (Broad and Lahiff, 2019), as well as the interrelatedness of expertise, skill, and tacit knowledge. In considering the interrelatedness of these concepts, the development of practice-based expertise, as per Guile and Unwin (2019), is directly premised on the development of skill. The interrelatedness of the development of expertise is also argued by Coetzee:

> Developing expertise in any occupation requires an act of integration, where the practitioner comes to understand the pattern making up the whole, and as tacit knowing is developed a skill will come to feel as though it were something habitual or routinised; while at the same time developing a basis for discretionary judgement that comes into play when unpredictable events or consequences come into play. (Coetzee, 2011, p. 64)

While the use of this expertise in making judgements will be unpacked further in the next section, Coetzee further strengthens the argument for occupational expertise as an integrated concept. The ability of an expert to apply judgement amid new or unpredictable scenarios also ties to the cross-occupational feature of expertise as it suggests the ability of an expert to apply their expertise in broader contexts.

In considering the cross-occupational feature of expertise, the ability of experts to apply their expertise outside of the original context in which it develops points to an extended knowledge base, particularly of principled knowledge, that the expert draws on. Tennant argues that the transferability

of knowledge between contexts suggests "that expertise is built on a number of generic capacities that can be utilised in different contexts: such as problem formation, self-monitoring skills, higher-order principled thinking, and flexibility and adaptability to the environment in problem-solving" (Tennant, 1999, p. 171). Fuller and Unwin argue that an apprenticeship should include these types of knowledge and expertise that enable them to develop this broader cross-occupational feature of expertise that allows them to move beyond their current context. Interestingly, Buchanan et al. (2020) have conducted research on how this cross-occupational feature is evident in the way people use their expertise in one occupation and relate this to other new occupations that are arising because of changes to the workplace and labour market mobility.

The last feature of expertise, according to Guile and Unwin (2019), is that it is definable and measurable. This is in contrast, to some extent, to the previous discussions regarding the tacit element of expertise that is found in the other features. However, according to Gamble, there is an "increasing use of the term 'expertise' to signify the aims and outcomes of professional and technical curricula that prepare for work" (Gamble, 2018, p. 252). While the focus of this research was directly on conceptualising expertise as it arises from the workplace, the case study on which this research was based directly related to recognition of prior learning for a formal vocational qualification and, thus, this notion of expertise cannot be ignored.

The idea of vocational curricula as a way of developing expertise is demonstrated in the way in which theorists such as Dreyfus and Dreyfus (2005) conceptualise the process of moving from 'novice' to 'expert' (Dreyfus, 2004). Billett (2006), although focused on the workplace as a site of learning, also argues for a formalisation of a workplace curriculum as part of vocational curricula. He refers to studies such as the one by Ericsson and Lehmann (1996) which examine expertise from a cognitive perspective and suggests that they were also about vocational practices. However, despite these studies, "this seems not to have translated into a wider acceptance of complexity of the purposes of vocational education, including the need to respond to the changing requirements of vocational practice and to adapt to variations in work practices within the same occupation" (Billett, 2003, p. 7).

This section has attempted to conceptualise expertise starting with Winch's (2012) arguments for the interrelatedness of knowledge types in expertise and extended this to consider the interrelatedness of knowledge and vocational practice in expertise through the application of knowledge to practice. It then draws on Guile and Unwin's (2019) features of expertise to unpack the various components that comprise expertise and consider individual features that contribute to a broader conceptualising of expertise.

The interrelatedness of these features of expertise, together with the interrelatedness of knowledge types and vocational practice, makes the argument for occupational expertise as an integrated concept that brings together a range of other concepts into a broader whole. It positions what I would propose calling an 'occupational expert' as an individual with their own personal vocational knowledge (including elements of principled, procedural, craft, and tacit knowledge), skills and dispositions, but who employs these in a vocational practice context as part of a broader collective environment.

The concept of judgement

The concept of judgement, or what Winch (2020) refers to as 'professional judgement', has been referred to previously in this chapter, particularly in the section on expertise. While it forms part of the conceptualisations of skill and expertise, it also stands alone as a concept with a distinct theoretical connotation. I have used the exercise of judgement as an indicator for the presence of occupational expertise, hence I have included the section that follows to clearly conceptualise what judgement looks like in the context of an occupation.

Cook, writing in 1982, identified three main fields of literature that write about judgement, namely philosophy, psychology, and management, although he suggests that most of the literature at the point when he was writing came from the field of philosophy, and this is therefore the field that he draws on. He points to the writings of Dewey as the first philosopher to make the argument that judgement can be learned and taught, an argument with which Cook agrees. This section will, however, focus more on conceptualising judgement as it is understood in the context of a work environment, a context that Winch (2020) argues is where most professional judgements are made. Similarly, Cook (1982) suggests that, although the extent may vary, "Judgement has a place in every occupation" (Cook, 1982, p. 20).

In trying to understand what constitutes professional judgement, Winch argues that

> …there is no simple answer to this question since the circumstances and nature of professional judgement are so varied. We need to go case by case, but it is best to start with a 'paradigm case' to set out the issues.
>
> In the paradigm case, an agent has to bring about a result. For example, a plumber has to instal a new plumbing system in a house. He is confronted with more than one possibility for doing so in a satisfactory manner. In this case, we assume that he considers the possible courses, weighs the advantages and disadvantages of each, chooses which is the best course of action and decides to implement that course of action. We consider the considering and the weighing to be mental acts of reasoning and the choosing and the deciding to be acts of judgement. (Winch, 2020, p. 2).

Winch's paradigm case provides a useful way of considering how judgement can be conceptualised in an occupational context. He further observes that making judgements in the workplace requires situational knowledge of the work environment or process as well as the application of more theoretical, principled knowledge (Winch, 2020). Winch does, however, also point out that the practical knowledge and *Kenntnis* involved in the use of judgement is likely to be tacit knowledge and therefore not easily described or explained (Winch, 2012).

Coetzee similarly argues that procedural expertise, where skills based on procedural knowledge have become so habituated or routinised that their use allows for 'discretionary judgement' based on implicit criteria, requires "the ability to make an immediate, reflexive decision" (2011, p. 64). This combination of skill and judgement appears to align to the concept of *Phronesis*, or practical wisdom, and "involves doing the right thing in the right way at the right time in the moral sense of right" (Winch, 2012, p. 60). The introduction of disposition and values into the exercise of judgement relates again to the concept of occupational expertise, as it could be argued that an expert would be expected to draw on their moral values as part of the decision-making process.

As argued above, while judgement relies on the application of both procedural and principled knowledge to a scenario, at least some of this may be in the form of tacit knowledge. Drawing on Polanyi's concept of tacit knowledge, Cook argues that

> Making judgments entails implicit factors: things we know but cannot say. Part of what we need to know in order to make a judgment is knowledge which we cannot make explicit. That is judgment relies on tacit knowledge. (1982, p. 138)

Similar to the description of the tacit knowledge involved in riding a bicycle, Cook (1982) argues that there is an element of tacit knowledge involved in making a judgement, working in combination with other types of knowledge. He draws on Ryle's (1963) distinction between 'knowing how' and 'knowing that', suggesting that judgement rests on this distinction. He returns to the description of riding a bicycle, suggesting that 'knowing that' is the explicit component of what to do to ride a bicycle, while 'knowing how' is the implicit way in which the rider does so. However, certain elements of the judgement may be made explicit while making the judgement, such as what particular concept may lead to making the judgement — for example an auto mechanic who is able to explain that the engine sounds wrong because it does not sound like what a properly running engine sounds like (Cook, 1982).

As suggested in the example above, the ability for an individual to articulate why they have made a particular judgement relying on tacit knowledge may be very limited. Winch (2020) argues that an individual should be able to articulate how they reached a particular judgement, although he does acknowledge that it may not be fully articulable. However, returning to the concept that tacit

knowledge is by its very nature not able to be languaged, it does suggest that a worker relying on tacit knowledge will be unable to explain the process by which the judgement was made. Indeed, Cook proposes that it is not reasonable to expect someone to be able to fully explain the reason for their judgement (1982). Gamble refers to the work of Bloch (1998) who argues that "when people are asked to explain their actions they reinvent a hypothetical, quasi-linguistic, linear, rational thought process that appears to lead satisfactorily to the conclusions reached but it is in fact a *post hoc* rationalisation" (Bloch, 1998 in Gamble, 2006, p. 96).

Therefore, the process of making a judgement entails an individual drawing on a range of sources and combining them, without being able to fully identify individual components that contribute to the 'whole' of the judgement. Polanyi (1969, pp. 139–141) proposes that judgements are made through "the integration of clues to perceptions" where clues can be either subliminal (ones that we cannot be aware of such as involuntary body functions) or marginal (ones that are possible to observe but are not the focus of what is being observed). He refers to the awareness of the main object as 'focal awareness' while the clues are only present in a secondary 'subsidiary awareness' and argues that the integration of the clues, or parts that we are subsidiarily aware of, into the perception of the focal object is 'tacit knowing'. It is this tacit knowing of the elements that comprises subsidiary awareness that enable a judgement to be made on the focal awareness. However, as Frankham (2006) argues in her critique of 'learning networks', drawing on Polanyi (1969),

> What we cannot do… (even in relation to 'skills') is to break down the apparent component parts of knowledge and understanding and present them as a series of steps to be followed to completion and predetermined outcomes. He describes the importance of many clues being used simultaneously (and unconsciously) in order to make judgements about what we see. In breaking things down into apparently bounded, independent component parts, with a clear 'route map' on how they fit together, these parts ironically lose their meaning. (2006, p. 668)

In a similar way, according to Cook (1982), judgement should not be reduced to parts which are considered 'more real' than the judgement 'whole'. He argues that judgement cannot be reduced to some form of unconscious decision-making process. However, judgements should not be considered more or less superior than objective evaluations such as measuring.

Returning to the deskilling debate, the argument around increased deskilling as a result of increased automation in workplaces is that there is a need to reduce the amount of uncertainty in the workplace by increasing the level of automation and digitalisation. This perspective suggests that "explicit techniques and objective measures" are viewed as "superior to human judgment" and that judgement should be viewed only as a "last resort" (Cook, 1982, p. 37). In conceptualising the work environment

as a place where judgement may be exercised, it is useful to start by identifying the type of environment that enables the use of judgement. As Gamble observes

> …the greater the need for certainty of end-result, the greater the emphasis on standardised work performance through common work procedures. The greater the emphasis on innovation and design, the greater the need to work out new connections between parts, not by trial and error but through principled reasoning. Here, risk is inevitable, as the answers are not known beforehand. (2016b, p. 18)

This suggests that work of risk, and therefore work environments that require complex problem-solving, are more likely to show evidence of judgement. However, Cook (1982) argues that even in the most automated environment, the human element cannot be removed because there will always be a need for some measure of control over the machines which will still require judgement in some form. He also argues that judgement has an ethical dimension that should not be removed by using technology.

In considering the role of judgement in the workplace, particularly in manufacturing, Cook also observes that the systems of work being implemented in manufacturing industries during his time of writing (1982) emphasise the line workers' decision-making and that there is a recognition of the workers' expertise due to their proximity to the work. Similarly, Winch argues that the circumstances of the workplace

> …entail that agents have to make and act on decisions that cannot be easily rectified, have serious negative consequences if they are incorrect, involve the vital interests of clients, colleagues and enterprises and are made under significant constraints. These include resources, multiple demands, time, expense, safety, weather, the needs of colleagues and clients and the vagaries of materials and equipment, to name the more salient. (2020, p. 7)

Thus risk extends beyond just the direct monetary implications of a judgement and includes consideration of a variety of factors that could influence the outcome of a particular course of action — this is similar in some measure to Pye's (1968) definition of work of risk where the result of the work is not easily predetermined. Coetzee (2011) discusses the use of what she calls 'discretionary judgement' by trainee drivers and points to the need for its application during work of risk (Coetzee, 2011). She defines discretionary judgement as "the ability to make rapid decisions in real time" based on "implicit criteria [that] have a tacit knowledge base acquired through experience" (2011, p. 63). It is important to note that decision-making is considered part of the exercise of judgement, but that exercising judgement cannot be equated to only making decisions or, indeed, solving problems (Coetzee, 2011; Winch, 2020).

Cook (1982) considers judgements made in work contexts to be directly influenced by the worker's understanding of their particular context and 'made by people' rather than through 'cognitive

processes'. He further distinguishes it even from decision-making and treats it as a concept on its own. In Cook's thinking, judgement is the way people understand their context and is not solely based on how they acquire information from the context. He argues that

> I wish to view the making of judgments as an activity of human beings — whole human beings. I see this as an important and valid perspective because I believe that it is as whole human beings that people can and ought to make judgments, and because it is as whole human beings that people can be affected by the judgments of others. (Cook, 1982, p. 24)

When making a judgement, Cook suggests that it is not individual parts of the whole that people recognise but rather that a judgement is made on the overall image and that it is not always possible for someone to even explain why they have made that judgement. Again, he refers to the auto mechanic who can hear the car and make a judgement there is a problem with it but would still need to investigate to determine what the problem actually is.

It is interesting to note that, in Cook's example of the auto mechanic, the mechanic refers to the way in which they listen to the car's noises in order to determine a fault and can hear when something is wrong (Cook, 1982, p. 22). What Cook suggests, however, is that "when the auto mechanic… tunes an engine by sound, he does it not on the basis of information in the sound but on his understanding of the sound" (Cook, 1982, p. 35). This suggests that there is a role for the use of sensory tacit knowledge in the exercise of judgement, which relates to the previous discussion on sensory tacit knowledge that drew on Maslen's (2015) conception of the senses as a source of knowledge.

Research into the exercise of judgement occurs in several different work environments including both crafts such as flute-making (Cook, 1982) and manufacturing environments (Johnson *et al.*, 2019). Within this, there are several examples that suggest that sensory tacit knowledge is involved in making judgements. Cook (1982) conducted a study of a craft workshop that focused on flute-making, looking specifically at the use professional judgement in the workplace. In explaining professional judgement, he refers to the need for the object that they are working on to 'look right and feel right'. Drawing on interview examples from several different contexts, including an interior designer, physician, auto mechanic, and woodworker, Cook also suggests that "Typically, what goes into such judgments is not spelled out, but often much of what people do in their work depends on their ability to make them" (Cook, 1982, p. 18).

Studying a manufacturing environment, Johnson et al. draw on a psychological definition of tacit knowledge by Reber (1989) to conceptualise visual inspection as a form of tacit knowledge that involves "an intrinsic understanding of how things work and are organised which enables humans to intuitively produce strategies and solutions in new circumstances" (2019, p. 1). This provides a further

example of the use of sensory tacit knowledge in the exercise of judgement, in this case visual tacit knowledge.

The ability to exercise judgement, therefore, relies on the proximity of the individual to the workplace context in order for them to develop the knowledge, particularly the tacit knowledge, required for the individual 'clues' that they must combine to make the whole that is judgement. Hordern (2014) suggests that there is a process of recontextualisation whereby procedural and principled vocational knowledge are recontextualised for vocational practice. This process combined with the tacit knowledge of vocational practice provides the grounds for problem-solving and decision-making and, thereby, the exercise of judgement. This is in some respects similar to the development of expertise, and it is likely that that these two concepts may develop in tandem. Also similar to the cross-occupational feature of expertise, Cook suggests that once someone is able to make judgements about a specific thing, they can then begin to develop further and will eventually be able to apply that judgement to other contexts when they encounter the same issue. However, he also argues that there is not necessarily a set of rules that they use to make such a judgement, and judgements can evolve over time (Cook, 1982).

Thus, as argued above, judgement has a vital role to play in the development of expertise and Cook (1982) argues that the importance of judgement should not be underestimated. While objective measurements and analytical decision-making tools can provide useful insights, he argues that they are not equivalent to judgement, and that both the former and the latter have a place. Analytical tools may be able to assist in making better decisions, but Cook argues that judgement is still essential because of its reliance on the tacit knowledge of the individual drawn from their understanding of the work context.

Conclusion

This chapter has attempted to develop a broader framework for analysing the complexity of work by exploring conceptualisations of skill, expertise, and judgement. These concepts provided me with different lenses through which to view the knowledge surfaced in the RPL programme that this case study is based on, as well as extending my understanding of how tacit knowledge can be surfaced and identified.

The concept of expertise, drawing on Guile and Unwin's (2019) features of expertise, allows for a much richer explanation of what is occurring in the workplace than by relying solely on a conceptual framework that differentiates between forms of knowledge. It draws on the concepts of vocational

knowledge, skill, dispositions and values, and judgement in a way that suggests a more holistic conception of an 'occupational expert'. When combined with the conceptualisation of judgement as requiring an integration of principled, procedural, and tacit knowledge together with the skills drawn from vocational practice as well as ethical considerations, this holistic conception points to what could constitute an expert capable of making judgements related to complex problem-solving in environments that rely on work of risk. As Winch argues:

> The designation of expertise should apply to those who operate in progressively more demanding, complex and unpredictable situations that are to a certain extent not typical of the environments in which relative novices are expected to operate. (Winch, 2020, p. 14)

I draw upon this conceptualisation of what I have termed an occupational expert – someone who is able to operate in complex work contexts, drawing on a broad range of knowledge, skills and moral values – to provide a language of description to analyse the data that is presented in Chapters 5 and 6. Chapter 4 that follows discusses how this conceptual framework was adapted into a language of description for the analysis of the data.

CHAPTER 4: METHODOLOGY

Introduction

The purpose of this research was to identify the types of knowledge surfaced through an RPL programme conducted in an automated production environment in order to explore the nature of this workplace knowledge and further develop a conceptual language for describing and analysing the knowledge present. In doing so, the study asked the question:

What forms of workplace knowledge used in an automated production process can an RPL programme surface, and how might such knowledge be categorised and conceptualised?

To answer this question, sub-questions were posed, namely:

1. What kinds of workplace knowledge used in an automated production environment can be surfaced through an RPL Programme?
2. How are such forms of knowledge surfaced, i.e. which tools in the RPL Programme are able to surface what forms of knowledge?
3. What languages of description can conceptualise such workplace and occupational knowledge?

This qualitative research project was based on a case study approach drawing on Participatory Action Research and Educational Design Research Methodology. It drew on an RPL programme conducted for machine operators on a high-speed beverage packaging line and focused on the knowledge surfaced by the tools used to assess the candidate during the RPL programme.

A note on the use of terminology

Ralphs (2016) raises the question of what participants in RPL programmes should be called and suggests that the terms 'candidate' and 'assessor' imply that RPL is solely an assessment process and obscure the pedagogy of RPL. However, for the purposes of this research, the terms candidate and assessor were used as those were the terms used by the training provider.

It must be noted that the term 'candidate' was deliberately chosen by the training provider instead of the term 'learner' to distinguish the RPL programme from the 'learnership' that is run for the same qualification. The term 'candidate' is also the term used by SAQA to refer to someone participating in an RPL programme. They use the term 'RPL Practitioner' to refer to the individual overseeing any part of an RPL programme, which they define as "a person that functions in one or more aspects of RPL provision, including policy development, advising, portfolio course design and facilitation, assessment,

moderation, administration, monitoring and evaluation, research and development" (SAQA, 2019, p. 6).

The use of the term 'occupational' in relation to the occupational sector and occupational qualifications referred to in this research is considered the same as the term 'vocational' in the South African context and the two are used interchangeably. In reference to vocational educational education and training more broadly in South Africa, I use the term 'occupational' as this is the term used by the sector, and Technical and Vocational Education and Training (TVET) in the South African context is used specifically to refer to the public TVET colleges.

The use of racial classifications in the descriptions of the RPL candidates is used with care but was considered important as it provides insights that are specific to the South African context and history. RPL as a tool for transformation and redress is understood within the history of discrimination and lack of access to educational opportunities experienced by those termed as 'black' under the previous apartheid government. I have drawn on the definitions provided by Ralphs in the book *RPL as Specialised Pedagogy*, where:

> 'black' is used in a generic sense for all South Africans historically disenfranchised under apartheid. 'African' refers to black South Africans who speak indigenous languages such as isiXhosa, isiZulu or Sesotho. 'Coloured' refers to South Africans of diverse cultural origins, most of whom speak Afrikaans and/or English as a home language, and who were also disenfranchised under apartheid. 'White' refers to South Africans who were classified as 'of European ancestry' and enfranchised under apartheid. (Ralphs, 2016, pp. 16–17)

Case study approach

This research study made use of a qualitative case study research design. Merriam suggests that "[q]ualitative case studies can be characterized as particularistic, descriptive and heuristic" (Merriam and Tisdell, 2009, p. 43). For the purposes of this research, the use of a case study allowed for a small study of a participant cohort of nine candidates, employed as operators on a high-speed beverage packaging line, from one employer. These candidates participated in a pilot project that drew upon a recognition of prior learning (RPL) process to assist them in achieving their NQF 3: National Certificate in Food and Beverage Packaging Operations (SAQA, no date a).

The use of the case study approach allows for use of rich, thick description (Merriam and Tisdell, 2009). For the purposes of this research, by focusing on a small case study, it allowed me as the researcher to capture the RPL process in detail, as well as providing opportunities to examine the evidence

produced by the candidates in depth to draw out the details and nuances of the data that may have been lost in a larger study.

Participatory action research

The field of RPL is one that appears to differentiate into two distinct fields, namely research and practice. A duality of perspective arises, however, when these fields overlap because in this case study the researcher is also the practitioner. As a practitioner, I participated in the RPL programme in several ways. Firstly, I provided input to the training provider during the development of the RPL implementation model and secondly, I worked as facilitator for the some of the contact sessions. My third area of involvement was as a moderator who quality assured some of the assessments. This third role had the most overlap with that of my researcher role as it provided me with access to observe some of the Workplace Observation Assessments while they were being conducted. To best make use of this duality, this research project made use of Educational Design Research Methodology. Van den Akker *et al.* propose that the main characteristics of Education Design Research Methodology are that it is interventionist, iterative, process-oriented, utility-oriented, and theory-oriented (van den Akker *et al.*, 2006, p. 4). It was these characteristics of the methodology that made it useful to the qualitative case study research design used this research.

Educational Design Research Methodology, although seemingly categorised as a methodology on its own, ties into the broader approach of Action Research. Action Research is defined by Koshy as "an enquiry, undertaken with rigour and understanding so as to constantly refine practice" (2005, p. 1). Action Research has a long history in the field of education and much has been written on the use of Action Research by education practitioners, particularly in the field of formal education and schooling. Although there are several models used to conduct Action Research, the general approach is fairly similar. One such model is known as the Action Research spiral: Plan – act and observe – reflect (Kemmis and McTaggart in Koshy, 2005). This is similar in approach to the Educational Design Research Methodology which in simplistic terms, involves design, implementation, and evaluation.

Both Educational Design Research Methodology and Action Research are underpinned by the need to answer questions that "emanate from neither theory nor practice alone but from critical reflection on the intersections of the two" and "emerge from the day-to-day experiences of practice" (Cochran-Smith and Lytle, 2009, p. 41). The difference lies in the design element of the methodology. Although action research does allow for the use of specified interventions and seeks to examine their effect, Design Research Methodology is more focused in this regard, aiming both to critically examine the design of the intervention as well as the participants' interaction with the intervention.

By carefully studying progressive approximations of ideal interventions in their target settings, researchers and practitioners construct increasingly workable and effective interventions, with improved articulation of principles that underpin their impact (Collins, Joseph & Bielaczyc, 2004; van den Akker, 1999 in van den Akker *et al.*, 2006, p. 4). Although this research design did not intend to include multiple iterations of the project, it was the iterative approach to the research that was envisaged as adding further value to the RPL programme by providing possible improvements for future roll-outs of the RPL programme.

The Educational Design Research Methodology approach, based on the Action Research methodology, makes space for the possibly conflicting roles of researcher and practitioner, and allows for the implementation of a project as a practitioner to be coupled with the critical analysis of the project as a researcher. This is valuable in this project as it allows for 'ground up' development of the model and enables the researcher to be involved from the early development of the model used in the RPL programme.

However, this approach is not without constraints. As is evident in the writing on Action Research, there are concerns that must be addressed in the design of the study. Zeni points out that "the action research stance violates conventional norms. It cannot be forgotten that, as a practitioner involved in the implementation of the model, there is also a distinct relationship between the practitioner and the participants. While pursuing an inquiry, the researcher usually exercises some power over other participants" (Zeni, 2009, p. 257), an issue which must be taken into consideration in this study. It is important to remember that "all social research is a social construction, made possible through existing power relations" (Noffke, 2009, p. 9).

Within the context of educational research in particular, the relationship between other participants and the researcher as a participant demonstrates unique power relations based on the role of the researcher as a mediator of learning who holds the power to decide what is learned and how this learning is measured.

> Practitioner inquiry across types is built on the assumption that the relationships of knowledge and practice are complex and distinctly non-linear, and that the knowledge needed to improve practice is influenced by the contexts and relations of power that structure the daily work of teaching and learning (Cochran-Smith and Lytle, 2009, p. 41).

Thus it is critical to be aware of the complexities of the researcher/participant relationship arising from the Action Research methodology and to attempt to minimise their effect on the research. These constraints were considered in the final research design and were included when considering how best to incorporate research into the roll-out of the RPL programme.

Data sources

Although drawing only on a qualitative methodology, this research drew on a range of data sources to try and capture the full extent of knowledge that was surfaced through the RPL programme. The data for this research was drawn from a variety of sources to capture as broad a range of evidence as possible, as well as to attempt to capture the nuances that may have been surfaced in the individual RPL programme's assessment tools. The data collection process occurred in conjunction with the roll-out of the RPL programme, as well as through semi-structured interviews that occurred after the programme was completed.

The full details of the RPL programme and how it was rolled out are contained in the following chapter as they relate closely to the findings of the research. The combination of document-based analysis with observations and interviews to study a recognition of prior learning process allows for the opportunity to unpack other forms of knowledge that arise in non-formal and informal learning contexts which are not as easily documented. As suggested by Johnson and Majewksa:

> The hybrid nature of non-formal learning means that researchers need to consider using a diverse range of qualitative and quantitative methods to study it (e.g., document-based analysis that captures intended learning aims alongside interactional observations of the enacted learning process). (2022, p. 5)

The data sources that I drew on and their role in the RPL programme are discussed below.

Qualification

The SAQA qualification document was used as a preliminary data source as the RPL programme was based on the Exit Level Outcomes and Associated Assessment Criteria contained in this document. The full qualification document is included in Appendix A. As discussed in Chapter 1, the RPL programme was based on a 'historically registered' unit standard-based qualification that was overseen by the Food and Beverage Manufacturing SETA. The qualification was registered on the NQF and was designed according to learning outcomes. By coding the qualification document in the same way as the other evidence, it allowed for a comparison between the qualification requirements and the data generated during the RPL programme.

RPL programme tools

One of the primary data sources for this research was the RPL model and materials used to roll out the programme. This included the specific guidelines given to the RPL candidates to assist them in

completing the requirements of the programme. The data that this research draws on is based on the evidence produced by the candidates during the RPL programme.

The RPL programme's model included:

- a Literacy and Numeracy Screening Assessment,
- a Technical Packaging Knowledge Screening Assessment,
- a Journal of Workplace Experience detailing their work, and
- a Workplace Observation for each of the two machines (filler and labeller) that the candidate is required to operate.

Once completed by the candidates, an analysis of these documents, excluding the Literacy and Numeracy Screening Assessment[6], was carried out. This enabled me to identify the types of knowledge surfaced by the RPL programme's assessment tools, as well as the types of knowledge surfaced by the candidates' evidence based on the tools. The data sources are as a direct result of the RPL programme as it is the evidence that the candidates generated during the RPL process.

Building on the documentary sources is the use of the Workplace Observations. This assessment, which was part of the RPL process, was an observation tool that provided insights into the way in which employees were able to perform the workplace tasks required of them. Although aligned to the Exit Level Outcomes of the qualification, the workplace observations are customised to the specific beverage packaging environment and machines used by the company. These workplace observations allowed for insights into the candidates' ability to operate the machines by providing an opportunity to observe them operating the machines. The six assessments observed were conducted in February and March of 2017, and the list of the observations are provided in Appendix B. They were reported on via written observation notes as, due to the noise of the environment, audio or video recordings were not possible. It was also not possible to write down candidate-assessor exchanges verbatim.

My research observation notes became one of the key data sources in this research, as they captured what I observed during Workplace Observations, both in terms of the actions taken by the candidates and the assessor's interactions with the candidates during the assessment. I was also able to get direct comments and observations from the assessors about what they were observing and its importance. Although, as mentioned above, my research observation notes were not a verbatim record, they were written in situ as I was directly observing the Workplace Observation being conducted on the production line.

[6] As this assessment was focused on benchmarking learners to an NQF level for access rather than directly related to the content of the qualification, I chose not to include this assessment as part of the research.

There was a very distinct participant/researcher duality during this phase as, although I was researching the RPL programme, I was also a participant in the RPL programme. My role involved facilitating some of the workshops that assisted candidates in producing the evidence as well as administering some of the screening tests. I was also involved in the quality assurance of the Workplace Observations as the internal moderator. I have reflected on my participation in the RPL programme and its impact later in this chapter.

Candidate interviews

Semi-structured, in-depth interviews were conducted with the five candidates whose journals were analysed, as well as a subject matter expert from the company who was involved with the project. Refer to Appendix C for the list of interviews and the original interview schedule. Although the interviews were not part of the original RPL programme and not used as an assessment instrument, they were used to validate the coding process in my research and provided me with further insight into the knowledge surfaced in the Journals of Workplace Experience.

Candidates were questioned about the overall RPL project, but then were asked further questions related to their journals specifically in order to confirm certain classifications or gain further insight into certain entries. Questions were also asked regarding the candidates' approach to and involvement in problem-solving which enabled me to gain insight into some of the less explicit elements of the problem solving done by operators.

The interviews were recorded with permission from the interviewees and then transcribed. The transcriptions form the basis of the data for this section of this research. The transcripts were validated using my notes taken during the interviews to ensure that they were as accurate as possible.

RPL programme participants

The participant cohort in the pilot project used for this case study consisted of nine employees of a large beverage manufacturing and packaging company. Brief biographical sketches of each of the candidates and assessors, as well as the subject matter expert (SME) are provided below. To ensure anonymity, all participants have been given pseudonyms.

Candidates

- James was a 49-year-old Coloured[7] man whose home language was English. He had 15 years of experience working for the company and worked mainly as a filler operator at the time.
- Shaun was a 28-year-old White man whose home language was Afrikaans. He had three years of experience working in the packaging environment and had completed his N4 as he was working to become an artisan.
- Matthew was a 38-year-old Coloured man whose home language was Afrikaans. He had nine years of experience working for the company and worked mainly as a labeller operator. He was also studying a management diploma part time.
- Nkosi was a 42-year-old African man whose home language was isiXhosa. He had 20 years of experience working for the company and was involved with one of the trade unions in the industry.
- Leon was a 31-year-old Coloured man whose home language was Afrikaans. He had nine years of experience working for the company and worked mainly as a labeller operator.
- Themba was a 45-year-old African man whose home language was isiXhosa. He had 16 years of experience and worked mainly as a filler operator.
- Neville was a 39-year-old Coloured man whose home language was Afrikaans. He had 11 years of experience and was working mainly as a labeller operator.

Assessors and Subject Matter Expert

- The first Assessor, Lucas, was a White man whose home language was Afrikaans. He was a trained artisan who had extensive experience working in the packaging environment and had worked both for the company and at the specific site where the RPL programme was based. He was also a registered FoodBev SETA assessor.
- The second Assessor, Steven, was a Coloured man whose home language was English. He had experience working in the packaging environment and had also worked for the company. He was a registered FoodBev SETA assessor as well.

[7] As discussed at the beginning of this chapter in the section "A note on the use of terminology", the inclusion of racial classifications in the biographical sketches of the RPL programme participants speaks to the role of RPL as a tool for transformation and redress where those classified as "historically disadvantaged" due to their racial classification under the Apartheid regime could be provided with the opportunity to achieve qualifications that were previously denied access to.

- John, the Subject Matter Expert (SME), was a Coloured man who worked for the company at the site where the RPL programme was based. He had extensive experience in packaging and was a technical specialist who dealt with on-site training in World Class Manufacturing.

Ethical considerations

Participatory action research and power relations

As discussed in the section on the research design, a critical element to consider during the research design phase is the power relations between researcher and participants. Participatory action research requires the researcher to fulfil two roles – that of a researcher but also that of a participant in the process that is being researched. The aim is to minimise its impact on the study and ensure the integrity of the process. Although I was an active participant in the RPL programme, my role was in no way linked to decision-making about the learner's competence as that judgement was made by the assessors who were subject matter experts in the field.

My role in the RPL programme was as a facilitator for the fundamental (Mathematics and Communication) section, which involved assisting candidates to identify the ways in which they used mathematics and communication skills in their job so that they could capture that information in the Journals of Workplace Experience. While I also administered the literacy and numeracy screening assessments, they were assessed by the service provider who owned the assessment tools according to a set model answer, neither of which I was involved in developing. It is possible that I may have influenced participants' views regarding what Young refers to as 'powerful knowledge' (Young, 2009; Young and Muller, 2013) and what could count as knowledge for the purposes of the RPL programme. However, the final decision on the candidate's competence was made against the requirements of the qualification that they were being 'RPL-ed' against as that is what the assessment instruments were designed against.

I did play a further role as the internal moderator responsible for ensuring that the assessment process was conducted correctly. Performing this role enabled me to observe the assessors conducting the workplace observation assessments and, in so doing, gather useful evidence that contributed to my findings. At that point, I was in a dual role as both researcher and participant. However, I was not the only moderator and was only responsible for providing feedback on the assessment process and the conduct of the assessors. While the workplace observations were part of the RPL programme, candidates were briefed on the role of the moderator during their assessment preparation.

Positionality and credibility

Merriam and Tisdell (2016, p. 244) make the argument that "qualitative researchers can never capture an objective "truth" or "reality,"" due to the nature of qualitative research. However, they also acknowledge that there are strategies for ensuring that the research is credible. In this section, I reflect on both the subjectivity of my position as researcher, as well as some strategies that I employed to mitigate possible risks it may have posed to the credibility of the research.

In considering what Merrian and Tisdell refer to as the "researcher's position, or reflexivity" (Merriam and Tisdell, 2016, p. 249), I have reflected on my role as a researcher/participant in the previous section. However, it is also necessary as a researcher to consider my positionality in relation to the data collected as well as in relation to the RPL candidates. As a researcher embedded in the RPL programme, and with several of years of experience as an ETD Practitioner working in the Food and Beverage Manufacturing sector, I was already familiar with the production environment where the candidates worked, as well as with the qualification that the RPL programme was based on. This allowed me, as the researcher, to conduct a more nuanced analysis of the data by drawing on my own experience and understanding of the production environment. However, despite my close relationship with the production environment, I cannot claim an insider's perspective on the work as I have never actually worked as a machine operator in a production environment.

My perspective is that of an outsider who observed what was happening, albeit with some understanding of what was going on. The RPL candidates were embedded in their production environment and drew on a wide range of knowledge and skills developed through their many years of experience, some of which I cannot claim any insight or understanding of. Furthermore, it is also important to take cognisance of the impact of my race, gender, class, and language group on this research. As a younger, white, female, South African researcher, my social identity set me apart from the workers whose experiences I was trying to understand. As an academically trained researcher drawing on a particular analytical framework, it is also quite likely that there may be nuances in the candidates' knowledge that I could not capture as they were not observable to someone not fully immersed in the production environment.

Through a systematic data collection process, I drew on a variety of data sources including RPL candidates' evidence, regulatory documents, research observations, and research interviews which allowed for a form of 'data triangulation'. Although as Cooper (2005) in citing (Hammersley and Atkinson, 1983) warns, it would be naïve to assume that aggregation of data equates to a more complete picture as the differences between data sources may be just as significant. Indeed, in this

research, the differences between the various data sources provided important insights for answering the research question by highlighting forms of workplace knowledge that may not have otherwise been visible without the comparison between data sources.

One of the strategies discussed by Merriam and Tisdell (2016) that I used to eliminate any possible disjuncture between my interpretation of the data and what the RPL candidates intended to present in their evidence was the notion of 'respondent validation'. This is where the researcher "solicit[s] feedback on your preliminary or emerging *findings* from some of the [participants]" with the intention that "participants should be able to recognize their experience in your interpretation or suggest some fine-tuning to better capture their perspectives" (Merriam and Tisdell, 2016, p. 246 emphasis in original). While the research interviews conducted provided a data source, they were conducted after the rest of the data sources had been through a preliminary analysis and provided an opportunity to clarify any questions that arose during the preliminary analysis. By asking for their input into my analysis, they were able to validate my original data coding and confirm my interpretation of their evidence from the RPL programme.

Ethics

Ethical clearance was granted for this project upon submission of the proposal, informed consent letter, and interview schedule to the University's School of Education Ethics Committee. Participants were briefed on the purpose of the research and their consent was requested before proceeding with the research and the interviews particularly. Permission was also sought from and granted by the training provider who developed the model and assessment tools to use the data from the RPL programme for this research.

Candidates were asked about their willingness to participate in the research study, and it was explained that their refusal to participate in the data collection of the research study would have no impact on their participation in the RPL pilot project and would not affect their assessments or participation in the programme. They were also assured of their anonymity in the research, and all participants who were interviewed signed informed consent forms agreeing to their participation. The interviews were only conducted after the programme had been completed and participation in the interviews was voluntary. Permission was granted by the company to conduct the interviews, but candidates were approached directly regarding the interviews to ensure that they did not feel coerced by management to participate.

The use of company intellectual property from both the training provider and the employer was a concern at the outset of this research as I had to obtain the consent of all parties to examine the evidence produced by the RPL programme. In reporting on my findings, it was important that I made every effort to maintain the anonymity of the beverage packaging company involved and to ensure that intellectual property was safeguarded. This did provide some constraints in terms of what I was able to include as examples in my findings chapter as I had to remove certain references to company-specific information. Furthermore, as I was making use of assessment materials from the training provider, I had to respect the confidentiality of the assessment tools. This means that I was not able to fully report on individual assessment questions.

As the data for this research drew on a single case study environment, care has been taken to anonymise the participants as far as possible. Furthermore, due to the need to respect the intellectual property of the company, the beverage packaging company has not been named and the products and any company-specific information was removed from the data.

Data Analysis

Gamble's (2016b) four quadrants

The Technical Packaging Knowledge Screening Assessment, Journals of Workplace Experience, my research observation notes, the assessment tool for the Workplace Observations, and the SAQA qualification document were first coded using the four-quadrant model developed by Gamble for her 2016b study on "work itself, … its organisation and … the diagnostics and problem-solving found in the work of artisans and technicians" (Gamble, 2016b, p. 1). The four classifications of knowledge that she drew on to analyse the knowledge types present in various occupations is explained in more detail in Chapter 2. The knowledge types as laid out in Figure 1 of Chapter 2 drawn from Gamble (2016b) are:

- Specific procedural knowledge (K1)
- General procedural knowledge (K2)
- Specific principled knowledge (K3)
- General principled knowledge (K4)

The coding process drew on an understanding of the knowledge involved that developed as result of my previous engagements with the qualification and its outcomes as a learning material developer and moderator, together with the insights gained through coding the assessment tools prior to coding the qualification.

To refine the coding process and ensure that the four knowledge types could be accurately identified in the data, the Journals of Workplace Experience were coded first. The first journals coded were used to refine the classifications by ensuring that each entry coded could be substantiated by a clear explanation of why it was coded that way. An example of this is in Appendix D where the full coding of the first Journal of Workplace Experience is included. Once these had been coded, the SAQA qualification document was coded next, after which I completed coding the Technical Packaging Knowledge Screening Assessment, my research observation notes, and the assessment tool for the Workplace Observations. The coding of the SAQA qualification document is included in Appendix E.

As the coding process continued and the classifications of the knowledge types were refined, it became clear that the four quadrants did not always fully capture the richness of the knowledge individually. Ensor and Hoadley (2004) refer to the concept of the 'discursive gap' between the language of description and the empirical evidence. In an attempt to address the 'discursive gap' between the empirical data and my coding, I decided to capture certain entries using two codes. For example K1/K2 where the evidence pointed to both specific procedural knowledge in terms of procedures that they follow that related directly to their work context, and general procedural knowledge where the candidates referenced procedural knowledge that could be applied to various contexts. This enabled me to code in a way that suggested the presence of both the overall procedure as well as the more specific steps that would be followed for a quality check according to the requirements of their work, for example.

However, as I pointed out in Chapter 2, these four quadrants were not sufficient for the purposes of this research. It was necessary to extend the analysis and add to these knowledge types by including other conceptualisations of knowledge, such as those discussed by Winch (2012). Thus, the aim of extending the analysis was to incorporate a broader, more nuanced conceptualisation of the knowledge in the PRL programme so as to better capture the complexity of knowledge that was surfaced in the RPL programme. I also aimed to do so in a way that did not splinter the definitions into smaller parts, but rather enhanced the language of description to accommodate what was surfaced in the empirical data.

Coding Challenges

At several points in the data analysis drawing on Gamble's quadrants, it became apparent that this language of description that I was using was not sufficient to adequately explain or describe the evidence that was surfacing in the empirical data, suggesting that there was a 'discursive gap' (Ensor and Hoadley, 2004) that needed to be addressed. While this is most evident in the need to extend the

analytical framework to include further languages of description, there were also certain differences between the way in which Gamble (2016b) described the four knowledge types in her four quadrants and how the knowledge types were identified during the data coding process.

In considering the coding challenges presented using Gamble's quadrants, one of the specifications she made in her 2016 study was that K1 (specific procedural knowledge) is not written down. What became apparent in my coding was that there are some forms of K1 knowledge that can be written down. In later reading, I encountered Eraut, who delineates the specific procedural knowledge of the workplace into two further categories:

> *Codified knowledge* that is not academic can be found in nearly all workplaces, including those of educational organizations, in the form of textual material containing organization-specific information, records, correspondence, manuals, plans, etc.
>
> *Cultural knowledge* that has not been codified plays a key role in most work-based practices and activities. There is considerable debate about the extent to which such knowledge can be made explicit or represented in any textual form, and the evidence gathered so far suggests that its amenability to codification has been greatly exaggerated (Eraut, 2000). What does appear to be generally acknowledged is that much uncodified cultural knowledge is acquired informally through participation in social activities, and much is often so `taken for granted' that people are unaware of its influence on their behaviour. (Eraut, 2004, p. 263 italics in original)

Although this distinction was not used during the data coding, this flexibility in the ability to code for specific procedural knowledge in both written and non-written contexts ensured that there was a clearer distinction between specific procedural knowledge and general procedural knowledge. This enabled me to analyse references in the data to written procedural documents such as Standard Operating Procedures based on whether the knowledge referenced was specific or general in a more nuanced way instead of just basing it on whether it was written down or not.

Winch's (2012) Dimensions of Expertise

The second lens used for data analysis drew on Winch's (2012) distinctions between 'knowing that' and 'knowing how' and how these formed the knowledge bases for the exercise of skill. While there are overlaps between Winch's concepts and Gamble's (2016b) knowledge types, this lens allowed for a richer analysis of the relationship between different forms of knowledge and the exercise of skill. The coding for this drew on the proposal made in Chapter 3 that knowing that and knowing how could be considered as opposite poles of a continuum. As depicted in the figure below, by placing knowing that and knowing how on a continuum, it allowed for the inclusion of more nuanced classifications between the two poles to capture a more detailed description of the knowledge bases in the exercise of skill.

Table 1: 'Knowing that' – 'knowing how' continuum

H--	H-	H+	H++
Extensive subject or theoretical knowledge required. No evidence of direct application of knowledge using skill or technique. Little to no technical knowledge.	Moderate subject or theoretical knowledge. Application of knowledge.	Moderate practical knowledge required. Involves skill. Less theoretical knowledge.	Extensive practical knowledge. Involves skill and technique. Procedures to be followed. Little to no subject or theoretical knowledge.

However, as discussed in Chapter 3, the exercise of skill and the corresponding knowledge bases are not sufficient as skill also includes the concept of disposition and values. Therefore, linked to the analysis of the data using the continuum, was the need to identify any instances of the dispositions and values that were present in the evidence. Drawing on Winch's (2012) conceptualisation of skill also required an analysis of the data for evidence of the use of judgement. Both disposition and values, as well as judgement, were analysed based on their conceptualisations as discussed in Chapter 3. The evidence related to dispositions and values, as well as the use of judgement, formed part of the analysis for the exercise of skill but was also used as a data source for the analysis of the data to identify for expertise.

Craft knowledge

Although Gamble's (2016b) classification of the four knowledge types includes a classification for craft knowledge as specific, principled knowledge, the data analysis made it apparent that the way in which craft knowledge was conceptualised in the quadrant model needed to be extended to encompass the context of a manufacturing environment which is different to the environment in which craft knowledge was initially conceptualised. This was done by using Gamble's (2004b) concept of the 'visualisation principle' as discussed in Chapter 2 to analyse the data, with the interviews used to confirm this analysis. To distinguish between the visualisation principle and original conceptualisation of craft knowledge in its traditional concept, I chose to use the term craft-like knowledge to distinguish between traditional craft knowledge and the form that was identified in the context of this research.

Tacit knowledge

There is, inherent in a study which seeks to expose tacit knowledge, the challenge of giving language to knowledge which, by its very definition, is knowledge "that … is not presentable in language"

(Gamble, 2004, p. 1). However, as discussed in Chapter 2, an attempt was made to analyse the data for possible evidence of tacit knowledge. As the data was analysed, instances of tacit knowledge in the candidates' evidence were identified and, as in the instance of craft knowledge, confirmed through the interviews with the candidates and subject matter expert.

However, the process of analysing the data in search of evidence pointing towards the use of tacit knowledge indicated a further 'discursive gap' (Ensor and Hoadley, 2004). While the original conceptualisations of tacit knowledge by Gamble (2004b) and Winch (2012) provided a starting point, the language of description that they provided was not sufficient to capture the tacit knowledge contained in the empirical data. Thus, a further lens was used to analyse the data for sensory tacit knowledge, particularly auditory, visual, and tactile tacit knowledge. The use of these classifications provided a richer description of the tacit knowledge present in the data.

Expertise

As with the analysis for tacit knowledge, the starting point for analysing the data was Winch's (2012) 'dimensions of expertise'. However, as the data was analysed, a need for a stronger framework to conceptualise expertise became apparent, particularly in the form of occupational expertise. Thus, to expand the descriptions of expertise and develop a more detailed picture of how expertise was surfaced through the RPL programme, Guile and Unwin's (2019) features of expertise were used. While there are various theoretical approaches to draw on when conceptualising expertise, I chose to use Guile and Unwin's features of expertise as it allowed for the inclusion of both practical and theoretical elements of expertise. By extending their features of expertise to incorporate the theoretical component, they provide an analytical tool that draws vocational knowledge into the realm of expertise. In contrast, a perspective such as that of the socio-historical approach discussed previously in Chapter 2, considers knowledge to be shaped by social and historical context; although it distinguishes between 'scientific' and 'everyday' knowledge, it does not provide conceptual tools to distinguish between the different forms of 'scientific' and 'everyday' knowledge that comprise expertise.

The data was analysed using Guile and Unwin's (2019) features of expertise to provide the language of description for speaking about the findings related to expertise. To analyse the data for the features of expertise, the findings of the previous data analyses were drawn on to feed into the findings on expertise. The use of the features of expertise (Guile and Unwin, 2019) as the final lens through which to analyse the data as well as consolidate the findings of the previous analyses allowed for the various,

seemingly fragmented, conceptual parts of the analytical process to be drawn together to provide the full picture of the complexity of knowledge surfaced through the RPL programme.

Presentation of data and findings

The data and findings from this research are presented in Chapters 5 and 6 that follow. Chapter 5 presents the data and findings from the analysis of the SAQA Qualification Document and RPL programme tools using the analytical framework derived from Gamble's (2016b) four quadrants. It discusses the forms of knowledge surfaced by the RPL programme tools and compares these to knowledge requirements of the qualification.

Chapter 6 presents the data and findings from the analysis of the data using the analytical lenses focused on skill and expertise. It starts with an analysis of the organisation of work in the high-speed beverage packaging environment of the RPL case study before discussing the findings related to the knowledge bases for skill that were surfaced by the RPL tools. The chapter also presents findings related to disposition and values, as well as professional judgement, before drawing the various sections together in the findings related to occupational expertise.

The final chapter of this thesis includes a reflection on the methodological challenges that I experienced while analysing the data and proposes conceptualisations of knowledge forms and occupational expertise that support a language of description for talking about workplace knowledge. It also discusses some of the possible implications of this research for RPL, as well as proposing some considerations for vocational curricula that arose from the research.

Conclusion

In this chapter I have discussed the methodological considerations of this research. This is a qualitative research study that makes use of a case study approach. Methodologically, it draws on Participatory Action Research and Educational Design Research Methodology. While the emphasis of this research is not directly on the design of the RPL programme, the use of these methodologies accommodated the duality of the researcher/participant roles that were present due to my personal engagement with the RPL programme. The use of these methodologies also supported a case study approach which rests on the intersection between research and day-to-day experience in practice.

The last section of this chapter focused on the data sources used in the study and provided a description of how the data was analysed. Each of the elements of the analytical framework was briefly discussed in relation to how the concepts from Chapters 2 and 3 were used in its development.

A progression in the development of the analytical framework resulted from attempts to address the 'discursive gaps' (Ensor and Hoadley, 2004) that emerged between the data and the languages of description, and further conceptualisations were developed to address these.

The following chapters will provide the findings of the data analysis based on the parts of the analytical framework and elaborate on the complexity of the knowledge that was surfaced in the RPL programme, before drawing all the parts together to produce a more holistic picture of the 'occupational expert' as a whole.

CHAPTER 5: ANALYSIS OF KNOWLEDGE TYPES IN THE SAQA QUALIFICATION AND AS SURFACED IN THE FORMAL RPL PROGRAMME

This chapter focuses on the types of knowledge surfaced through the formal recognition of prior learning (RPL) programme. It first discusses the official qualification document on which the programme is based and then focuses on the data generated by the RPL programme in the form of the candidates' evidence and the tools used in the programme. The tools and evidence were analysed as elaborated on previously in the methodology chapter.

The findings reported in this chapter focus specifically on the four knowledge types identified by Gamble (2016b) — specific procedural knowledge (K1), general procedural knowledge (K2), specific principled knowledge (K3), and general principled knowledge (K4). These findings are reported on for the SAQA qualification document as well as the various tools used in the RPL programme, and a comparison is then made between the two.

Analysis of the SAQA qualification

The SAQA qualification that this RPL programme was based on was the National Certificate: Food and Beverage Packaging Operations, which is at Level 3 on the National Qualifications Framework (NQF). At the time that this programme was rolled out (2017), the qualifications on which learnerships were based consisted of overarching Exit Level Outcomes and Associated Assessment Criteria, which were then broken down into individual unit standards.

Unit standards are classified into three types — core unit standards which focus on the essential knowledge and skills required for the qualification, fundamental unit standards that cover the literacy and numeracy requirements, and elective unit standards that provide the flexibility to tailor the qualification to different workplace requirements. Each unit standard contains a set of specific outcomes and assessment criteria that are used to assess learners. In a standard learnership, the learning programme is designed against the specific outcomes and assessment criteria as each criterion must be trained and assessed at some point in the programme.

All qualifications on the NQF are required to make provision for RPL and as such, the qualification used for this RPL programme was the same as the one that would be used for a standard learnership at the time. However, the RPL guidelines make provision for RPL candidates to be assessed against the

higher-level Exit Level Outcomes of the qualification rather than the individual unit standards' Specific Outcomes and Assessment Criteria. Because the Exit Level Outcomes of the qualification broadly encompass all the criteria contained in the unit standards, assessing against the Exit Level Outcomes enables a more holistic process that allows the candidates to demonstrate their overall knowledge and competence against the qualification's requirements without needing to deconstruct their evidence into a set of tick boxes against the individual criteria of each unit standard.

The National Certificate: Food and Beverage Packaging Operations qualification consisted of four Exit Level Outcomes and sixteen Associated Assessment Criteria in total, as per the table below. Although the qualification is further divided into unit standards, these unit standards are all addressed in the high-level Exit Level Outcomes. For the RPL programme, the focus was on demonstrating the candidates' competence against the Exit Level Outcomes and their Associated Assessment Criteria rather than the individual unit standards. As the RPL programme was the focus of this research, analysis of the qualification was therefore also focused on the Exit Level Outcomes and Associated Assessment Criteria rather than the smaller unit standards.

Table 2: Exit Level Outcomes and Associated Assessment Criteria from qualification document (SAQA, n.d.)

ELO 1	**Communicate in a variety of ways in a food and beverage manufacturing environment.**
Associated Assessment Criteria	1.1 Relevant production plans are interpreted according to organisational operations procedures.
	1.2 Measuring instruments are used to measure production inputs and outputs and record information according to organizationally acceptable methods.
	1.3 Technical packaging operating equipment terminology is identified and explained according to supplier specifications and standard operating procedures.
	1.4 Operating data is collected and recorded according to generally accepted norms and practices and standard operating policies and procedures.
	1.5 Deviations from required standards are identified and recorded according to organizationally acceptable methods.
	1.6 Team members are informed of production plans, shift objectives and problem-solving solutions to recorded deviations[8] according to organizationally acceptable methods.

[8] Recorded deviations refers to times when the production process operates outside of specific identified limits. These deviations are recorded in the process records kept by operators and trigger a specified problem-solving process that the operator must follow.

ELO 2	**Maintain quality assurance and monitor critical control points in a food and beverage packaging manufacturing environment.**
Associated Assessment Criteria	2.1 Critical control points in a packaging line are identified, monitored, and maintained to ensure health and safety standards are met.
	2.2 Micro-biological concepts and practices are applied to a primary packaging operating line in order to prevent contamination and cross-contamination of products.
	2.3 Quality control and quality assurance practices are applied in a packaging operating environment.
ELO 3	**Operate a context specific range of automated packaging equipment.**
Associated Assessment Criteria	3.1 Preparation and planning to operate context specific packaging equipment is conducted and documented to ensure quality and correct quantity of output is obtained.
	3.2 Packaged products are produced within the context of organisation's primary production process.
	3.3 Personal health, hygiene and food safety procedures are applied throughout the packaging operating process.
ELO 4	**Solve problems and improve an automated packaging process.**
Associated Assessment Criteria	4.1 Deviations from required standards are identified and recorded according to standard operating procedures.
	4.2 Problems, challenges and matters within the operating process requiring a decision are identified to ensure efficient ongoing operation.
	4.3 A proposed solution is identified and implemented according to recognized organisational methods or standard operating procedures.
	4.4 The solution is evaluated and assessed in accordance with organizationally accepted methods or standard operating procedures.

The Exit Level Outcomes and their Associated Assessment Criteria were coded using Gamble's four knowledge types, based on the knowledge that underpins each outcome or criterion. The Journals of Workplace Experience that the candidates produced was the first data to be coded using this analytical lens. The SAQA qualification document was coded later based on the definitions of each of the four knowledge types determined during the coding of the journals to ensure that the coding was consistent between the qualification and the various tools.

The Exit Level Outcomes of the qualification are high level outcomes which each have a set of Associated Assessment Criteria linked to them. It became clear that each high-level outcome encompasses a range of knowledge types, and it was therefore necessary to use a combination of knowledge type codes to ensure that they are adequately described. The Associated Assessment

Criteria each represented a different knowledge type contained in the Exit Level Outcome and so the Associated Assessment Criteria were coded first as they provided a breakdown of the knowledge types encompassed in the Exit Level Outcome.

The majority of Associated Assessment Criteria for Exit Level Outcome 1 are coded as either K1 or K2, as shown in Table 3 below.

Table 3: Exit Level Outcome 1 and its Associated Assessment Criteria

Exit Level Outcome 1	Communicate in a variety of ways in a food and beverage manufacturing environment.	K1/K2
Associated Assessment Criteria	1.1 Relevant production plans are interpreted according to organisational operations procedures.	K1
	1.2 Measuring instruments are used to measure production inputs and outputs and record information according to organizationally acceptable methods.	K2
	1.3 Technical packaging operating equipment terminology is identified and explained according to supplier specifications and standard operating procedures.	K4
	1.4 Operating data is collected and recorded according to generally accepted norms and practices and standard operating policies and procedures.	K1/K2
	1.5 Deviations from required standards are identified and recorded according to organizationally acceptable methods.	K1
	1.6 Team members are informed of production plans, shift objectives and problem-solving solutions to recorded deviations according to organizationally acceptable methods.	K1

Criteria 1.1, 1.5, and 1.6 were coded as K1 because they relate directly to the specific procedural knowledge of the company — these criteria tend to refer to “organizationally acceptable methods”. Although criterion 1.2 above also refers to “organizationally acceptable methods”, the focus of the of the criterion is on measuring instruments, which are used according to procedures that are generally accepted rather than just being site-specific, hence coded as general procedural (K2) knowledge. Criterion 1.3 was coded as general principled (K4) knowledge because the identification and explanation of packaging terminology requires scientific and theoretical knowledge related to the operating principles of packaging equipment. None of the criteria for this Exit Level Outcome were coded as specific principled (K3) knowledge.

Although the Associated Assessment Criteria are a breakdown of the Exit Level Outcome, they are also fairly high-level criteria designed to cover a spectrum of unit standards' knowledge and therefore certain Associated Assessment Criteria contain more than one knowledge type. For example, criterion 1.4 is coded as K1/K2, due to it encompassing both "generally accepted norms and practices" which refer to general procedures that are applicable to various packaging environments (i.e. K2), and "standard operating policies and procedures" which refer to procedures that are specific to a particular packaging environment (i.e. K1).

Thus Exit Level Outcome 1 was coded as specific and general procedural knowledge (K1/K2) because it has Associated Assessment Criteria that were coded as either specific procedural or general procedural, or a mixture of both (K1, K2, or K1/K2). The focus of this outcome is on the procedures used to communicate in a packaging environment — it requires knowledge of general communication processes and those applicable to the specific packaging environment, as indicated by the references to standard operating procedures.

For Exit Level Outcome 2, the Exit Level Outcome is coded as K2/K4 while the three Associated Assessment Criteria are coded as K4 and K2.

Table 4: Exit Level Outcome 2 and its Associated Assessment Criteria

Exit Level Outcome 2	**Maintain quality assurance and monitor critical control points in a food and beverage packaging manufacturing environment.**	**K2/K4**
Associated Assessment Criteria	2.1 Critical control points in a packaging line are identified, monitored, and maintained to ensure health and safety standards are met.	K2/K4
	2.2 Micro-biological concepts and practices are applied to a primary packaging operating line in order to prevent contamination and cross-contamination of products.	K4
	2.3 Quality control and quality assurance practices are applied in a packaging operating environment.	K2

Assessment criterion 2.2 is coded as general principled knowledge (K4) because it focuses on the scientific knowledge of microbiological concepts and practices. Assessment criterion 2.3 is coded as K2 because it refers to general procedural knowledge related to "quality control and quality assurance practices". Assessment criterion 2.1 is coded as both K2 and K4 as it combines the theoretical knowledge of food safety through Hazard Analysis and Critical Control Points (HACCP) with their practical application in procedures used in packaging environments. This Exit Level Outcome is

therefore coded as a combination of general procedural knowledge (K2) as candidates are required to know the general procedures related to food safety and quality assurance, and general principled knowledge (K4) as they are also required to know the underpinning scientific principles and concepts of microbiology that underpin food safety and quality assurance. As shown above, this combination is reflected in the Associated Assessment Criteria linked to the ELO.

Analysis of the Exit Level Outcomes using the four knowledge types proposed by Gamble indicates that all four Exit Level Outcomes show more than one knowledge type present, with two coded as K1/K2, one as K1/K4, and one as K2/K4. The four Exit Level Outcomes were coded as follows:

Table 5: Exit Level Outcomes with coding

1	Communicate in a variety of ways in a food and beverage manufacturing environment.	K1/K2
2	Maintain quality assurance and monitor critical control points in a food and beverage packaging manufacturing environment.	K2/K4
3	Operate a context specific range of automated packaging equipment.	K1/K2
4	Solve problems and improve an automated packaging process.	K1/K4

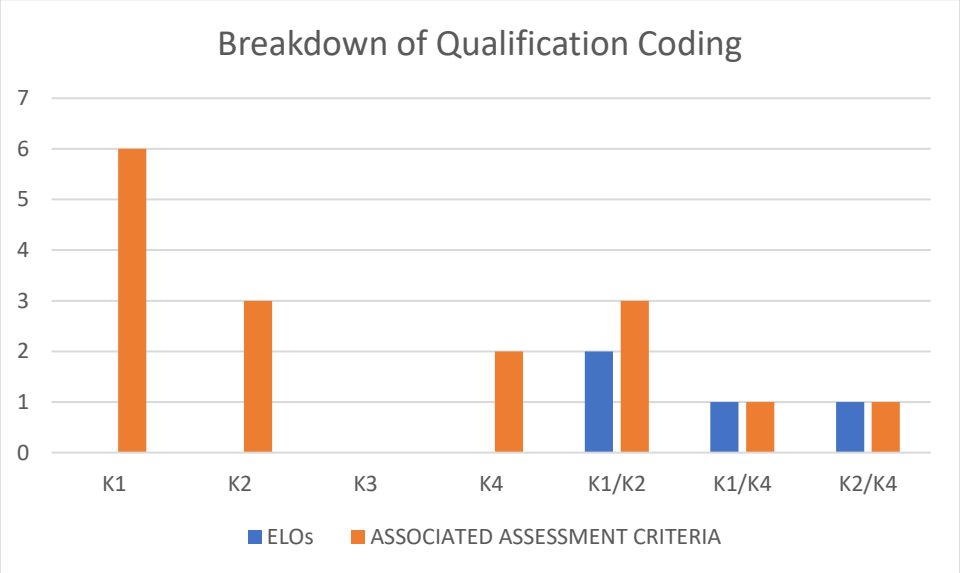
The full coding of each Exit Level Outcome and its Associated Assessment Criteria is included in Appendix E. It is interesting to note that most Associated Assessment Criteria were coded as procedural knowledge, with only four of the sixteen (25%) (Associated Assessment Criteria 1.3, 2.1, 2.2 and 4.3) coded as either general principled (scientific) knowledge or a combination of general principled knowledge with another type of knowledge (K4, K1/K4, or K2/K4). However, only two (Associated Assessment Criteria 1.3 and 2.2) are actually coded as general principled knowledge (K4) only and encompass 'technical packaging operating equipment terminology' and 'microbiological concepts and practices'.[9]

In total, 14 of the 16 criteria (88%) relate to procedural knowledge in some form with 50% of the criteria related to specific procedural knowledge. Six of the criteria are coded as specific procedural knowledge (K1) only, and a further three are coded as a combination of specific and general

[9] Refer to ELOs 1 and 2

procedural knowledge (K1/K2). Only three criteria are coded as specific principled (K2) only, equating to 44%. Overall specific procedural knowledge is the most prevalent type of knowledge required by the qualification, followed by general procedural knowledge. There is no direct reference to specific principled (K3) knowledge in the qualification and limited general principled (K4) knowledge.

Figure 2: Graph showing the breakdown of coding for the Exit Level Outcomes and Associated Assessment Criteria



Based on the above, it seems that the qualification focuses predominantly on procedural knowledge related to both the operator's workplace and the broader packaging environment. While there is some reference to principled knowledge, it relates to scientific knowledge required in the packaging environment, for example microbiology and packaging machine operating principles. The focus is therefore on the procedures that operators need to follow, with some background scientific knowledge to develop the novice's understanding of why certain procedures are necessary or done in a particular way. This strong focus on procedural knowledge may be related to the fact that the qualification was designed to focus on training new operators rather than on recognising the prior learning of experienced operators.

The knowledge required to gain the qualification appears to reflect what the qualification developers considered essential for novices to learn in order to become packaging operators. The focus on procedural knowledge in a qualification based on learning outcomes is unsurprising, considering that this is one of the key critiques of outcomes-based qualifications by social realists such as Young (2006) and Gamble (2006).

The RPL programme

In contrast to the SAQA qualification's intentions, the design of the RPL programme differed substantially from the model used for the roll-out of a traditional 'learnership[10]' version of the qualification. In South Africa 'learnerships' are designed to train novices — either those who are currently unemployed to equip them to find employment, or those who are currently employed but lack some of the competencies required for the job. A standard learnership runs over a period of approximately one year to 18 months and provides time for both classroom-based training and workplace experience. The generally accepted approach is that the time allocated is split 30% and 70% respectively. Unemployed learners are contracted for the period of the learnership and, ideally, spend the majority of their time at a host employer working in the relevant environment in order to learn how to do the job.

As the RPL programme was aimed at candidates who already had significant workplace experience and knowledge, the programme timeline was set at six months to allow sufficient time for the candidates to collect the necessary evidence. Furthermore, as there was no need for extensive classroom time, time out of the workplace was limited to 10 days.

RPL model

The model used for this RPL programme was designed to allow candidates to demonstrate their competence in operating the filling and labelling machines on a high-speed beverage packaging line, as well as their grasp of the supporting knowledge bases. The RPL programme was based on the training providers' understanding of the work environment that the candidates operated in. The programme was specifically aimed at experienced operators and was "not a curriculum for novices" (Turner, 2015, p. 10). The RPL programme specifically aimed to award the NQF 3 National Certificate: Food and Beverage Packaging Operations qualification to candidates who demonstrated the full range of knowledge, practical skills, and applied competence contained in the qualification. Within the specific environment in which the pilot was rolled out, all the candidates had previously been through

[10] The South African Qualifications Authority (SAQA) defines a learnership as "a work based learning programme that leads to an NQF registered qualification", and which is "directly related to an occupation or field of work" (SAQA, no date c). To date, the SETAs have been responsible for the quality assurance of these programmes under the NQF.

extensive non-formal internal company training. As described in the SAQA Bulletin article on this RPL programme:

> Foundational to the design of the RPL model was the specification in the qualification document that, for RPL, the "qualification will be awarded should a learner demonstrate that all the Exit Level Outcomes (ELOs) of the qualification have been attained" (SAQA, no date a). Through the Exit Level Outcomes of the qualification and their Associated Assessment Criteria, the assessment criteria of the individual unit standards that made up the qualification were addressed. As explained previously, learnerships train and assess learners according to the individual unit standards' specific outcomes and assessment criteria. However, the RPL programme focused on assessing candidates at higher level using the overarching Exit Level Outcomes of the qualification. Focusing on the Exit Level Outcomes instead of the individual unit standard assessment criteria reduced the need for extensive alignment exercises that were merely focused on 'ticking the boxes' of the unit standard assessment criteria. This also allowed for an integrated, holistic approach to evidence-gathering that demonstrated the candidates' ability to reflect critically on their evidence, while still ensuring that it aligned with the qualification requirements. (Tennison, 2019, p. 118)

First stage of the RPL programme

To generate interest in the RPL programme, information sessions were held by the training provider on-site at the factory for anyone who was interested and provided information about the programme as well as how to apply. Information about the RPL programme was also distributed through the company's internal communication channels. Any interested employees were invited to submit a comprehensive application form that included information about the candidates' experience in the packaging environment as well as any previous formal or informal training relevant to their RPL application. The application also included a supporting letter from the candidate's team leader.

Candidates submitted their completed hard copy application forms to the company's HR department, who then passed them on to the training provider for evaluation. Applications were evaluated based on their number of years of experience working in packaging facilities, as well other evidence of relevant prior knowledge and skills. Based on the applications received, 10 potential candidates were given the opportunity to complete the screening process.

The application process was followed by the completion of Screening Assessments. Screening was conducted on-site during shift times with the support of the packaging manager, and several time slots were scheduled to make allowances for shift times and candidate availability. The assessments consisted of paper-based assessment tools that covered literacy and numeracy as well as a further assessment to address the content knowledge required in the packaging environment.

To meet the qualification requirements for the fundamental[11] unit standards, candidates were required to meet minimum standards for literacy and numeracy. Literacy and numeracy screening was done using a screening tool that aligned each candidate's current English language and numeracy skills performance to an NQF level.

Candidates' packaging-related knowledge was also assessed using a test developed by a packaging subject matter expert. As the focus of the RPL programme was only on closing the knowledge gaps (see following sub-section), candidates were also expected to achieve a minimum of 70% in the technical packaging knowledge screening part of the assessment. Based on the results of the screening process, nine candidates were accepted into the RPL programme.

Second stage of the RPL programme

The second stage of the RPL programme involved contact time between the two programme facilitators (one a packaging specialist and the other a 'fundamentals' specialist) and the candidates, as well as the collection of evidence by the candidates in the form of a journal of their workplace experiences. As candidates entering the programme were expected to have a significant level of subject matter understanding already, contact time was limited to 10 days and focused on closing any identified knowledge gaps as well supporting candidates in the completion of their journals. The contact time was split between days focused on the 'fundamentals' (Mathematics and Communication) component and technical workshops focused on closing the candidates' technical knowledge gaps.

The fundamentals workshops were aimed at assisting candidates in identifying where they were already using Mathematics and Communication in their work, as well as providing guidance and inputs on how to compile their Journals of Workplace Experience. One of my roles in the RPL programme as the fundamentals facilitator was running the fundamentals workshops and providing language and writing support to the candidates during the completion of their Journals of Workplace Experience. The technical workshops brought in subject matter experts to both assist candidates in closing their knowledge gaps, and to encourage candidates to extend their understandings of the packaging environment.

As part of the contact sessions, candidates were guided as to the evidence requirements for their journals, and how to map the evidence in their journals to the Exit Level Outcomes and Associated

[11] As discussed previously, 'fundamentals' refers to the Communication (language) and Mathematics unit standards in the qualification.

Assessment Criteria of the qualification. The candidates were required to provide evidence gathered while operating each of the two machines — a bottle filler, and a labeller — for 10 days per machine. The Journals of Workplace Experience were compiled by the candidates while they were operating the machines and were comprised of any naturally occurring workplace evidence that the candidate felt may address the Exit Level Outcomes of the qualification.

The intention was that the journaling process would collect sufficient supporting evidence to demonstrate the candidates' competence and ability to perform the required tasks. The evidence collection took place over a period of approximately three months, with candidates spending six weeks on each of the two machines on which they were required to demonstrate competence. Unlike in the standard learnership model, as discussed previously, they did not spend time on the machines in order to learn how to operate them, but rather to allow them sufficient time to collect the required evidence. As I observed in my reflections on the process:

> The journal compilation process required extensive inputs from the facilitators, who assisted the candidates in accurately capturing the evidence of their competence. Candidates also had to reflect critically on their journals and align their evidence to the Exit Level Outcomes of the qualification, which they did successfully after receiving coaching from the facilitators. All nine candidates eventually completed their journals for both machines, and the journals were then assessed by a FoodBev SETA registered assessor. (Tennison, 2019, p. 122)

Final stage of the RPL programme

Once the candidates had completed their journals and had been found 'competent' by the assessor, they had to undergo a final assessment. Each candidate completed a Workplace Observation for each of the two machines, during which they were required to demonstrate their knowledge and skill in operating the machines. The Workplace Observation assessment instrument was originally designed and used by the training provider for the learnership version but, as it was specifically aligned to the Exit Level Outcomes and Associated Assessment Criteria of the qualification, it was also suitable for use in the RPL programme. The observations provided the final evidence of the candidates' abilities and, when combined with the journals, were intended to demonstrate sufficient evidence of competence for candidates to achieve the qualification.

The Workplace Observations involved the observation of candidates operating each machine for a period of several hours as part of the daily production runs with the intention of confirming the competences demonstrated/reported in the journals. FoodBev SETA-registered assessors, who were also packaging subject matter experts, conducted the observations. Once the candidates had completed the observations and met the assessment requirements, they were declared competent.

My role during the Workplace Observations was to moderate the assessment process by observing the assessments being conducted. The moderation role is a quality assurance function that confirms that the assessments were conducted correctly. However, for my purposes as a researcher, it allowed me to observe some of the Workplace Observations being conducted and I was able to make my own research notes based on what I observed.

Analysis of knowledge surfaced by tools used in the RPL programme

The RPL programme was designed to incorporate various assessment instruments and methods that were applied at different stages of the programme. The data produced by each tool was coded using Gamble's (2016b) four knowledge types to identify the types of knowledge surfaced by each tool. As touched on in the previous section, the assessment instruments used in this RPL programme were:

- A Screening Assessment that assessed the candidates' technical packaging knowledge to confirm their eligibility for the programme.
- A Journal of Workplace Experience that required candidates to record evidence of their workplace experience while working on the packaging line at the required machines.
- A Workplace Observation that was conducted at the end of the programme and that confirmed candidates' competence on the machines through an in-situ observation according to clearly defined outcomes. Evidence from these observations consists of both the assessment tool used to guide the assessor, as well as my notes taken during some of the observations that I was present for.

Each of these tools is discussed in more detail below, together with an analysis of the data produced by each tool to identify the knowledge types surfaced by each tool.

Interviews were also conducted post hoc with five of the candidates who had completed the programme, as well as with a subject matter expert who had been involved in the programme. The interviews were not part of the original RPL programme but were used for research purposes to validate the coding process and provide further insight into the knowledge surfaced in the Journals of Workplace Experience. These interviews are also referred to in the following sections to support some of the findings as they provide a deeper understanding of the candidates' evidence, particularly the Journals of Workplace Experience.

Technical Packaging Knowledge Screening Assessment

The Screening Assessment consisted of 50 questions broadly covering the theoretical packaging knowledge that an individual who is working as an operator on a beverage packaging line, and who had achieved the qualification, should have. This assessment was designed by a packaging subject matter expert who was familiar with both the company and the plant. By completing this assessment,

candidates demonstrated that they already had sufficient prior learning to complete the RPL programme.

The questioning style comprised a combination of multiple choice, true or false, fill in the missing word, and selecting the correct answers. The focus of the coding was on the types of knowledge that the candidate required to answer the questions as all the candidates' answers were the same because of the question styles used. Each question was coded according to Gamble's (2016b) four knowledge types, based on the knowledge that the question asked for. It must be noted that only 49 of the 50 questions were coded for knowledge types. This is because the last question on the assessment instrument did not refer to a specific knowledge type but rather focused on the values required of an operator.

The tool was designed to address the Exit Level Outcomes of the qualification, but the inclusion of this question related to the "Critical Cross Field Outcomes" that were included in unit standard based qualifications as an attempt to address "whole person development" and "reflexive competence" (SAQA, no date a). The notion of disposition and values will be discussed in the following chapter as it relates to the concepts of skill and expertise.

Questions that were coded as general principled knowledge (K4) focused on general principles of packaging, such as machine operating principles and raw materials, or theoretical knowledge of food safety and legislation. An example of a question coded as K4 is the following one about the science of labelling materials:

> Is the following Labelling Statement TRUE or FALSE?
>
> Conventional metallised paper is not suitable for labels that will be used on returnable bottles. The aluminium layer dissolves in the bottle washing detergent solution, leaving the printing ink to float free and contaminate bottles going through the washer.
>
> (extract from Screening Assessment)

This question requires candidates to use their scientific knowledge of the labelling process and raw materials to determine whether the statement presented is accurate.

Questions focused on knowledge related to procedures such as standard machine operation procedures or procedures related to standard food safety requirements were coded as general procedural knowledge (K2), as these are procedures that are not just applicable to that specific packaging environment. For example, the following question extracted from the Screening Assessment was coded as K2 because it deals with knowledge related to standard food safety procedures that are applicable to food handling environments:

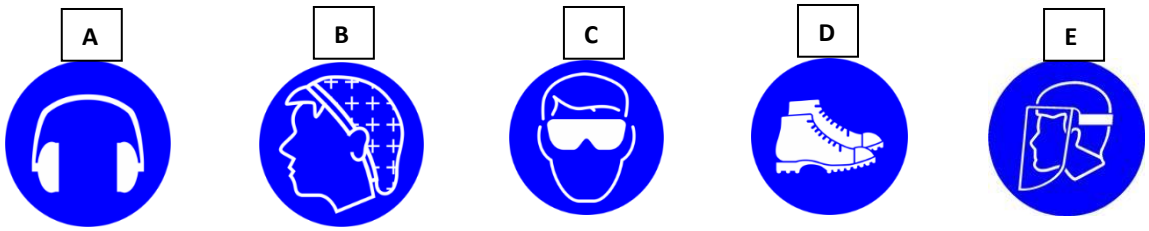
Select 3 GMPs expected from employees within the packaging environment:

A. Use clean and proper PPE
B. Jewellery can be worn when operating machines
C. Cover open wounds and report illness
D. Hair nets to be worn sometimes
E. Wash hands before and after toilet

(extract from Screening Assessment)

The question below was also coded as K2 because it focuses on the candidate's knowledge of health and safety signs that could be applicable to any workplace:

Identify the following Safety Signs displayed in the packaging hall and match the description from list below:



- Safety shoes
- Ear protection
- Full face shield
- Hairnet
- Safety glasses

(extract from Screening Assessment)

Both question examples above require knowledge of the procedures used in the packaging environment, but these procedures do not only apply to the candidates' specific environment.

The questions coded as specific procedural knowledge (K1) covered points such as the procedure to be followed for problem solving at the plant and documentation to be completed at the operator's workstation. An example of a question coded as K1 is the following question on the company's procedure to follow for problem solving:

Identify the correct problem solving escalation sequence.

1. Notify the Team Leader (TL).
2. Apply Quick Fix routine (QFR) to try and resolve the problem
3. Notify Process Artisan (PA).
4. If the QFR's do not rectify the problem, stop the machine.
5. Do 5 why with PA to find Root cause.

(extract from Screening Assessment)

Although the principles and some procedures of problem-solving could be applicable to a variety of environments, the procedure above is one that is company specific.

A question that was coded as specific, principled knowledge (K3) required candidates to visualise the principles behind two statistical process control graphs to decide which showed a process that was 'out of control'.

> Identify from the Quality Control Charts below which one is **IN CONTROL** and which is **OUT OF CONTROL**. Write down answers in the space provided.

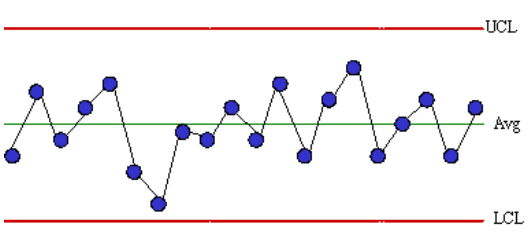


Chart A

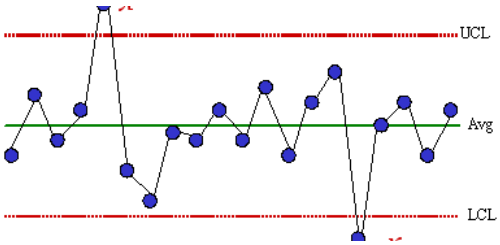


Chart B

(extract from Screening Assessment)

The above question required candidates to use a combination of their knowledge of the machine operating principles and company-specific parameters for machine operation to interpret what the graph was indicating about how well a machine was operating.

When analysed, the 49 questions of the Screening Assessment instrument that were coded for knowledge types showed a definite focus on the general side of Gamble's quadrants, as 39 of the questions were coded as either general procedural knowledge (K2) or general principled knowledge (K4). 25 of those 39 questions were coded as general principled knowledge (K4) while the other 14 of the 39 questions that were coded as general were focused on the general procedural knowledge that constitutes K2. The remaining 10 questions that were coded for knowledge types focused on company- and plant-specific knowledge, with nine of the 10 questions coded as specific procedural knowledge (K1) and only one question in the Screening Assessment coded as specific principled knowledge (K3).

It is evident that the Screening Assessment focused more on general knowledge rather than on knowledge specific to the candidates' specific context. There was also a definite focus on the general, principled, or scientific knowledge that underpins the packaging environment, which is understandable as it was designed to link directly to the qualification's theoretical knowledge requirements. In terms of the procedural knowledge required, the focus was also more on general procedural knowledge rather than company- and factory-specific procedures, although some of these were included. However, as noted above, there was also one question that dealt with the disposition

and values expected of an operator in that packaging environment. The inclusion of specific procedural knowledge and company values was possible because the subject matter expert who designed the assessment had worked at the same company and factory as the candidates.

Journals of Workplace Experience

The Journals of Workplace Experience were completed as part of Stage 2 of the RPL programme. As per the guidelines given to the candidates, the purpose of the journal was

> to provide [the candidate] with an opportunity to showcase how [their] previous learning, work experience and work performance matches the purpose and learning outcomes of the NQF Level 3 packaging qualification. (Turner, 2016)

Candidates were provided with an A4 hard cover book in which to complete their journals and required to produce 10 days' worth of evidence for each of the two machines that they operated (for this programme these machines were a bottle filler and a labeller). For each of the 10 days, candidates had to record a narrative of everything that they had been involved with while operating the machine, and then use this as a basis for adding further details of the packaging knowledge that underpinned that day's operations. They also had to collect supporting evidence in the form of any company documents used or recording sheets completed that day. Candidates also had to critically reflect on their journals and align their evidence to the Exit Level Outcomes of the qualification.

The aim of the journals, as the name suggests, was for candidates to capture their workplace knowledge gained through their experience in operating the machines, and this is what they did by focusing on the specific procedural knowledge that they encounter daily. Candidates explained their daily work routines and procedures in detail, referring to following the Standard Operating Procedures for their machines and outlining the context specific practices that they are required to do. These explanations included knowledge such as plant-specific requirements for quality testing (such as how often and where tests should be done) and what the company calls 'Quick Fix Routines (QFRs)' for solving common problems in their context.

Coding of the journals

In terms of the sequencing of analysis in this research, The Journals of Workplace Experience were the first tool to be coded using Gamble's (2016b) four knowledge types. The definitions and explanations of each of the knowledge types used by Gamble were used as the basis for determining which of the knowledge types was present in each of the journal entries. As the journal entries were quite extensive and included a range of knowledge and procedures, the different parts of each entry were coded separately. As this was the first attempt at coding, for the first few journals coded, detailed reasons

were recorded as to why the decision was made to code something as a particular knowledge type. An extract of the spreadsheet used for the coding is included below.

Table 6: Extract from coding spreadsheet for James' journal showing reasons for coding

Description	Coding	Reasons for Coding
Label stock reconciliation record sheets - pallet counting, recording number of labels.	K1	Filled in as per SOP.
Description of pre-shift meeting and referenced interpreting production plan.	K1	Context-specific.
Narrative account of what he did with regard to machines operated.	K2	Basic practical knowledge needed.
Explanation of how he did the 'recon' of the production run.	K1	Recon is based on procedure.
Reference to 'running sheets' which are attached, indicating maintenance tasks completed such as lubrication.	K1	Specific tasks to be completed, techniques used.
Description of how records of process inputs and outputs are recorded, including identified problems.	K1	Knowledge of how to record data.
Description of principles of pressure sensitive labelling.	K4	Used words to describe scientific principles – abstraction.
Description of how the labeller operates to maintain steady flow of labels.	K2/K4	Systems knowledge with procedure.
Pictures of recording label faults and fixing a broken web.	K1	Technique — specific ways of doing both activities, very practical.
Description of interpreting error message on machine and then rectifying error (web break).	K1	Follow procedure.
Explanation of how the web break was fixed.	K1	Practical knowledge of how to do correctly — technique.
Explanation of the impact of web break on KPIs.	K4	Higher level of theoretical knowledge demonstrated.

The reasoning was then reviewed and critically evaluated to further refine the definitions of the four knowledge types for use in coding the rest of the data. This process attempted to address what Ensor and Hoadley (Ensor and Hoadley, 2004) refer to as the "discursive gap" between the language of description, as laid out by the conceptual framework, and the empirical evidence produced through the data. The coding of the journals was thus an iterative process during which the refined definitions surfaced during the process were then used to code the rest of the journals, as well as the data from the rest of the tools.

Analysis

Once the journal entries were coded, the number of entries coded according to each of Gamble's four types of knowledge were collated. This is reflected in the table below.

Table 7: Breakdown of K coding in journals per candidate

	James	Shaun	Matthew	Nkosi	Leon	TOTAL	Example of type of journal entry coded this way
K1	58	81	69	83	47	338	Explanation of testing completed after new [tank] is connected.
K2	28	33	18	9	21	109	Description of conducting the [quality] check including doing a reference check with process checklist attached.
K3	10	9	7	0	4	30	Description of problem identified with labels and how he applied his machine knowledge to investigate and determine the cause of the problem.
K4	27	39	23	28	19	136	Detailed explanation of why cleaning and replacement of [filler] nozzles is done at the start of the shift, related to microbiological contamination, after assessor questioned.
K1/K2	2	4	2	2	1	11	Explanation of production plan with interpretation of what this means for his operation.
K1/K3	1	0	1	0	0	2	Explanation of terms used in their plant but includes explanation of how operators figured out a specific technique for ensuring line is cleared before changeover.
K1/K4	3	2	3	2	0	10	Description of putting [specific test] bottle through [inspection sensor] with explanation of why this is done and including photo of bottle.
K2/K4	3	0	0	1	3	7	Detailed explanation of CIP[12] including importance of correct time and temperature.
K3/K4	0	0	1	0	0	1	Detailed explanation of an identified problem on the labeller and the process that he went through in order to solve the problem.

The focus of the Journals of Workplace Experience rests in the realm of specific procedural knowledge (K1). An analysis of the entries for all the journals coded indicates that K1 is the most coded knowledge

[12] Clean-in-place (CIP) is a process used to clean the inside of the machines.

type in all five of the journals analysed and constitutes approximately half of all entries coded. Examples of entries coded as K1 include procedures followed to begin a shift, such as the following entry from a labeller journal describing the procedures followed when Leon came on shift.

> When I got down to the shop floor I received a handover from the morning shift (Process Operator) who said that they had some issues with floating back labels on start up and that it has been resolved by the machine specialist. I then confirmed that I will monitor the back labelling station and then I went about doing my daily and hourly machine and quality checks which are stated in my [process input and process output monitoring] sheets. I then checked if the video jet (date coding machine) was printing properly on the bottle and I also checked if the best before date was correct. I then swipe a label carton past the video jet nozzle which I then paste in my [process input monitoring sheet] as physical evidence that the date is correct. (extract from Leon's labeller journal, highlight in original)

The highlighted section in the above extract was linked by the candidate to Exit Level Outcome 3's Associated Assessment Criterion 3.1 – "Preparation and planning to operate context specific packaging equipment is conducted and documented to ensure quality and correct quantity of output is obtained" (SAQA, no date a). Below the entry, he had also pasted a picture of himself checking the date on a bottle to support his evidence. This was coded as K1 because it described the specific procedures followed in the packaging environment that the candidate was working in.

The other half of the entries in the journals were coded as covering all three of the other knowledge types, although the entries tend to focus on general principled, and general procedural (K4 and K2 respectively) knowledge and these two comprise most of the remaining journal entries. The journal entries coded as K2 (formal procedural knowledge) focus on routines and procedures that the candidates perform in their workplace but that are more generic in nature and do not apply only in the context of the current plant or company environment. These include standard test procedures that are replicated in various contexts and machine-related operations that are applicable to various machines or plants. The following journal entry was coded as K2 because it contains a description of the procedure for how Clean in Place (CIP) is conducted, which would be similar for any plant conducting CIP on a filler.

> The CIP consists of 2 points; Mains CIP and Filler CIP. Mains CIP is when we just cleaning the [product] mains with water at 80 degrees Celsius diluted with caustic, with a concentration of 80 for 1800 seconds and the rinsing the mains with WCA water. Filler CIP is when we cleaning the filler with water at 80 degrees Celsius diluted with caustic, with a concentration of 80 for 1800 seconds, then sterilising the filler for 600 seconds and then rinsing the filler WCA water. *Samples must be taken to be analysed*. Refer Figures 2, 2.1, and 2.2. To see CIP steps refer to figure 2.3. (extract from Shaun's filler journal, emphasis added)

The italicised section in the above extract was linked by the candidate to Exit Level Outcome 2's Associated Assessment Criterion 2.2 – "Micro-biological concepts and practices are applied to a

primary packaging operating line in order to prevent contamination and cross-contamination of products" (SAQA, no date a). The figures referenced are photographs of the relevant filler parts for sampling, the candidate taking the sample, and the filler HMI screen showing the steps for CIP.

The journal entries coded as K4 (formal, principled) included explanations of the operating principles of the machines and the scientific principles that underpinned the various processes that the candidate had explained, for example the microbiological principles that explain why cleaning is done is in particular way or why it is necessary to take microbiological samples after cleaning, as with the example below which follows on from the previous description of CIP and elaborates on the highlighted section about samples.

> We take filler CIP sample water to check if the CIP was effective and check if quality and concentration is at the right specification to eliminate (prevent microbiological contamination) to produce good quality [product] with no [product] spoilers (Shaun, extract from filler journal)

Further examples of K4 include explanations of the machine's operating principles and the science behind the use of certain raw materials, such as the types of labels used. James, for example, provided the following explanation of some of the principles of labelling.

> With PSL (Pressure Sensitive Labelling), it is a completely different setup to the normal paper labelling that we used to. We use a different aggregate and do not use glue. The PSL has its own sticky back and wipe down pads to press the label onto the bottle.
>
> I operated on labeller 1 and the labels are on reels. Only the neck label is a foil, but body and back labels are reels. There is two stations for the body and two for the back label. For example, stations 3 and 4 is for the body label. Both stations are set up and ready to run. So when station 3 runs out of reel, it will automatically change over to station 4. So while station 4 is running you as the operator will replace station 3 with a new reel of body labels and prepare it to run. This station will then go on standby mode. Once station 4 runs out of labels it will automatically change back to station 3. (James, extract from labeller journal)

It is interesting to observe that coding of entries as K2 and K4 tended to be fairly evenly matched, and only Nkosi had a very definite difference between the number entries coded as K4 and K2, with K4 significantly higher. The reason for this difference was not clear from the data. Three journals showed a higher prevalence of K4 over K2 coded entries, while the other two were reversed, with a higher prevalence of K2 over K4. The prevalence of general (formal) knowledge, both principled and procedural, is in line with the brief that the candidates were given when they were given the journals, as they were instructed to include as much information as possible to address all elements of the qualification.

Although limited to a few entries in four of the five journals, coding revealed the presence of specific principled (K3) knowledge which seemed to be surfaced in very specific ways. This knowledge came

through in the way that candidates discussed the application of principles to their machines, which required the visualisation of these principles in operation, or made use of hand-drawn sketches in their journals to demonstrate specific principles. The detailed evidence and explanations of how K3 was identified is included in the next chapter.

Not all entries, however, could be coded as one knowledge type. Although in the minority, certain entries seem to rest between two knowledge types. This tended to be the case in entries where the candidate wrote about procedures in a way that incorporated the application of their theoretical knowledge to the procedure. The most common dual classifications are specific and general procedural (K1/K2), and specific procedural and general principled (K1/K4). Entries with overlaps between K1 and K2 related to instances where candidates integrated their knowledge of standard procedures, such as procedures for conducting maintenance or quality testing, with site-specific procedures that they need to follow. Nkosi presented an entry in his filler journal that described the procedures he followed on a maintenance day:

> When CIP was running on its own I went to the filler to proceed with autonomous maintenance. From 07:30 to 08:30 I lubricated crowner and cleaned up excess grease also topped up autolube machine and topped up oil for lift cylinders. At 08:30 to 10:00 (90 mins) I did autonomous maintenance by serviced valve parts, I replaced 154 spreader rubbers, 154 tulips and changed 20 cradle springs. (extract from Nkosi's labeller journal)

In this example, the procedures for conducting maintenance such as lubrication and servicing valve parts are coded as general procedural knowledge, as they can be applied to any filler machine. However, there are also specific procedures related to the plant's requirements that are also included in the maintenance processes such as inspection checks that need to be completed according to site-specific documentation (included as supporting evidence for this entry by the candidate), hence the coding for a combination of K1 and K2.

There is often an overlap between K1 and K4 when candidates recorded entries in their journals dealing with the interpretation of figures or when they describe a site-specific procedure but include references to their knowledge of machine operating principles. In the first example below, the candidate used a combination of his understanding of the context together with an interpretation of the numbers that the line is running to make a judgement on how the line will run and was running:

> At 13:55 we go down to the line for the machine and process area handover, and the figure that we took at 14:00 end of morning shift paint a very good picture with a potential to run perfect with no deviations to our standards.
>
> The figures below confirm the above:
>
> [Labeller performance figures listed]

> … At the end of the shift we took our figures and indeed it was a good shift with the following figures posted and recorded at labeller no. 3
>
> [Labeller performance figures listed]
>
> … As we were heading to the change room at the end of the shift we also noticed on the Poly Comp screen that the line ran 100% that afternoon. (extract from Nkosi's labeller journal)

A further example of an entry with an overlap between K1 and K4 relates to James' explanation of the procedure for a particular quality check in which he includes a brief explanation of the reason why it is conducted:

> I put the vent tube bottle through the Post Fill Bottle Inspector (PFBI). (Sometimes while in the process of filling a vent tube will sometimes come loose and drop into the bottle). The PFBI, if it properly set up should reject this bottle every time. I do this twice at the start of the shift. (extract from James's filler journal, highlight in original).

The highlighted point was linked by the candidate to Exit Level Outcome 1's Associated Assessment Criteria 1.2 – "Measuring instruments are used to measure production inputs and outputs and record information according to organizationally acceptable methods" (SAQA, no date a).

The third most prevalent combination appeared to be that of general procedural and general principled knowledge (K2/K4). This kind of coding was made when candidates detailed a standardised procedure but included the scientific principles that underpin it, for example a quality check that is conducted together with an explanation that demonstrates a general scientific understanding of how the test works. In the following example, Leon described a standard test that checks how well attached the labels are to the bottles, including references to his understanding of the principles on which it is based:

> I also had to take samples for ice proofing which the morning shift forgot to do and I was asked by the team leader to take the samples. This sampling happens on every pack/brand change or Monday start ups. We do the sampling because of the different materials of labels and glue that we apply to line one's different bottle sizes. We take three samples per labelling machine from the discharge after the video jet machine, fill in the dates and work ticket (batch numbers) on the ice proofing document. All this information written on the ice proofing document confirms the production dates and timespan of the labelling or glue materials. We then take the ice proofing page together with the six bottles of both machines to the packaging sampling lab where the line one quality technician will collect it and perform the ice proofing test by soaking the bottles in water for 12 to 24 hours depending on the type of labels or glue used on the bottles. This check is also done for bottle washing purposes to see how long the label will stick to the bottle before coming loose due to the wetness or temperature of the water. (extract from Leon's labelling journal)

The coding of combinations of specific procedural and specific principled knowledge (K1/K3) and specific principled and general principled knowledge (K3/K4) were also made, but only in a very limited number of entries. Only two entries are coded as K1/K3 and only one as K3/K4. These entries are of

interest, however, as they demonstrate instances where the candidates made use of their knowledge of either plant-specific procedures or theoretical concepts but then went on to apply their knowledge, particularly during problem-solving, directly to the machine without requiring codified procedures to follow (e.g. written documents such as SOPs).

In one entry coded K1/K3, for example, James explained how the operators had figured out a specific technique for ensuring that the line is cleared before changeover. This example involves putting into language very specific contextual knowledge that is passed between operators and was not written into any company documents, something which was confirmed by the company Subject Matter Expert (John) when asked about it in his interview. In the entry coded as K3/K4, Matthew gives a detailed explanation of an identified problem on the labeller and the process that he went through to solve the problem, during which he made use of his understanding of the labeller's operating principles, but, more importantly, he explained how he was able to visualise these principles in operation on the actual machine. As these entries support the presence of craft-like knowledge (K3), they will also be unpacked in the following chapter in the section that deals specifically with craft-like knowledge.

In conclusion, it is evident from the above analysis that the Journals of Workplace Experience that the candidates produced demonstrated a diversity of knowledge types. The predominant knowledge type in the journals was specific procedural knowledge as candidates recorded their daily work practices. However, there was also evidence of a broad range of other knowledge types surfaced in the journals. Candidates included evidence of knowledge in these journals that ranges from pictures of themselves completing tasks that tended toward Gamble's (2016b) concepts of situated and formal procedural knowledge, to detailed descriptions of their understanding of the theoretical principles behind the machine operation and how they have used this theoretical knowledge to solve problems that occurred in their environment. This is supported by the interview data, where the candidates were probed about their problem-solving processes.

Workplace Observations

The Workplace Observations were conducted by the assessor during Stage 3 of the RPL programme. The assessor observed the candidates during two separate observations of between four and six hours for each candidate. Each observation covered a specific machine as well as addressing some of the other qualification requirements.

The data coded and analysed in this section comprises the formal assessment instrument used by the assessor for each of the two observations per candidate, as well as my research observation made

while observing six of the assessments conducted. The six assessments observed are reported on using my research notes as, due to the noise of the environment, audio or video recordings were not possible. It was also not possible to write down candidate-assessor exchanges verbatim. However, the combination of the assessment instruments and my research observation notes provides a clear picture of the types of knowledge surfaced during the Workplace Observations.

Coding and Analysis of the Workplace Observation Assessment Instruments

The assessment instruments used were the same as the ones used to assess learners who have completed the traditional 'learnership', as the Exit Level Outcomes assessed are the same in both cases, since they were based on the same qualification. The instruments were designed by a subject matter expert at the training provider and had been approved by a FoodBev SETA external moderator. They contain a combination of points that the assessor had to observe, as well as what the tool termed 'Probing for Critical Thinking and Problem Solving'. The latter were questions designed to be asked while the candidate was operating the machine and were aimed at getting candidates to explain the knowledge that underpins what they were doing. They had to explain through critically reflecting on their actions while they were operating the machines, although certain questions only required explanations of procedures that the operator followed. The observation points and questions are aligned to the qualification Exit Level Outcomes and Associated Assessment Criteria.

When coding the assessment instruments using the four knowledge types, it became evident that most of the assessment instrument focuses on procedural knowledge in the observation points. An overall analysis of all observation points and questions show that specific procedural and general procedural knowledge (K1 and K2) accounted for almost double the number of points and questions coded as K4. There was no evidence of specific principled knowledge (K3) being required in the assessment instruments' observation points or questions.

Observation points coded as K1 included actions that the operator had to take, which were performed according to site-specific procedures, for example the following actions from the filler observation:

Action: Attended Pre-Shift Meeting
Obtained Production Plan
Conduct Shift Handover
Check Raw Material availability
Plan for changes

(extract from Filler Workplace Observation Assessment Instrument)

Similarly, the following questions were linked to the above actions and require candidates to elaborate on the site-specific procedures and were therefore coded as K1:

Question 2: Describe the action to be taken when the machine runs outside of the acceptable parameters.
Question 3: Explain the procedure you use to confirm that the measuring instruments are working and accurate.

(extract from Filler Workplace Observation Assessment Instrument)

Observation points coded as K2 required candidates to demonstrate general procedures that would be common to any similar packaging environment, such as health and safety procedures, quality checks, and machine checks. Actions from the labeller assessment instrument that were coded as K2 included:

Action: Wear the correct PPE
Practice personal hygiene
Action: Conduct all QC checks

(extract from Labeller Workplace Observation Assessment Instrument)

Questions in the labeller assessment instrument that were coded as K2 required candidates to explain their demonstrated actions in more detail and to elaborate on some of the more abstract procedures such as formal problem-solving procedures or company-wide general procedures, as can be seen in the examples below.

Probing for Critical Thinking and Problem Solving: Question 1: Explain how you would go about inspecting and cleaning the labeller in a safe manner.
Conduct formal 5 WHY problem solving
Probing for Critical Thinking and Problem Solving: Question 1: Explain the process [the company overall] follow in order to derive value from the maintenance systems used in order to improve all round machine performance.

(extract from Labeller Workplace Observation Assessment Instrument)

Upon further analysis of the differences between the observation points and the questions, it became apparent that the observation points address mainly procedural knowledge, as they require the assessor to observe what the candidate was doing while running the machine, for example conducting quality checks or conducting pre-shift checks. The number of points requiring specific procedural knowledge is, however, substantially higher than those requiring general procedural knowledge.

There were also observation points that were coded as seeking evidence of both specific procedural and general procedural knowledge (K1 and K2), such as when the candidate is required to conduct quality checks (general, procedural) and then record them on the required documents (specific, procedural), such as those in the example below.

Question 3: Compare the operator's role to that of the maintenance department in making certain that the machines run according to supplier specs and standard operating procedure.
Probing for Critical Thinking and Problem Solving: Question 1: Indicate the action taken as a result of recording the information. Point out the triggers for problem solving.
Perform Valve Sampling
Product: ATP measurements conducted and recorded by Learner
Action: Locate and Reference the Start up WI for Filler Crowner and EBI.
Action: Run & Monitor the Filler, Crowner, EBI
Product: Completed maintenance schedules (incl. walkabouts and scheduled maintenance)
Question 3: Discuss the steps to be taken if the in-built safety mechanisms are found to be inoperative

(extract from Filler Workplace Observation Assessment Instrument)

There were a small number of general principled (K4) observation points which tended to focus on asking candidates to identify the parts of the machine or interpret process documentation using their theoretical knowledge of the machine's operating principles. These observation points in many cases seek to identify a combination of K1 or K2 and K4 knowledge and have thus been coded as K1/K4 or K2/K4. The example below has an observation point that was coded as K1/K4 as it requires the candidate to review documentation (K1) but also to interpret trends using their knowledge of the scientific principles related to the quality checks, which is probed in the questions related to the observation.

Review Quality check sheets for the last week and interpret trends for key parameters: Ph; DO & Alcohol.	K1/K4
Probing for Critical Thinking and Problem Solving: Question 1: Explain the importance of the test bottle check and the non-conformance procedure.	K2/K4

Question 2: Explain the SPC concepts associated with the structure of the Quality graphs. (Limits!)	K4
Question 3: Identify how the limits promote food safety and quality.	K4

(extract from Filler Workplace Observation Assessment Instrument)

By comparison, although many of the probing questions probe knowledge coded as procedural knowledge, a much larger number of these questions cover general principles and scientific knowledge, such as:

The operating principles of the labeller are described.
Different techniques for solving problems or making decisions are explored and an indication is given of when each is appropriate.

(extract from Filler Workplace Observation Assessment Instrument)

Often these probing questions covering general principles and scientific knowledge follow on from the procedural observations and require the candidate to explain the theoretical principles underpinning the procedures or tasks that they have just completed. An example of this is that, after the candidates have been observed conducting quality checks at the filler, they are questioned about some of the food safety principles that dictate the procedures, such as the following extract from the filler observation:

Action: Conduct all QC checks
Out of Control (OOC) Procedure
Probing for Critical Thinking and Problem Solving: Question 1: Explain the procedure to be followed when QC results are out of specification
Question 2: State the risk associated with deviating from the laid down frequency of QC checks.
Question 3: How are the frequencies at which QC checks are conducted determined.

(extract from Filler Workplace Observation Assessment Instrument)

There were also a number of instances where, as with the observation points, questions probe knowledge that has been coded as a combination of specific procedural or general procedural and general principled knowledge (K1/K4 or K2/K4). For example, candidates were asked to explain a specific procedure and then give a further explanation on the reasons why the procedure is important.

There were a few instances where observation points or questions were coded as a combination of specific procedural and general procedural knowledge (K1/K2). This coding was used for instances where the observation point or question requires the candidate to complete or explain a series of procedures which combine plant- or line-specific procedures with general procedures. An example of this is the observation point that requires the candidate to be observed running the machine. To do this, the candidate must complete the specific procedures required by the plant while also completing the general procedures that would be applicable to running any machine. For an example, see the following observation point from the labeller:

Action: Run & Monitor the labeller.	K1/K2
Product: Quality Checks.	K2

(extract from Labeller Workplace Observation Assessment Instrument)

For this observation point, the candidate is required to run and monitor the labeller, which requires them to follow the plant-specific procedures but also the general procedures that are used for running that type of labeller and conducting the standardised quality checks that would apply to any beverage-labelling environment.

Researcher's Observation Notes on the Workplace Observation

When comparing the coding of the assessment instrument with my own observation notes, it became apparent that the assessment instrument did not capture the operator's own personal knowledge and practical experience in operating the machines, which extended beyond what was required by the qualification. This is to be expected, however, as the assessment instrument is designed against the qualification which focuses on training new operators rather than recognising the prior learning of experienced operators. My notes, however, seem to reflect a wider range and depth of knowledge in comparison to what is required by the assessment instruments.

This is particularly true of my research observations that I coded as specific principled knowledge (K3) which, though not evident in the assessment instrument, seemed to be demonstrated by candidates during the assessment process. I recorded multiple comments in my notes from several of the observations referring to the candidates' ability to use the icons and readings on the HMI (Human Machine Interface) computer screens (used to control the machines), and their ability to interpret their meaning based on what they could see the machines doing. As can be seen in the extract from my research notes below, candidate Themba takes what he is seeing on the screen and applies it in

conjunction with his understanding of what is actually going on with the machine to decide how to proceed and make a judgement on whether he needs to adjust the machine. As I described in my notes:

> looking at HMI figures and recording on [process monitoring sheets] – [he is] able to explain why, even though different to normal, he is not worried about pressure reading (extract from my research observation notes on WO2)

I also commented in my notes for another candidate's assessment that

> [There are] lots of little icons on HMI screens – [Leon] knows which ones to select in order to make [the sensor] eject bottles for sampling. Needs to know numbers for sampling and how to select specific bottles. (extract from my research observation notes on WO3)

Aside from my identifying its presence in candidates' interpretation of HMI screens, specific principled knowledge (K3) also seemed to be surfaced during problem-solving, where candidates visualised the principles through applying them to the machines in order to make adjustments to the machines. I remarked in my notes that

> Matthew can judge whether labels are correct and then fix it – identified why machine rejecting and then adjusted to fix. (extract from my research observation notes on WO1)

A further example is my description of problem-solving done by Neville. The candidate was questioned on problem-solving by the assessor but, in the process, demonstrated his ability to solve problems using his understanding of the labeller and its operating principles. An extract from notes of my observations of the Labeller Workplace Observation for Lucas' assessment of Neville recorded an exchange between the assessor and the candidate:

> Lucas: "What happens if there is a problem (faults)?"
>
> Neville explained. Picked up actual problem, explained what was happening and what cause was. Carefully examines machine to see what is wrong in the way it is running — makes minor adjustments then checks again before making more minor tweaks, then allowing machine to run. Calls out to colleague about where the problem is. Explaining what he is doing as he goes. Carefully observes machine, stops it, adjusts again then restarts. Explains what was happening. Checks product to make sure all ok now. Visually examines labelled bottles plus uses gauge to check. Then checks camera on screen and goes back to check bottle visually. (extract from my research observation notes on WO4)

The role of visualising principles is carried through into various elements of the assessment as my notes reported a further incident where "Leon battles to recall some information to explain although he knows what to do – [he is] using pens[13] to demonstrate what he means while explaining" (extract

[13] Leon made use of the pens to physically represent the machine parts that he was explaining.

from my research observation notes on WO3), suggesting that he is only able to properly explain what he is doing when he can use a visual aid (in this case pens) to show how the principles are applied.

The above descriptions of the candidates' ways of conceptualising the relationship between the parts and whole, while not in a traditional craft context, still resemble the visualisation principle of craft knowledge (Gamble, 2004a). Candidates were not just touching icons on the HMI to control the machine; they were interacting with a diagram on the screen in order to visualise the way in which the different parts interact within the whole of the filling or labelling process. Candidates were also able to visualise what is happening to conduct problem-solving involving the interaction of the parts with the whole process. While this cannot be termed craft knowledge *per se*, it does suggest a form of 'craft-like' knowledge.

According to my observations, when comparing the coding of the observation points and probing questions of the assessment instruments with the way in which the assessors actually conducted the assessment, it was evident that, although all the points on the instrument were addressed by the end of the assessment, the assessors mediated between the instrument requirements and each candidate's knowledge and practices.

As both assessors were subject matter experts with experience in that particular environment, they were able to use their understanding of the processes to interpret the requirements in line with the specific environment. This was highlighted on one occasion when my observer notes specifically flagged that, for one of the candidates who was more comfortable in Afrikaans, the "assessor [was] able to translate [the] Afrikaans answer and records on tool in English" (extract from my research observation notes of WO4). Furthermore, as described in the previous paragraph, the assessor could interpret Leon's explanation using visual aids and link it to the requirements of the assessment instrument.

Types of knowledge surfaced through the RPL programme tools

The RPL programme, through its various tools, surfaced a wide spectrum of knowledge with the different tools highlighting specific kinds of knowledge. As the SAQA qualification requires candidates to demonstrate their competence in packaging machinery operations and the tools were designed to meet the qualification requirements, a high level of procedural knowledge became evident. Coding for Gamble's (2016b) knowledge quadrants surfaced a substantial amount of knowledge coded as K1 and K2, i.e. both specific and general procedural knowledge. The focus on procedural knowledge was confirmed during the interviews when candidates were asked about what they felt the most important

things were that an operator should know to do their job successfully. Interviewees' answers to this were all fairly similar, focusing on safety first and then machine operation and quality aspects.

> There's a wide range of things; firstly, you need to know safety. Safety in and around the packaging hall, safety with regard to doing the job on the machine; the basic operation of the machine; the quality that's required; the critical control points of the machine, and the area that you work in. (extract from Interview 2)

Shaun further added the need to understand the elements of maintenance, which was repeated by Leon, and what he referred to as 'first level problem-solving' — this is the basic problem-solving that all operators are required to do and is fairly routine-based. The two kinds of procedural knowledge (K1 and K2) were particularly evident in the Journals of Workplace Experience and in the assessment instruments for the Workplace Observations.

It is interesting to note however that, although limited, there was also evidence of specific principled knowledge, coded as K3, in some of the journal entries and in the implementation of the Workplace Observations. General principled or scientific knowledge, coded as K4, is not excluded from either the journals or the Workplace Observations but certainly came to the fore in the Technical Packaging Knowledge Screening Assessment.

Knowledge in the RPL programme versus knowledge in the qualification

Based on the findings reported above, there are distinct differences in the types of knowledge present in the qualification in comparison to the knowledge surfaced by the RPL programme's tools. Although the tools used in the RPL programme were designed from the qualification, the way in which they were enacted by the candidates and assessors during the programme allowed for a much broader range of knowledge types to be surfaced.

The qualification is focused mainly on the specific and general procedural knowledge required for new learners to become packaging operators. Although some general principled knowledge is present, it is only in relation to what is required to support the packaging process, for example machine operating principles and microbiology related to food safety. By comparison, the RPL programme a surfaced a much broader range of knowledge types.

The knowledge types and complexity of knowledge surfaced through the RPL programme varied in the different tools. The Screening Assessment surfaced more general principled knowledge as it was designed to determine whether candidates had the underpinning knowledge required by the qualification. Thus it was tied very closely to the general principled knowledge present in the

qualification outcomes. As this was a knowledge assessment with very clear model answers, there was no scope for candidates to demonstrate any further knowledge beyond what the questions asked.

By contrast, the Journals of Workplace Experience were aimed at allowing candidates the opportunity to provide their own evidence that they felt demonstrated their competence and then to link it back to the Exit Level Outcomes and Associated Assessment Criteria of the qualification. As a result of this, most of the evidence in the journals related to procedural knowledge and specific procedural knowledge in particular as required by the outcomes of the qualification. Candidates provided evidence of their daily practices in their work environment, many of which were specific to their site and even their line. However, the candidates also included various pieces of evidence that went beyond what the outcomes of the qualification required and demonstrated the broader knowledge held by the candidates.

Although not as prevalent as the specific and general procedural knowledge, candidates included evidence of both specific and general principled knowledge. While the general principled knowledge linked back to that required by the qualification, the specific principled knowledge was of particular interest as it demonstrated the candidates' ability to visualise the principles and interpret them through sketches, diagrams, and even photographs of the machines and processes. The descriptions of problem-solving also provided insights into how candidates applied these principles to the machine as they worked. These forms of knowledge were often also presented in combination with each other, as indicated by the journal entries that were coded for more than one knowledge type. This points to the way knowledge types may be enmeshed with one another within the context of the workplace and is also an indication of the complexity of the workplace knowledge surfaced by the Journals of Workplace Experience.

The Workplace Observation tool was also designed to directly reflect the Exit Level Outcomes of the qualification and, as a result, also focused on both specific procedural and general procedural knowledge, with some of the probing questions covering general principled knowledge. However, because the Workplace Observations are conducted by the assessors while the candidates are operating the machines, the knowledge types surfaced during the Workplace Observations include specific principled or craft knowledge (K3). These knowledge types became evident to me in my research observation notes on the Workplace Observations that I was present for.

The candidates demonstrated their competence while operating the machines, drawing on their knowledge of the machines and procedures, as well as their ability to visualise the relationship between the parts, in the form of procedures, and the whole, as the entire filling or labelling process

included principles of operation. This was then 'translated' by the assessors onto the Workplace Observation tool to reflect that they had met the tool's (and therefore the qualification's) requirements. Thus, although the assessment tool only catered for certain forms of knowledge, the knowledge surfaced during the Workplaces Observations, and captured in my research observation notes, suggested that the knowledge required in the workplace was more complex than that required by the assessment tool.

It is apparent, therefore, that, through the RPL tools and programme, candidates were able to demonstrate a much broader range of knowledge types, as well as complexity of knowledge, than what was required by the qualification. The candidates' depth of knowledge was most apparent during problem-solving. Although their journals referred to solving problems using the Quick Fix Routines (QFRs) drawn up by the company, and which draw on specific procedural knowledge, the candidates also used their own understanding of the machines to solve problems that went beyond the simple QFRs. How they did this requires a further exploration of other elements that are involved in occupations, and the way in which the candidates function in their workplace.

The prevalence of procedural knowledge in the qualification and, therefore, the RPL programme's tools gave further support to the argument that outcomes-based qualifications favour procedural knowledge over the principled knowledge required for an occupation (Gamble, 2006; Young, 2006). What does become apparent through the forms of knowledge surfaced by the RPL programme tools is the extent of underpinning principled knowledge required even in an automated work environment, even if it is not present in the qualification.

In Chapter 2's account of how vocational knowledge is conceptualised, it was argued that there is a recontextualisation of principled knowledge into vocational practice through its relationship with work (Young, 2006; Hordern, 2019). This interplay between vocational knowledge and vocational practice, together with the 'enmeshed' nature of knowledge types (Young, 2006) in a particular occupation, has been illustrated through the findings discussed in this chapter. These concepts and findings will be further unpacked later in this thesis. However, the forms of knowledge present as captured through Gamble's (2016b) classifications provide only part of the picture. In considering the broader understanding of knowledge and expertise discussed in Chapters 2 and 3, it is also necessary to examine the data through the lenses of skill and expertise, as well as considering the role of tacit knowledge. The findings related to these concepts will be discussed in the next chapter.

CHAPTER 6: MOVING FROM KNOWLEDGE TO EXPERTISE

This chapter builds on the findings on the types of knowledge surfaced in the RPL programme discussed in the previous chapter but extends the analysis beyond the type of knowledge categorised by Gamble's (2016b) four-quadrant model. While craft knowledge was discussed in the previous chapter as it forms part of Gamble's specific, principled knowledge quadrant (K3), elements of craft knowledge also feed into the findings around tacit knowledge.

Moving on from Gamble's knowledge types, this chapter attempts to identify the tacit knowledge demonstrated by the candidates during the process. It examines how skill and expertise were surfaced in the RPL Programme, using the conceptualisations of skill and expertise developed in the conceptual chapters and then provides a description of the disposition and values identified in the candidates' exercise of skill and expertise. Finally, it considers how these concepts are applied in the form of expert judgements made by the candidates in the course of their work.

Organisation of work

In order to unpack the expertise surfaced in the RPL programme, it was necessary to have an understanding of how work is organised in this high-speed beverage packaging environment. This section provides a brief description of the work environment, drawing on some of the concepts described in the section on deskilling in the previous chapter. Gamble classified the sites of her study according to

> …the kind of problem-solving found in a particular labour process configuration: tending towards routine problems and predictable or standardised solutions; or tending towards complex problems requiring new and innovative solutions. (2016b, p. 5).

This draws on Pye's (1968) concepts which capture the complexity of work through the contrast between certainty and risk, where "The difference lies in the degree of predetermination of the end result" (Gamble, 2016b, p. 4). Gamble proposes that certainty and risk are opposite poles of a continuum where workplaces "try to reduce risk and aim for work of certainty through the use of templates and jigs in handcraft, through automated work processes, or through strict adherence to standard operating procedures (SOPs) and health and safety procedures" (Gamble, 2016b, p. 4).

Distinguishing between risk and certainty particularly as it relates to problem-solving provided a useful approach to examining the organisation of work in the high-speed beverage packaging environment that the RPL programme was based in. Analysing the RPL candidates' Journals of Workplace Experience as well as their Workplace Observations for work of certainty and work of risk, coupled

with confirming data from the interviews, provided some insight into the organisation of the work environment.

As an automated manufacturing environment, the expectation based on the deskilling literature was that this was likely to be a routinised environment with limited exposure to risk. The coding of the Journals of Workplace Experience and the Workplace Observations for certainty and risk did point to a relatively routinised environment. Examples of coding for work of certainty in the Journals of Workplace Experience related to descriptions by the candidates of how process inputs and outputs were recorded. This included recording identified problems, and how a candidate a conducted a [quality] check, including a photo and the relevant document. Further indications of work of certainty included where basic problem-solving relies on the use of Quick Fix Routines (QFRs)[14]. In the interview with Matthew, when asked about problem solving, he clarified that company policy starts with using the QFRs and the problem is only escalated when the QFRs do not work. Matthew is an expert labeller with quite a few years of experience working in the plant on both machines.

> QFRs is stuff that we generally do without even knowing that we're doing it. Say, for instance, your machine, I'm working at the filler, the machine stops, or you can see there is a valve that's under-filling, your natural instinct, as the operator, is to, if there's a moment, stop the machine, check what the problem can be. A lot of the times, it's only a spread rubber that has to be replaced, you replace it quickly, and you run, your problem is solved; that is QFR. So you do it sometimes without even knowing that you're doing it, but it all falls in line with the company's policy. (extract from Interview 1)

What is of particular interest is the way in which he explained how the QFR procedures become routinised for the operators, to the point where they conduct QFRs without even thinking about the process that they are following. I will return to this aspect later as part of the findings around skill and expertise.

While the majority of the data pointed to a work environment that centred on routines and certainty, there was also evidence of work of risk, particularly as it related to scenarios of complex problem-solving where the outcome was not predetermined. An example of this was contained in one on the Journals of Workplace Experience where James described how he was involved in testing new parts for the filler machine and had to make his own recommendation on which part to use, based on his expertise. The use of judgement by the machine operator for problem-solving was also supported in the interview with John, the packaging subject matter expert who was involved with the RPL programme who explained that the operator needs to apply his knowledge of the problem-solving process and the company's procedure to decide how to approach the problem and when to escalate

[14] Quick Fix Routines (QFRs) refer to routine problem-solving guidelines provided to operators that detail commonly experienced problems and provide solutions to follow.

it. The use of judgement is also significant for the operator when applying their own solutions to problems on the machine as they can apply their own understanding during problem-solving within certain limits.

> So they have got a, I can't say a fair amount, but they have got a good amount of leeway in terms of doing what they must do, to get it right, provided that quality is not impacted, or your speed is not impacted, or secondary damage to the machine is not impacted. When they do those things, many times, their learning will then be shared amongst the operators, if it is a good learning. Other than that, he has then to account for maybe making correct decisions. (extract from Interview 3)

The use of judgement will be discussed in more detail later in this chapter but, for the purpose of this section, it is important as it pointed to the presence of work of risk in a seemingly routine and automated environment. This supports the argument that there are certain tasks that cannot be automated as they still require an operator to deal with the uncertainty (Kim, 2019). In classifying a work environment using the risk-certainty continuum, Gamble argues that

> The ideal description of most types of technical and artisanal work would probably be at the midpoint between complete predictability and complete unpredictability of results. In reality, though, it is likely that any one kind of work may tend to veer more to the one side or more to the other. For certain components of work, there may also be more certainty, while, for other components, there may be a greater degree of risk. (2016b, p. 5)

For the high-speed beverage packaging environment that this case study was based on, the data suggested that it predominantly rested at the certainty pole of the continuum but that there was still a degree of risk present. This combination of a greater degree of work of certainty, while still being exposed to some work of risk, provided an environment that enables the machine operators to develop expertise and implement their own judgement, as will be seen in the findings that follow in the rest of this chapter.

Surfacing tacit and craft knowledge

In the previous chapter, findings were presented based on Gamble's (2016b) classification of knowledge into four quadrants: specific procedural knowledge (K1), general procedural knowledge (K2), specific principled knowledge (K3), and general principled knowledge (K4). Within this framework, she classifies specific principled knowledge as craft knowledge. Although the evidence for the presence of this form of knowledge has been discussed briefly in the previous chapter, it will be revisited here within the context of its use in expertise and judgement, as well as how it relates to tacit knowledge.

Tacit knowledge, as discussed in Chapter 2, although forming part of craft knowledge, is conceptualised more broadly and it was proposed that it was possible for it to be present in other forms of knowledge as well. Extending beyond the presence of tacit knowledge in the context of specific principled knowledge, this section will present findings based on an analysis of the data using the conceptualisation of tacit knowledge from Chapter 2 that focused on possible forms of tacit knowledge surfaced in the RPL tools. This includes identifying the presence of sensory tacit knowledge.

Surfacing tacit knowledge

In the discussion of tacit knowledge in Chapter 2, the point was raised regarding the difficulty in identifying tacit knowledge in the RPL programme tools since they were developed for a learning outcomes-based qualification. The use of learning outcomes, as Gamble (2004b) argues, tends to result in qualifications that do not allow for tacit knowledge because of the demand that everything be made explicit for the purposes of assessment. However, in analysing the data, tacit knowledge did appear to be present and was suggested by some of the entries in the Journals of Workplace Experience, as well as in my research observation notes on the Workplace Observations.

As the definition of tacit knowledge relies on its implicitness and inability to put it into words, analysis of the journals required some inference of the presence of tacit knowledge in the written data, generally through the presence of craft-like knowledge which will be discussed later in this section. The research interviews conducted after the RPL programme was completed also allowed for the gathering of detailed descriptions that confirmed the inferences drawn from the other data sources.

There was also evidence of tacit knowledge recorded in my research observation notes from the Workplace Observations. Candidates struggled to describe certain elements of what they were doing in the journals, and this difficulty became most apparent during their machine operations as part of the Workplace Observations. Even for operations that would seem to be easier to explain and put into words, such as calculating raw materials, James commented that “I know it, but I can’t write it down... can’t get it out of my head” (James as quoted in my observation notes from a contact session with candidates). The inability of the candidates to language certain of their practices was echoed by Lucas the assessor in one of the Workplace Observations where he commented to me that “they tend to know what they do but they don’t relate it to the terminology” (extract from my research observation notes on WO1).

As indicated above, tacit knowledge was surfaced during the Workplace Observations. This was most evident during problem solving, as seen in the extracts from my observer notes on Matthew's Labeller Workplace Observation, conducted by Lucas:

> Matthew [shows] familiarity with machine – "we do a quick fix because this machine does … which causes a problem" using his own knowledge on how to limit a problem.
>
> Matthew: "we run these machines, so we know what the problems are" (extract from my research observation notes on WO1)

Although the above extract refers to a quick fix, this was not the documented Quick Fix Routines (QFRs) where a specific procedure is followed. The subject matter expert (SME) John explained during his interview that operators develop their own quick fixes based on their experience of operating the machine — "so as they get to know the machine, they would then apply some of their quick fixes" (extract from Interview 3). These become part of the greater body of knowledge that operators rely on as part of the 'shared learnings' where operators pass knowledge between themselves.

In referring to new learners coming into the plant, John points to the need for them to develop some of the tacit knowledge and the sensory tacit knowledge of the more experienced operators:

> So they're... academically, they're clever, and it's easy to rote-learn quite a few things. But when you have somebody who's doing something... the same thing all the time, that learning becomes embedded, and there's nothing that can add that same value, so ja. (extract from Interview 3)

There is a transfer of uncodified knowledge, where such knowledge is shared between operators, enabling others, such as newer operators, to learn and then apply the knowledge to their own machines. As John stated in his interview:

> there are a few things that are not written at his machine, but they would pick it up through problem-solving or wanting to learn further, during valve maintenance, or during a breakdown, where the machine owner is involved. (extract from Interview 3)

This suggestion of collective tacit knowledge shared between operators is related to the collective feature of expertise (Guile and Unwin, 2019) that draws on tacit knowledge. Tacit knowledge was also present through the individuals' own understanding and vocational practices, and this was surfaced through the Workplace Observations, particularly in the form of sensory tacit knowledge.

Sensory tacit knowledge

The role of sensory tacit knowledge in the context of the operator's environment was surfaced through my research observation notes of the Workplace Observations, as well as through the interviews with both the candidates and the SME. The importance of the operator engaging with the machine using their senses, particularly in terms of touch (tactile tacit knowledge), hearing (auditory

tacit knowledge), and seeing (visual tacit knowledge), while they are operating the machine is referred to by the SME during the interview when he states that

> …he's the owner of the machine, so he's the one who knows the feel of the machine, he knows the sounds of the machine, he knows the ins and outs of the machine; maybe not from a technical ability, but from an operational ability. (extract from Interview 3)

This is further apparent in the way in which operators speak of their practices and refer to their ability to respond to problems on the machine. For example Matthew spoke about the importance for an operator, particularly on the filler, to be aware of what is happening on the machine through using their senses.

> The machine needs to be watched, you need to watch that machine; you need to listen, because your eyes is not always on the machine. So we are now so tuned in with our ears, like you can hear, like before a crown jam even happen, I can hear the crowner makes a certain sound that only you, as the filler operator, identifies, when you hear that sound, you know. (extract from Interview 1)

Tactile tacit knowledge

As candidates operated the machines, it was evident that they are very familiar with the skills and, in particular, techniques required to run the machines. This was particularly evident while observing Matthew as he operated the labeller. Although familiar with both the filler and the labeller, he is an experienced labeller operator and this was apparent in the way he ran the machine and his ability to use the correct techniques for certain tasks, as recorded in my research notes:

> Matthew packing labels onto magazine at speed — very specific set of movements as he picks up each pack of labels, takes off binding, and packs it into magazine. Does it almost without looking. (extract from my research observation notes on WO1)

It is also interesting to note that, while he was packing labels, Matthew was conducting a discussion with the assessor about other aspects of the labeller's operation. A similar scenario occurred during another of the Workplace Observations as per the following extract from my notes on the observation of Neville's Filler Summative Observation conducted by Lucas:

> Neville answering questions (unrelated to current task) as he works through the steps in starting up the filler. (extract from my research observation notes on WO4)

The experienced operators demonstrated how deeply ingrained these techniques and routines had become as they were able to continue what they were doing while in discussion with the assessor, even when their discussions were unrelated to the task they were completing. Yet, when asked about what they are doing, they found it difficult to answer. In my notes from my observations of Themba's Filler Workplace Observation conducted by Steven, I recorded a comment from someone on the factory floor who was observing the assessment, who remarked that "You do this every day, but you

get asked about it and you go blank" (my research observation notes on WO2). These examples also refer to the exercise of skill and techniques, which align to Coetzee's (2011) description of routinised or habituated skills that draw on tacit knowledge as discussed in Chapter 2.

These ingrained techniques and routines may also be seen as a form of sensory tacit knowledge, and tactile tacit in particular, as candidates are able to engage with their machines while barely thinking about what they are doing, as well as relying on their senses to engage with the machines, for example using 'feel' to do checks on the machine or to determine whether a setting was correct. An extract from my notes for the observation of James' Labeller Workplace Observation conducted by Lucas, describes how

> James checks by feel how much labeller feed is still there. Changes reels as quickly as possible — knows how to thread and join reels on machine. (extract from my research observation notes on WO6)

Candidates are also able to make adjustments to the machine based on their ability to feel the correct pressure response from the machine using their hands. During the interview when asked about the use of QFRs versus experience during problem-solving, Leon answered very specifically that although QFRs are there and are specific, they become outdated as machinery changes and that, even in using QFRs, there is a definite need for experience. He outlined a scenario where they had replaced a valve on the labeller (which had to be adjusted by the Process Artisan (PA) and required using a spanner) with a knob that was easier to adjust but pointed out that, in order to adjust the knob to the correct setting, the operator still required experience on the machine before they could 'feel' the settings correctly. During his interview, when he was asked about problem-solving and whether he only follows the QFRs or whether he can use his own understanding, Leon explained:

> There's certain issues that comes, that only comes with experience. Like our QFRs is specific, but it's also outdated, because our machinery gets modified all the time. So there would be certain things that, like we've got a penetration [..] labeller now, just currently; where, in the past, we used to loosen now, the whole magazine by [..] with a spanner, and we used to move it forward, we'd have to call a PA to do that. Currently now, we don't need the PA to do it, because they replaced the whole penetration valve with a knob that you can just turn. But a younger, or a newer operator would not know, because he would not be able to estimate as to how much further in, or how much further out, to take it. So in terms of that, yes, it comes with experience. That is something that I can show you, but you're going to have to do it frequently, in order to understand what's happening. You also need to feel the tension on the rope, and stuff like that, in order to know, okay, this is too tight, or that's going to cause too much pressure on your label. So ja, certain things comes with experience only. Your QFRs can guide you up until there, but they can only help you up until so far. (extract from Interview 6)

This example describes how Leon has developed what Polanyi (1969) refers to as 'focal awareness' of the process of adjusting a knob on the labeller that affects the way in which the labeller is applying labels. Although he does describe some of what he is doing, he speaks about how it is not something that he can easily explain as it is based on his experience with the machine, which suggests that the inputs he feels through his body have become a 'subsidiary awareness' providing the clues that contribute to his focal awareness of the whole of the adjustment process.

Auditory tacit knowledge

What also became evident to me during the observations is how candidates were able to use their knowledge of the machine's sounds to identify possible problems, despite the surrounding noise. This phenomenon was noted several times in my observer notes, for example:

> Themba can easily identify by hearing what is happening – e.g. burst bottles. (extract from my research observation notes on WO2)

My notes on my observation of Neville's Filler Workplace Observation conducted by Lucas, record that

> although there is a cacophony of sounds in the plant (bottle clanking, machine noise, whistles, hooters, intermittent radio calls, etc.) and everyone wears ear protection, experienced operators recognise the sounds from their machine and react to them immediately. Neville switched from labeller to filler and adjusted to the filler immediately, ignoring whistles from the labeller. (extract from my research observation notes on WO5)

I also noted in another of my observations that the "labeller alarm [is] almost imperceptible above [the] noise, but James responds immediately" (my research observation notes on WO6). This points to the presence of auditory tacit as candidates draw on 'sonic skills' (Bijsterveld, 2018) by using their hearing as a source of knowledge that allows them to identify and respond to problems on the line. The same seemed to also be true for the assessors who conducted the Workplace Observations. They were both experienced subject matter experts who used to work for the company and, for Lucas, in the same plant as the candidates. Despite no longer being continually exposed to the noise, Lucas was able to still hear the different sounds and react accordingly. For example, my research observation notes describe a situation where the packaging line was "currently running out brand for changeover. Assessor used to work on the line, heard a noise and immediately reacted to situation to rectify" (my research observation notes on WO5).

Visual tacit knowledge

The candidates were not only attuned to the sound of the machine that they were operating but also seemed to possess a level of visual acuity that enabled them to notice any differences on the line. I made a note of this in my observation of Neville's Filler Workplace Observation conducted by Lucas,

stating that the candidate had a “trained eye to notice 1 bottle going past amidst 100s of bottles but also knows to observe bottles” (extract from my research observation notes on WO5). This ‘trained eye’ that allowed Neville to immediately pick out the difference between one bottle and hundreds of others as they sped past on the line points to presence of visual tacit in the way that he interacts with the filling process.

The use of visual tacit knowledge was also identified during my interview with Leon when I asked about his journal entry where he included a hand-drawn diagram of the problem and the corrected version, and he explains a problem that he identified with a labeller sensor that was misaligned to the bottle and how he rectified it. Although this journal entry points to his use of the craft principle of visualisation, in answering this question, he also provided an interesting insight. Although company policy would say that everything is documented, there are still certain elements on the machines where knowledge is transferred directly between operators and not recorded. It also highlighted a scenario where his experience was critical in order to identify that there was even a problem. He explained how, previously, they were required to record information about a particular sensor in their process input recording documents but that this is now no longer required.

However, because he sees the value in doing this, he has continued to make a note of these figures and, in doing so, used that information to identify a problem with the sensor before it impacted their production too substantially. He then went on to detail how he used marks made on the machine by the electrical specialist to check the sensor and, thereby, fix the problem, pointing to his use of visual tacit in aligning the sensor to the marks. These marks are not part of the formal problem solving and are only used by the experienced operators as a check if there appears to be a problem because the current standard is for an electrician or process artisan to do the set up on the machine.

The role of experience in developing tacit knowledge

What was also apparent is the value placed on the operators’ years of experience in machine operation. There was an acknowledgement from the candidates, assessors, and even other operators, that the years of experience add value to the candidate’s ability to operate the machines correctly:

> Assessor Lucas: “Neville is very experienced. Stuff Neville is doing should be done according to [Work Instruction (WI)] but is not being done due to operators taking short cuts which causes problems. You can see the impact of Neville’s changes in improved quality”. [My note: Neville is doing it correctly according to WI.]
>
> I further commented in my notes that “due to experience, Neville is able to engage with [Process Artisans] and others around problem solving. Can explain what they are doing”. (extract from my research observation notes on WO4)

James also affirmed the importance of experience, particularly in terms of how it adds to the candidates' tacit knowledge and ability to problem-solve. When asked by Lucas the Assessor about the relationship between Work Instructions and problem-solving, he commented that "Most of the guys are here long, we've got our ways of fixing things" (extract from my research observation notes on WO6). The role of experience in connection with tacit knowledge will be further developed in the discussion on expertise later in this chapter.

Craft-like knowledge

As presented in the previous chapter, evidence for a form of craft-like knowledge was identified in certain entries in the Journals of Workplace Experience as well as through my observations of the Workplace Observations. To confirm these proposed classifications of craft-like knowledge, these examples were referred to during my research interviews conducted with the candidates after the RPL programme. The interviews with both the candidates and the subject matter expert provided useful insights into how the operators use their procedural and principled knowledge of the various 'parts' of the packaging process and apply it to their visualisation of the broader 'whole', particularly in the way in which they conduct complex problem-solving.

Although presented as part of the larger coding of the Journals of Workplace Experience in the previous chapter, the analysis of the entries coded as specific principled (K3) knowledge is presented again here for reference in the table that follows.

Table 8: K3 coding in journals per candidate

	James	Shaun	Matthew	Nkosi	Leon	TOTAL	Example of type of journal entry coded this way
K3	10	9	7	0	4	30	Description of problem identified with labels and how he applied his machine knowledge to investigate and determine the cause of the problem.
K1/K3	1	0	1	0	0	2	Explanation of terms used in their plant but includes explanation of how operators figured out a specific technique for ensuring line is cleared before changeover.
K3/K4	0	0	1	0	0	1	Detailed explanation of an identified problem on the labeller and the process that he went through in order to solve the problem.

As observed in the previous chapter, the number of entries that relate to craft-like knowledge was limited. The examples of craft-like knowledge arose in specific instances where candidates demonstrated the use of the visualisation principle (Gamble, 2004b, 2004a) that defines craft-like knowledge, which occurred most often in the way candidates could draw on their own understanding of machine operations and principled knowledge to solve complex problems. The small number of crossover examples — where entries where coded as a combination of specific procedural knowledge (K1) and craft-like knowledge — were as a result of James referring directly to his understanding of procedural parts and then using that to solve a complex problem related to the line as a whole. In this entry he attempts to describe how they conceptualised the problem and its solution:

> <u>Making Plan</u>
>
> - This is where we get an amount of [product] to run for the day e.g. 5000 HLs. I will then deduct what morning shift and afternoon shift produced, Whatever is left, that is the amount that our shift must run. We also produced a few hectolitres extra to make allowance for [product] loss.
> - Cut off!! – In previous years we had worked out that when 1 line is totally full of empties and there is still ten pallets of empties on the conveyors to the depalletiser, and we have +- 400 hectolitres product in the [tanks] – this is enough to run out the line. So the end result is no product plus no empties on the line when you start the changeover. (extract from James' filler journal)

The entry coded as K3/K4 is an entry where Matthew gives a detailed explanation of an identified problem on the labeller and the process that he went through to solve the problem, during which he used his understanding of the labeller's operating principles, but, more importantly, he explained how he could visualise these principles in operation on the actual machine:

> Today I had major issues with Label faults on labeller 4. My machine started off rejecting minimal bottles so I had to investigate. My problem solving then included checking if the pallets on the back label aggregate was clean, that the glue applied wasn't excessive to the point where the label moves around with the pressure of the penetration. Constantly monitoring this process.
>
> With the above problem- solving label faults were still not looking better. I then started looking at the amount of penetration from the magazine, the amount of pressure from the follower, these were correct. At this rate I was now getting label faults of about 401 label faults per hour which is about 383 more label faults than what I am allowed per hour.
>
> I then called my shift PA [Process Artisan] over the radio and requested that we should look at what the problem may be from a mechanical point of view. While investigating he could not find a cause to the problem. We then had to escalate this problem to the workshop and we had the workshop Machine Specialist (MS) come out to look at the problem. The MS completely stopped the machine and took the aggregate apart, he could not find any fault.
>
> I suggested to him that we should replace the pallets as they seem to be very sticky, regardless of the fact that the drip from the CIP water was ample to keep the gripper and pallets clean. He then agreed and brought me new pallets a little later. In the meanwhile we had recorded label faults of about 1050 for the shift which was a major concern.

> Upon replacing the pallets I noticed a drop in label faults, going from 325 in one hour to 33 in the next hour and then to just 7 in hour after which means my suggestion worked. (extract from Matthew's labeller journal)

This description of Matthew conducting complex problem-solving, although involving the Process Artisan and Machine Specialist, clearly shows how he was able to draw on his understanding of the labeller's operating principles and the parts of the process, in terms of what should be occurring on the machine, and was able to visualise the way they should apply to the whole of the production process in order to understand what he was seeing on the machine with the sticky pallets.

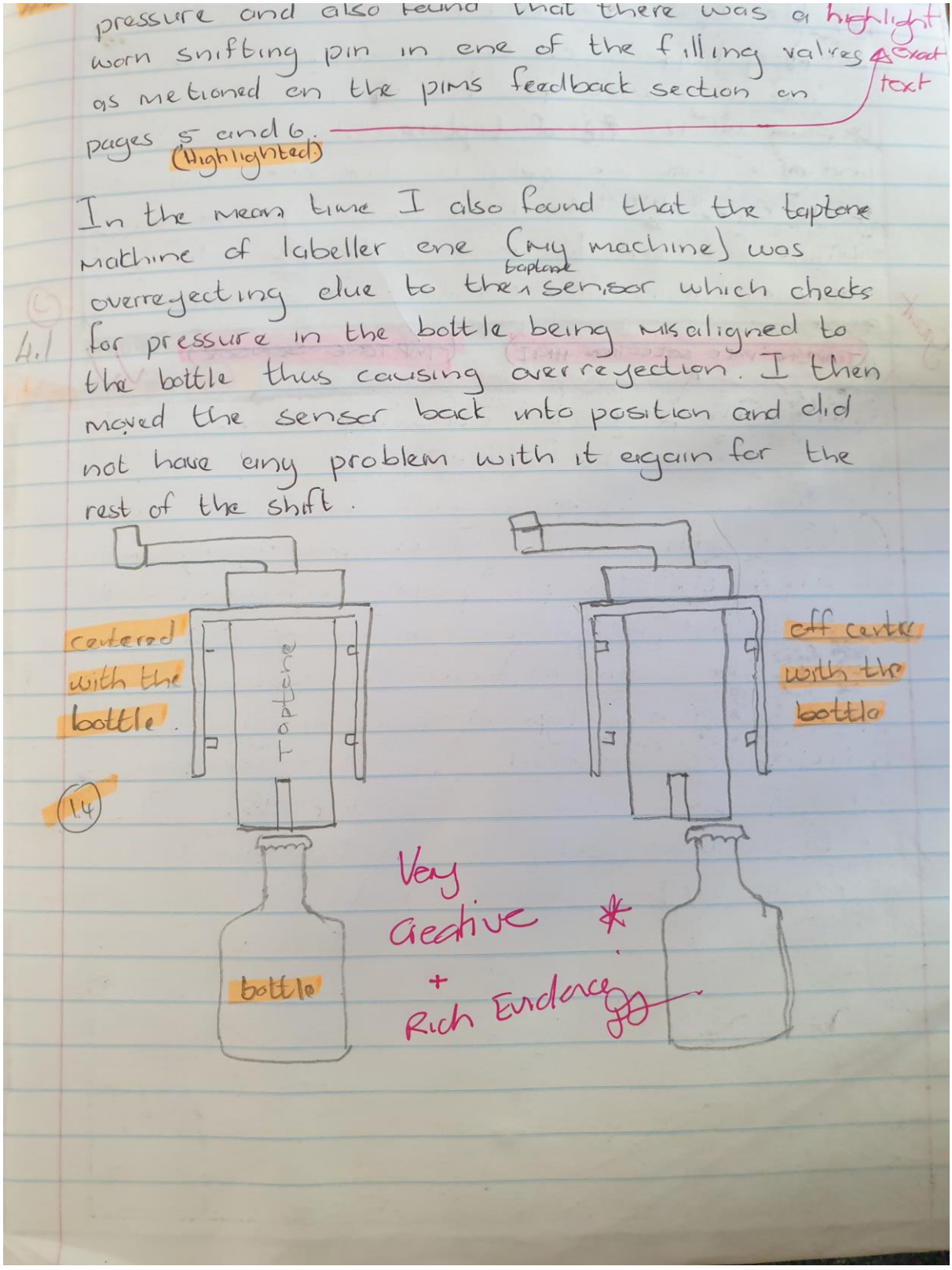
I coded Matthew's understanding of the labeller's operating principles as general principled knowledge (K4), as the operating principles involve scientific principles related to how the machine functions and the science of labelling materials. The use of his own judgement in this scenario to recommend a solution suggests that there is an element of work of risk (Pye, 1968; Gamble, 2016b) in the work, despite it being an automated process. I will return to this in the later section on the use of judgement and occupational expertise.

Journal entries that were coded as evidence of craft-like knowledge specifically occurred in four of the five journals. The example that relates most directly to the definition of craft as a visualisation of principles through diagrams occurs in the Leon's labeller journal. Leon has several years of experience, although he has spent more time operating the labeller than the filler. His journal includes several entries coded as K3 as he made use of several hand-drawn diagrams and photos to visualise his understanding of the machines.

Leon's journal entries also include several descriptions of work of risk and how he had applied his knowledge to various situations on the line to reduce risk in the work processes, particularly related to problem-solving scenarios. In the entry below, he explained how he identified a problem with a labeller sensor that was misaligned to the bottle and how he rectified it, including a hand-drawn diagram of what the problem and the corrected versions looked like:

> In the mean time I also found that the taptone machine of labeller one (my machine) was overrejecting due to the taptone sensor which checks for pressure in the bottle being misaligned to the bottle thus causing overrejection. I then moved the sensor back into position and did not have any problem with it again for the rest of the shift.
>
> (extract from Leon's labeller journal)

Figure 3: Diagram from Leon's labeller journal



Leon was also questioned during the interview about his journal entries that focus on how he solves problems using his knowledge of the machines and the operating principles of the machines. The first was a journal entry which includes a hand-drawn diagram of the problem and the corrected version, where he explains a problem that he identified with a labeller sensor that was misaligned to the bottle and how he rectified it. In answering this question, the candidate provided an interesting insight into how, although company policy would say that everything is documented, there are still certain elements on the machines where knowledge is transferred directly between operators and not recorded, but also where his experience was critical even in identifying that there was a problem.

The journal entries coded as craft-like knowledge (K3) tended to relate to scenarios where candidates were engaged in problem-solving but were using their understanding of the parts of the process, in combination with their vocational knowledge and vocational practice, to visualise the whole process. While this did not always involve the traditional visualisation principle suggested by Gamble (2004a, 2004b), as it did not always involve diagrams, the concept of visualisation is brought across through the operators' ability to draw on their understanding of the relationship between parts and whole in a more 3-dimensional form as well 2-dimensional pictures and diagrams. This came across in some of the interviews when candidates were asked to explain the problem-solving processes that they had followed.

One example of this was Matthew's response to a question on an entry in his journal where he explained how he had identified a problem on the filler and used his own understanding of filler operation to solve the problem by applying the knowledge to the machine directly. This was coded as a combination of specific procedural, and general principled knowledge (K1/K4). However, when questioned about this during the interview, he asked to make use of the picture in his journal to visualise what he had done and explain it, which suggested that there may also have been an element of craft-like knowledge (K3) involved.

James was the operator with the most experience in operating the machines, particularly on the filler, and this is evident in the amount of tacit knowledge that came through in both his journal and the interview. He was questioned about an entry in the labelling section of his journal where he conducted problem-solving on the labeller. In the entry he seemed to use judgement in combination with his machine knowledge applied to the situation to solve a problem. This entry was coded as specific principled (craft-like) knowledge (K3), and the candidate was questioned to confirm the validity of this coding. When asked to explain how he solved this particular problem, he replied "Look, it comes down to experience, and the fact that I've been working there for plus minus thirty years; you know what to look out for" (extract from Interview 2), which confirms the original coding of the journal entry.

While not craft knowledge in its 'traditional' sense — where the craftsman is visualising the parts of the construction of a table using a diagram and then building the whole in the final product of the table as described by Gamble (2004b), the evidence suggests that craft-like knowledge is still present in this environment. It is apparent in how the candidates, as experienced operators, draw together the parts of machine's process in order to visualise the whole filling or labelling process of the machine, incorporating the required principled knowledge in their manufacturing context.

Skill

Coding for skill

As proposed in Chapter 3, drawing on the work of Winch (2012), the analysis of skill in the RPL tools makes use of a continuum between 'knowing that', or principled knowledge, that is not used in the exercise of skill (coded as H--), and 'knowing how', or procedural knowledge, that is directly related to procedures in skill and technique (coded as H++). By coding the data in this way, it allowed for a more nuanced analysis that included instances where skill might have been underpinned by forms of principled knowledge (coded as H-), and where skill is only moderately underpinned by procedural knowledge (coded as H+).

This coding allowed for a nuanced description of how skill was exercised in relation to the knowledge bases that it drew on. As discussed in the methodology, using a continuum enabled a better way of addressing the 'discursive gap' (Ensor and Hoadley, 2004) between the original language of description that only differentiated between 'knowing that' and 'knowing how', where only the latter could be used to classify skill. It was noted during the coding of the RPL tools using this continuum that there were similarities with the coding for Gamble's (2016b) four quadrants, which relates to the overlap in the classifications as knowing that and knowing how are, in essence, a variation of the concepts of principled and procedural knowledge, respectively. However, the use of the 'knowing that' — 'knowing how' continuum was preferred because it focused on surfacing of skill through the knowledge bases identified.

What the SAQA qualification says about skill

When coded using the continuum between 'knowing how' and 'knowing that', three of the four Exit Level Outcomes of the qualification are coded on the 'knowing how' side of the continuum, with one coded as H++ and two as H+. The fourth outcome is coded as H-. Once broken down into the Associated Assessment Criteria, a similar pattern is evident as four criteria are coded as strongly 'knowing how' (H++) and a further nine as moderately 'knowing how' (H+). The criteria coded as H++

all relate to operating packaging machinery to produce a product, for example Associated Assessment Criterion 1.4 which states:

> Operating data is collected and recorded according to generally accepted norms and practices and standard operating policies and procedures. (SAQA, no date a)

This was coded as H++ as it refers to generally accepted norms and practices and standard operating policies and procedures which are directly related to knowing how and the exercise of skill. While not as strongly related to knowing how, the criteria coded as H+ relate to a range of skills and procedures that require some theoretical knowledge but still relate mostly to practical elements of the packaging environment, for example Associated Assessment Criterion 2.1:

> Critical control points in a packaging line are identified, monitored, and maintained to ensure health and safety standards are met. (SAQA, no date a)

This criterion, although still focused on a practical knowledge base and the exercise skill, includes the need for a small amount of knowing that related to what constitutes a critical control point in terms of food safety theoretical knowledge.

Two criteria are coded as moderately knowing that (H-) and only one criterion as strongly knowing that (H--). The criterion coded as H-- relates to technical packaging terminology:

> Technical packaging operating equipment terminology is identified and explained according to supplier specifications and standard operating procedures. (SAQA, no date a)

The explanation of the packaging equipment terminology is focused on theoretical 'knowing that' and is not directly related to the exercise of any specific skills. In contrast, the two criteria coded as H- refer to food safety and quality principles but require application of the knowledge to the 'packaging operating environment'[15] and include the exercise of skill, for example Associated Assessment Criterion 2.3 which states:

> Quality control and quality assurance practices are applied in a packaging operating environment. (SAQA, no date a)

Although a theoretical knowledge of food safety is required, it forms a knowledge base for the exercise of specific skills related to the application of quality control and quality assurance practices.

The prevalence of outcomes and criteria coded on the knowing how side of the continuum correlates with the results of the coding for Gamble's (2016b) four quadrants, which presented the majority of the outcomes and criteria as procedural knowledge. This is also in line with the critique presented in

[15] This is the term used in the qualification document - see ELO 2: "Maintain quality assurance and monitor critical control points in a food and beverage packaging manufacturing environment" (SAQA, no date a)

Chapter 1 that qualifications based on learning outcomes are focused on procedural knowledge and skills, to the detriment of the inclusion of principled knowledge (Gamble, 2006; Young, 2006).

Skill in the RPL tools

Technical Packaging Knowledge Screening Assessment

When coding the assessment instrument questions using the continuum between 'knowing how' (referred to also as practical knowledge) and 'knowing that' (referred to also as theoretical knowledge), the majority of questions were either coded as H-- or H-. This indicated that most questions contained a high level (moderately knowing that for H- and strongly knowing that for H--) of subject or theoretical knowledge and fell on the 'knowing that' side of the continuum.

In total, 21 of the 50 questions were coded as strongly knowing that with extensive subject or theoretical knowledge. These were questions that focused on the theoretical principles behind packaging operations, for example the purpose of labelling and filling and the importance of applying food safety and quality principles, such as the question below on the operating principles of the filler:

> Is the following statement TRUE or FALSE?
>
> The bottle in-feed screw, at the filler, spaces the bottles at the correct distance apart and then feeds them to the first star-wheel.
>
> (extract from Technical Packaging Knowledge Screening Assessment)

Fourteen questions were coded as H- (moderately knowing that) which still incorporated substantial theoretical knowledge. These were questions with practical elements such as identifying the probable causes of a particular problem or applying their knowledge of health and safety legislation to their work environment that may be used as a knowledge base for certain skills. An example of a question coded as H- was the following question on health and safety that required the candidates to apply their understanding of health and safety legislation to their work environment:

Match the following National Occupational Health & Safety Act statement to the correct Workers duty.

A. Look after your **own** health and safety.	a. **Report hazards**
B. Look after other workers who could be hurt if you do something unsafe.	b. **Follow instructions**
C. Report any unsafe or unhealthy situation that you notice to your supervisor/safety representative as soon as possible.	c. **Own safety**
D. You must carry out instructions about health and safety, or the OSHACT, given to you by your employer or supervisor.	d. **Report incidents/ accidents**
E. Report any accident or incident as soon as possible, BEFORE the end of the shift, to your supervisor/safety representative.	e. **Co-workers' safety**

(extract from Technical Packaging Knowledge Screening Assessment)

Although mainly focused on more theoretical questions, the assessment instrument incorporated eleven questions that focused on the 'knowing how' side of the continuum. Only four questions were coded as H++ (containing mainly practical knowledge), these questions related to specific procedures that operators follow, for example the procedure that the operator follows to escalate a problem:

Identify the correct problem solving escalation sequence.

1) Notify the Team Leader (TL).
2) Apply Quick Fix routine (QFR) to try and resolve the problem
3) Notify Process Artisan (PA).
4) If the QFR's do not rectify the problem, stop the machine.
5) Do 5 why with PA to find Root cause.

a) 1;3;2;4;5 or b) 2;4;3;5;1 or c) 3;1;2;5;4 or d) 2;4;1,5,3

(extract from Technical Packaging Knowledge Screening Assessment)

Ten questions were coded as H+ and these were questions that still required substantial practical knowledge but did require reference to some theoretical understanding, for example questions regarding safety where candidates were asked about functions of safety equipment:

Fill in the missing words by choosing from the list below:

- Shatterproof
- Flying,
- Protected coated,
- Broken.

A. Safety glasses, to protect your eyes against ……glass.
B. Safety shoes, to protect your feet against …….. glass on the factory floor.

(extract from Technical Packaging Knowledge Screening Assessment)

These were also questions that required candidates to use the practical knowledge bases of the skills that they use in their work environment.

Thus, when coding for the knowledge bases related to the exercise of skill, it became evident that the focus of the technical packaging knowledge screening assessment was not on skill but, rather, on the 'knowing that' side of the continuum. As the aim of the screening assessment was to determine the candidates' knowledge of the packaging environment, this does make sense. The inclusion of more procedural questions on the 'knowing how' side of the continuum also tended to include reference to elements of theoretical knowledge that formed the knowledge base for the exercise of skills related to the procedures being explained.

Journals of Workplace Experience

The coding of the journal entries using the continuum from knowing how (H++) to knowing that (H--) further demonstrates the prevalence of the procedural knowledge bases of skill in the journals, as indicated in the table below.

Table 9: Breakdown of H continuum coding

	James	Shaun	Matthew	Nkosi	Leon	TOTAL	**Example of type of journal entry coded this way**
H++	59	74	59	74	49	315	Comment on completing [process input and output records] and what he checked in order to do this plus indicating what he with regard to out of spec measurements - completed documents included.

	James	Shaun	Matthew	Nkosi	Leon	TOTAL	**Example of type of journal entry coded this way**
H+	18	28	22	4	14	86	Description of interpreting error message on machine and then rectifying error.
H-	12	31	12	5	6	66	Photo identifying parts of machine used to adjust air pressure and solve problem.
H--	3	5	0	0	1	9	Description of principles of [specific type of] labelling.

Although there is an extensive spread of entries that range from H++ through to H--, over two thirds of the journal entries still reside in the realm of H++ and H+ (strongly to moderately practical) and over 50% of these are coded as strongly practical H++. As per the classifications on the continuum, this is knowledge that is mainly practical, involves skill and/or technique, and is strongly procedural meaning that it links directly to the exercise of skills and techniques. Journal entries classified as H++ focus on work procedures and routines that require the candidate to do a particular task in a particular way, for example loading the labels into the machine correctly.

Here Winch's (2012) concept of normative appraisal is evident as there is definitively a correct way of completing these tasks, which is referenced in the way that the candidates write about it. For example, James writes in his journal about how he fixed a 'web break' (a break in the spool of labels that is fed into a particular type of labelling machine). This requires very practical knowledge, and he explains the technique to be used to fix it correctly in order to avoid the problem reoccurring.

H+ and H- tend to appear in the journals at similar frequencies, with slight variations in frequency between each candidate. Three candidates have slightly more H+ entries and the other two candidates have more H- than H+ entries. The H+ and H- coded entries tend to be fairly similar in some respects as both classifications tend toward the midpoint of the continuum, however there are still distinctions that separate the two classifications, and this is evident in the entries.

Entries classified as H+ are ones where skill was required in combination with slightly more theoretical knowledge, for example in doing calculations, or where the candidate referenced a theoretical

principle applied while completing certain procedures. One example is the entry below by Shaun where he describes how he conducts quality checks at the labeller:

> I checked if the video jet (Date Coding Machine) is in a working condition and accurate. Firstly I removed one the bottles of the line and if the date coding is printed correctly onto the bottle without any signs of smudging, printed as clear as possible. I also checked whether the BB (Best Before) date is correct.
>
> Follow up question by assessor: Why is this info [date coding] important?
>
> Answer: date coding is important to see when the product was made and the sell by date for the consumer when the product will expire. And which line it was produced. (extract from Shaun's labeller journal)

These entries showed substantial practical knowledge, and involved the direct exercise of skill, but also included some theoretical knowledge.

Conversely, entries coded as H- showed a higher level of theoretical knowledge but still showed evidence of some practical knowledge, although this was less evident. H- entries also rely less on skill and technique and show more use of a theoretical knowledge base, tending to move closer to the knowledge classification of 'knowing that'. For example, after writing about the maintenance checks that he completed (H++), Shaun went on to explain the importance of doing those checks related to their impact on cost reduction and quality (H-), which required him to demonstrate his theoretical knowledge and apply it. Entries coded as H- tended to include more detailed explanations of the theoretical knowledge bases of the procedures and routines.

Very few journal entries were coded as H--. Out of the five journals, only three contained H-- entries and at very low levels. As the focus of the journals was reporting on their workplace experiences, the lack of H-- entries were understandable as H-- requires extensive subject or theoretical knowledge and no evidence of direct application of the knowledge bases using skill or technique. Journal entries coded as H-- contained very little or no reference to procedures and were often separate from, or in addition to, the daily entries. Shaun, who included the most H-- entries (five in total), had included additional reports in his journal that detailed his theoretical knowledge of the labeller and its operating principles.

Workplace Observations

When coded using the 'knowing how' – 'knowing that' continuum, just over 50% of the assessment instrument rests on the 'knowing how' side of the continuum, and over 80% of the observation points and questions include some elements of practical knowledge as they are coded as H++, H+ or H-, which allow varying amounts of practical knowledge. The data showed that 44% of the assessment

instrument rests on the 'knowing that' side of the continuum but only 18% of the observation points and questions are coded as H--, which involves limited practical knowledge and no direct use of the knowledge in the exercise of skill or technique.

When considering the difference between the observation points and the probing questions, most of the H--knowledge was contained in the probing questions, although three observation points were coded as H--, as they were focused on the candidate identifying machine components, such as when candidates were required to point out the main parts of the labeller. Examples of the questions coded as H-- were on the theoretical principles of machine operations or related to food safety principles such as the following probing questions from the Filler Workplace Observation Assessment Instrument:

Probing for Critical Thinking and Problem Solving: Question 1: The operating principles of the Filler Crowner and EBI are described.
Question 2: Identify the 3 aspects of production that benefit from inbuilt safety mechanisms.
Question 3: Determine the impact that recording of inaccurate operating data would have on the packaging process.

(extract from Filler Workplace Observation Assessment Instrument)

In contrast to this, most of the H++ coding was contained in the observation points as most of the points focused on the practical knowledge base for the exercising skills and techniques that the candidate was required to demonstrate while following procedures and required extensive practical knowledge. These include observation of actions such as:

Action: Attended Pre-Shift Meeting
Obtained Production Plan
Conduct Shift Handover
Check Raw Material availability

(extract from Filler Workplace Observation Assessment Instrument)

A small number of observation points were coded as H+ and these tended to be points where the candidate was required to make use of some theoretical knowledge, albeit in a limited way, while demonstrating certain skills such as planning for changeovers or anticipating hazards. An example from the Labeller Workplace Observation Assessment Instrument was where candidates must

> Review Quality check sheets for the last week and interpret trends for key parameters: glue usage, label usage, etc. (extract from Labeller Workplace Observation Assessment Instrument)

As the Workplace Observation is focused on assessing candidates' skills in operating the machines, the high number of observation points coded on the knowing how side of the continuum is expected. While a theoretical knowledge base is present for the exercise of certain skills, more practical and procedural knowledge ties into the exercise of the skills and techniques being observed.

The very few observation points coded as H- related to situations such as interpreting test results where the candidate needed a greater theoretical knowledge base for exercising skill in a practical scenario. A larger number of questions are coded as H- and H+ in comparison to observation points. Although H+ includes the use of skill in its description, questions were still coded as H+ because they included more than 50% practical knowledge and related to a particular skill required, for example explaining procedures for confirming the accuracy of measuring instruments or the interpretation of production plans.

Questions coded as H- were the most common type of question and were questions that required a substantial theoretical knowledge base but required it through application in the exercise of skill in the production environment. This would include, for example, questions related to the interpretation of test results or explanations of problem-solving techniques and where it is appropriate to use them.

Skill surfaced through the RPL programme tools

The RPL programme, through its various tools, surfaced a wide spectrum of knowledge bases for the exercising of skill, with the different tools highlighting specific kinds of knowledge bases. As this qualification requires candidates to demonstrate their competence in packaging machinery operations and, ultimately, the tools were designed to meet the qualification requirements, a high level of procedural knowledge was evident as a base. Coding for Gamble's (2016) knowledge quadrants surfaced a substantial amount of knowledge coded as K1 and K2, i.e. both specific and general procedural knowledge. The coding for procedural knowledge is similar to the evidence presented above on how the knowing how side of the continuum is more prevalent.

In analysing the data through the lens of the 'knowing how'- 'knowing that' continuum, the prevalence of knowledge on the 'knowing how' side of the continuum was clear, with both the journals and the Workplace Observations showing a large proportion of coding for H++ and H+. Only the technical packaging knowledge Screening Assessment showed a higher prevalence of subject or theoretical knowledge, coded as H-- and H-. However, it must be noted that all four points on the continuum were

present to at least some degree, showing the extent and complexity of the kinds of knowledge surfaced.

The analysis in this section focused on the knowledge bases for the exercise of skill and technique but only touched very briefly on the role of normative appraisal in the exercise of skill (Winch, 2012). As discussed in Chapter 3, normative appraisal, and disposition and values, form part of the exercise of skill and speak to the development of expertise. The next section focuses on how these were surfaced through the RPL programme tools particularly.

Disposition and values

SAQA qualification

Although not clearly spelled out, the role of disposition and values cannot be removed from the dimensions of expertise (Winch, 2012). It appears that some attempt was made to include this in the qualification through what were referred to as 'Critical Cross Field Outcomes[16]'. Three of the critical cross field outcomes that focused more on disposition and values were:

- Work effectively with others
- Organize and manage oneself and one's activities
- Communicate effectively (SAQA, no date b)

The Critical Cross Field Outcomes were referenced in the Workplace Observation Assessment Instruments of the RPL programme, and these instruments require the assessor to sign the candidate off on the critical cross field outcomes, as well as the Exit Level Outcomes and Associated Assessment Criteria. However, this is mainly a referencing exercise rather than a separate assessment element.

The RPL programme tools

The role of disposition and values as part of the exercise of skill in the RPL programme was surfaced during the analysis of the various tools used in the RPL programme. While at times the references to disposition and values had to be inferred, there were also certain points when it was explicitly stated or questioned. Either way, it was surfaced in some form in all the tools analysed and was also further clarified in one of the interview questions that candidates were asked.

[16] The Critical Cross Field Outcomes (CCFOs) are a set of seven outcomes that are included in all qualifications and, in varying degrees, individual unit standards in an attempt to promote a set of higher-level critical thinking skills and certain general attitudes.

During the coding of the journals, although it was integrated into the various entries, disposition and values were coded separately for ease of identification. Entries containing disposition and values included the use of judgement around moral decisions — for example conducting themselves a certain way for 'the good of the team' or demonstrating their understanding of how maintaining efficiencies benefits everyone in the company or team.

Table 10: Examples of journal entries addressing disposition and values

1.	work history including reflection on altercation at previous job - supervisor was fired and he resigned as he felt that they both should have been disciplined
2.	short reflective writing piece on shift - notes that they 'were too obsessed with getting line running' which meant that they ignored something that didn't sound right and led to breakdown
3.	also how he should have taken initiative on crown jam problem
4.	comments on the line running smoothly with few faults
5.	exercise of moral judgement based on company standards - previous shift ran 88% which he indicates is good
6.	virtuous action of standing in for team member on leave and using his skill on various machines (multi-skilled operator) for the good of the team to the detriment of his individual development (in completing journal)
7.	comments on being late for his shift and how this impacted on his work as well as the team (couldn't attend meeting and do handover so colleague did handover)
8.	solving problem using knowledge of machine points to skilful operation but lack of care as he fails to complete a particular task which impacts on overall performance - he makes the comment that 'he should have' to avoid causing the problem
9.	moral judgement for not completing specific tasks (justification of decision using operational requirements)
10.	comment on impact of team members being late for work but stressing importance of strong team dynamics
11.	including details of a formal counselling session he received for not obeying a safety rule - a further explanation is included acknowledging that he contravened the rule but also explained why it had happened (operational challenges)
12.	comment that 'if the results are in specification, it will be good'
13.	makes a judgement decision to allocate specific tasks to his fellow operator and others to the learner operator who are working with him on the filler - clear delegation of tasks with specific responsibilities including what he will be doing - notes that he shows learner operator how to complete specific operation documents
14.	explains how an incorrect product impacts on consumers
15.	comments on how previous shift starting their shift's production allows them leeway for downtime without impacting on machine or factory efficiencies - implication is that maintaining efficiency is considered very important when judging performance

16.	notes that they now have their own tools to perform changeovers and small tasks instead of relying on the process artisan and responds to assessor prompting about feeling empowered as they can do it themselves
17.	explains how he notified other team members of an ongoing problem and how the problem affects production and other team members
18.	reports on high factory efficiency (97%) that they were running and how everything was done correctly – "nothing to write home about" – and assessor comments "good" on efficiency level
19.	notes that he took leave on Friday to explain discrepancy for journal entries
20.	explains the importance of safe maintenance practices e.g. locking out
21.	notes that he must keep time to fit in with other people who need to work on the machine

These insights on candidates' use of judgement in their work, as well as the values that they consider important, provided an interesting subtext. For example, the more experienced operators who have been working for the company for a longer time showed much more focus on teamwork, punctuality and adhering to workplace rules. The importance of being a 'team player' was emphasised by the subject matter expert interviewed as well as the candidates. For example, James talked about the need to be a cohesive team where all the team members work together and communicate with each other.

> Previously, we were one of the worst performing teams, according to the records that they hold. In the recent months, we got a new Team Leader, and suddenly, our standard of work and our output, with regards to efficiency, is picking up. So we like to keep it there, we are a good team, but we don't have arguments in the team. We are a good team. I think we are a one of the only teams that go out for weekends, (extract from Interview 2)

There was also an emphasis on each team member's contribution by upholding the values of the team to ensure that the team was seen to be working towards achieving company targets.

Although there was an emphasis on the team, there was also the requirement that operators support each other and do not inconvenience other operators. This was evident in the interviews when asked about the values required to be a good operator.

> If you're starting at two o'clock – make an example – we have a pre-shift meeting at quarter to, whereby the plan is put out for what's expected for the day. If you're late for the meeting, I don't have a problem with that, I can tell you what's going on, because I'm always in the loop. But if you're late for the line, you're putting pressure on me; at the start of a shift, being five to, five to two, because that five minutes, I must get the handover from the previous... the team that's on duty, as to where the issues are. If you come five past, ten past, even twenty past, it's putting pressure on me, now I have to wait for you to come back; I can't do my duties because I have to make sure the line is running, where you could have done it, I could have done some other work. Understand? So it's very important that an operator is on time, he must be on time, or even before time. (extract from Interview 2)

While James was emphasising the need for punctuality as a value, it was apparent that there was an underlying value is around solidarity. One of the other candidates interviewed, who was very involved in the trade union, also showed much more focus on values around worker solidarity, commenting on the "good values of an operator who, for instance, doesn't make life difficult for the next operator who comes in" (extract from Interview 4). Leon framed this in the context of versatility, as an operator who can operate various machines on the line will be able to step in for another operator who may be having difficulties.

> Currently, today, you get process operators that only know one area; it's not supposed to be like that, you should be able to operate the line; that means all three processes, as a process operator. So ja, I equipped myself quite a lot over the years; I've worked at the filler, I've worked at labellers, I've worked at bottle washer, and back end as well. That is all by means of trying to be proactive, if they do need help, or if the Team Leader needs me to... if we've got to let the operator off sick, then I can stand in for him easily; if we've got a guy at the back off sick, I can stand in for one of them easily; for flexibility purposes as well. And also for the main reason of not panicking when they put me in that area. (extract from Interview 6)

The description of flexibility above implied not only an emphasis on the value of supporting each other as operators, but also suggested the importance of the normative appraisal of skills. Leon placed significant emphasis on his ability to perform a range of skills well as this enabled him to support other operators by being sufficiently capable in other skills to take on their job as well if needed.

In analysing the technical Packaging Knowledge Screening Assessment, it was of interest that a question related to disposition and values was included in this assessment instrument. Candidates were required to answer a true/false question around who is responsible for safety, quality, and productivity in their company, with the correct answer requiring them to own their personal responsibility. Disposition and values were also included as one of the questions on the observation assessment instrument for the labeller. As part of testing their understanding of problem-solving, they were asked about the impact of their own attitude on solving problems. They were required to again take ownership of their role in the problem-solving process by indicating that they should be positively engaged with the process. When questioned during the interviews about the disposition and values needed to be a good operator, the subject matter expert interviewed also referred to the importance of the attitude of the operator in terms of approaching problem-solving:

> We have seen the advantages of having technical guys operating, because their problem-solving is to the next level, their attitude towards the machine and working on the machine, is the next level, because we know that they're not going to want to stay as operators, they have, obviously, a career path that they want to follow, and knowing the machines that... what we've picked up is, that the guys who know the machines, and are technically sound on the machines, are our future generation specialists; (extract from Interview 3)

John connected this with an eagerness to learn as he indicated that those who are motivated and willing to learn are seen to be more committed to their work and are more likely to progress to the higher-level jobs. The willingness to learn and take ownership were also indicated as important values during the interviews with the candidates. James and Shaun also referred to the need for operators to demonstrate resilience and, similarly, Leon referred to the need for operators to be able to work under pressure and cope with the stressful environment of the high-speed environment.

Thus it was evident that the role of disposition and values was considered to be an important part of being an operator in this environment. The combination of being able to exercise the required skills and techniques well (i.e. drawing on normative appraisal) and displaying the required dispositions and values pointed to the way in which the candidates in this programme were able to demonstrate dimensions of expertise, as conceptualised by Winch (2012). The last part of this chapter will focus on elaborating on a broader understanding of the expertise surfaced through this RPL programme by examining the features of expertise (Guile and Unwin, 2019) present, including individual expertise and candidates' application of their own judgement, particularly in terms of complex problem-solving.

Occupational expertise

Analysis of the data to surface expertise

In Chapter 3, expertise was conceptualised in relation to a set of particular features (Guile and Unwin, 2019). The section that follows will draw on these features as a tool of analysis for surfacing evidence of expertise in the RPL programme's data. The features of expertise that will be considered, as conceptualised in more detail in Chapter 3, include that it is: sociomaterial, individual, collective, practice-based, and definable and measurable (Guile and Unwin, 2019). These five features will be unpacked below. The sixth feature of expertise, that it is cross-occupational, cannot be addressed as the data for this research only applies to a single case study in one work environment. The role of judgement will also be discussed as part of the 'individual' feature of expertise.

Although the interviews were not part of the original RPL programme and not used as an assessment instrument, I used the interview data to validate my coding process. They provided further insight into the skill and expertise surfaced in the Journals of Workplace Experience. The interviews also provided an opportunity to gain insight into some of the less explicit elements of the problem-solving done by operators. Further data on the exercise of expertise was also drawn from my research observation notes on the Workplace Observations as they surfaced examples of the tacit knowledge that is integrated into the exercise of expertise.

Sociomaterial expertise

The sociomaterial feature of expertise arises "from the temporal interaction of social and material phenomena" (Guile and Unwin, 2019, p. 30). As discussed in Chapter 3, this suggests a relationship between expertise and the sensory tacit knowledge through which candidates engage with their work environment.

Sociomaterial expertise as procedural expertise (Coetzee, 2011) in the form of tactile tacit knowledge was surfaced in the Workplace Observations as the candidates were observed operating the machines and performing the daily tasks required for this. It was highlighted in terms of their ability to perform certain techniques without needing to concentrate on them, for example packing labels into the labeller magazine while having an unrelated conversation with the assessor. This was most evident in a short video that I took as part of my research observation notes on Mattthew's Labeller Workplace Observation conducted by Lucas. In the video, Lucas is asking him questions about the labeller's operating principles and how he does certain procedures but, at the same time, Matthew is packing the labeller magazines with new labels without even glancing down at what he is doing with his hands. He has a very well-developed technique and does the packing by 'feel' more than careful concentration. Leon, similarly, speaks about how he uses his 'feel' of the knobs to adjust the pressure of the labeller and make a judgement about when it is correct.

Related to the use of tactile tacit knowledge is its role in problem-solving. Matthew has quite a few years of experience working in the production environment on both machines, although his main area of expertise is the labeller. When asked about problem-solving during my interview with him, he clarified that company policy starts with using the QFRs[17] and only when they do not work is the problem escalated. What is of particular interest was the way in which he explained how the QFR procedures become routinised for the operators, to the point where they conduct QFRs without even thinking about the process that they are following. He uses an example from the filler, where he explains:

> QFRs is stuff that we generally do without even knowing that we're doing it. Say, for instance, your machine, I'm working at the filler, the machine stops, or you can see there is a valve that's under-filling, your natural instinct, as the operator, is to, if there's a moment, stop the machine, check what the problem can be. A lot of the times, it's only a spread rubber that has to be replaced, you replace it quickly, and you run, your problem is solved; that is QFR. *So you do it sometimes without even knowing that you're doing it,* but it all falls in line with the company's policy. (extract from Interview 1, italics mine)

[17] Quick Fix Routines

The use of sensory tacit knowledge by the candidates in engaging with their work environment has been discussed in detail above, with evidence drawn from both the Journals of Workplace Experience and my research observation notes of the Workplace Observations, which was reinforced through questions raised in the interviews.

As mentioned in the section on sensory tacit knowledge, it is not just tactile tacit knowledge that is used but also auditory and visual tacit knowledge. What is significant for this discussion of expertise, however, is Maslen's (2015) positioning of the senses as a source of knowledge. The use of sensory tacit knowledge was not just a way for operators to engage with their work environment but also, through the development of the sociomaterial feature of expertise, fed into the candidates' exercise of judgement for problem-solving and decision-making.

The use of 'sonic skills' (Bijsterveld, 2018) by both the candidates and the assessors was described in the previous section on auditory tacit knowledge. However, what I wish to draw into this discussion on how expertise was surfaced is the way in which the candidate was able to identify a possible problem developing in the filling process through the change in the sound of the bottles moving along the line. For example, my research observation notes recorded the following two examples:

> Assessor used to work on the line, heard a noise and immediately reacted to situation to rectify. (my research observation notes on WO5)
>
> Themba can easily identify by hearing what is happening – e.g. burst bottles. (my research observation notes on WO2)

The way in which they responded to these changes in sound suggested the presence of expertise based on their auditory tacit knowledge.

Similarly, during visual observations of the machines, candidates were able to identify issues such as skew labels or one wrong bottle in the midst of the hundreds moving past at speed and act on this to address the problem using their skills and expertise. Nkosi was an operator with many years of experience operating the machines. In the situation he described in his journal entry, they had had continuous problems with valves on the filler and, despite following the QFRs, the problem had not resolved so they had resorted to conducting their own problem-solving approach to fixing the problem. When asked about this during the interview, he explained what had happened and provided deeper insight into how the problem was solved by using a combination of the application of knowledge of filler operating principles and his own experience.

> You see, we've been wasting time on all the quick fixes, and all these mechanism, so now, it's time now to isolate that valve, out of the other valves, and say, this is the valve that is giving us problems, for the last couple of days. We have checked that, and that, and that and that; and that is not giving us joy; … after days of trying to find out what went wrong, what's

> happening*, we visually... that was a visual problem, that when you look there, there's a problem; it was there right in front of our eyes*. (extract from Interview 4, italics mine)

This relates back to Matthew's comment that operators need to engage the machine with their senses and be continually watching and listening to the machine. In this instance, Nkosi is very clear that it was only when they visually examined the offending parts in operation, could they use their knowledge of what it should look like to determine what the actual problem was and fix it.

The use of sensory tacit knowledge as part of operators exercising their expertise in the form of problem-solving and using their own judgement feeds into the broader feature of individual expertise discussed in the next section.

Individual expertise and the use of judgement

Individual expertise is conceptualised by Guile and Unwin as "specialized knowledge and capability, judgement, [and the] ability to work unsupervised" (2019, p. 29). In considering the individual expertise of the candidates surfaced through the RPL programme, it was necessary to draw on several of the findings unpacked in both this chapter and the previous one. In the section on the sociomaterial feature of expertise, I touched on the use of sensory tacit knowledge in the exercise of judgement. It is this ability to respond to potential problems through an "immediate intuitive situational response" that Dreyfus (2004, p. 180) uses to define an expert.

This capacity to draw on their own vocational knowledge, both tacit and explicit, in order to make judgements in situations, particularly problem-solving was highlighted by Nkosi in my interview with him. When asked about how he conducts problem-solving on the machines, he placed a much higher value on operators' making use of their own knowledge and experience rather than just relying on the QFRs and company procedures. This applied especially to ongoing problems such as the one referred to in the sensory tacit knowledge section above. He stated in his interview that

> …because we were applying those quick fix routines, which has got nothing to do with that, but visually, when we start looking and say, okay, there's a problem, because this lift cylinder is lower than the other, they are not level, so that's the problem. And then when it was rectified, that this is the problem, it was fixed, and then the problem disappeared. (extract from Interview 4, italics mine)

In combination with the visual tacit knowledge used to identify the problem, this example of problem-solving also appeared to rely on his craft-like knowledge as he described how he was able to draw on his visualisation of the filler as a whole to make a judgement about the problem and decide on the best way to fix it.

When questioned about the role of the operator in problem-solving, John the subject matter expert emphasised the importance of the operator in the problem-solving process, and in particular the importance of the operator's intimate knowledge of how their specific machine runs.

> Okay, so operator is very key, he's probably the number one role player in quick response to problem solving on the machine. So we, we call him, the operator he's... I would almost term it, he's the owner of the machine, so he's the one who knows the feel of the machine, he knows the sounds of the machine, he knows the ins and outs of the machine, maybe not from a technical ability, but from an operational ability.
>
> So when things go wrong, he is sort of the first line of defence, and he'll need to know two things, how do I attend to this breakdown, or this stop; and he has a few key tools that he can use, and some of those tools are at the machine, through either a quick fix routine opportunity, and if the quick fix doesn't assist him in solving the problem, he escalates the problem to the next level, which is his PA or his Team Leader; and if he knows the machine well enough and he sees that it's actually a machine owner or machine specialist task, then he would quickly also then get the machine owner - which we call the machine owners now, machine specialist involved.
>
> There could be something else, part of his problem-solving tool, that he has as well, is sort of our 5 Why[18] book process, so it's a hard copy 5 Why [problem-solving process], going to sort right through the detail of the problem, be descriptive about the problem, and then also give feedback, in terms of how he tried to correct the problem. So many times, if the 5 Why is employed, it's because it's now taken, either too long to fix the problem, longer than our trigger time, or it would have been because maybe there was multiple stops of the same issues, and he was able then to... or the trigger actually says to him, so for multiple stops also, of the same nature, create the 5 Why, to get to root cause. (extract from Interview 3)

The use of judgement by the operator was also apparent as he needed to apply his knowledge of the problem-solving process and the company's procedure to decide how to approach the problem and when to escalate it. These scenarios suggest that, despite the overall routinisation of the work and even of problem-solving through the use of certain problem-solving procedures, there were still elements of work of risk that cropped up during operations. Thus, while the work environment favoured reducing risk through the use of specified procedures, even in terms of problem-solving, the use of human judgement still had a role to play in instances where more complex problems arose. The use of judgement was also significant for the operator when applying their own solutions to problems on the machine as they were able to apply their own understanding during problem-solving within certain limits. As John explained

> So I think, in the beginning, many of the guys are very - can't use the word, afraid - okay, they might be a little bit... maybe feel a little bit unsure, or maybe there's not that they lack confidence; so as they get to know the machine, they would then apply some of their quick

[18] 5 Why is a formal problem-solving tool that is used to analyse problems to determine the root causes.

> fixes, on the provision that it has no secondary implications, or secondary damage to the process, or no, it doesn't yield any quality issues to their process.
>
> So they have got a, I can't say a fair amount, but they have got a good amount of leeway in terms of doing what they must do, to get it right, provided that quality is not impacted, or your speed is not impacted, or secondary damage to the machine is not impacted. When they do those things, many times, their learning will then be shared amongst the operators, if it is a good learning. Other than that, he has then to account for maybe making correct decisions. (extract from Interview 3)

The importance of individual expertise in solving complex problems was echoed by Shaun in his interview. When asked about the role of the QFR, Shaun explained that there was certain information that was recorded on their process input and output recording sheets which helped with problem solving and that, at the beginning, operators may need help from the process artisan, but they will eventually be able to problem solve and make adjustments to the machine without help. When asked about solving problems on his own, using his own understanding of the machine, he explained that "there is certain things that you can solve yourself, and certain things that you can see, okay, this is what's happening and this is what I need to do. But it all comes with experience" (extract from Interview 5).

In my interview with James, he also gave an example of where operators used their own judgement to decide whether there are sufficient crates on the line. He explained that a new robot was installed that was supposed to be able to determine when there were too many or too few crates on the line and pack more crates on or remove the extra crates. However, the machine was not doing this, and the operators continued to make their own judgement calls in this regard and make the changes manually.

> It's also the stuff that we know, that, you must do it this way, you must do it that way. And we also carry it over to the other operators, we will tell them, hey, that buffer is too full, you need to take off, or the buffer is too empty, you need to pack on. (extract from Interview 2)

The judgements made by operators on when to intervene and address a possible problem further suggested their ability to draw on their knowledge of the operating principles of the machine as parts that contribute to their visualisation of the whole beverage packaging process and how the various machines and processes interact with each other.

Similarly, Matthew, when asked about his operation of the labeller where he has most of his experience, explained a similar scenario where he used his understanding of the impact of a potential problem on the whole operation (a problem causing excessive waste and thereby losses to the company) to make a judgement call to stop the machine temporarily to address the problem. He also expanded on problem solving and how he made use of his experience and machine knowledge to

solve problems. He gave a detailed explanation of how an experienced operator picks up possible problems just by looking at the bottles, in relation to a journal entry coded as craft-like knowledge (K3), stating "operators like us, that we can see with the eye" (extract from Interview 1,) and how he can then go on to make adjustments on the machine based on his experience and machine knowledge in order to ensure a quality product is produced.

The importance of individual expertise was reinforced by Leon when reflecting on some of his problem-solving processes at the end of his interview. As he has been operating the labellers extensively for several years and has significant experience on the machines, he acknowledged that:

> I might be one of the only operators that actually understands what's happening on that thing. I think that we need to raise things like that more, man, I mean in terms of, if a new person comes in here, he might not know what to do, he might not know how it works. All of our experiences needs to be documented, (extract from Interview 6)

He went on to suggest that the journals that the candidates completed could be used by the company to document some of the knowledge that the operators have which is not currently written down in any other plant or company documents and are "the actual basic practices" that tend to be forgotten when processes are changed. His closing comments seemed to me to be a good reflection of the journal process that the candidates went through in terms of documenting their workplace experience. He referred to the interview questions when he was asked about what he had written in his journal (which occurred quite a while after the programme) and stated:

> you reminded me about everything I wrote now, in this book and all the information I had, I had to scratch out of my head now again, you know it's in far corners. When you have to explain it, now, like I said earlier, doing something and explaining it, I mean, you do all these things, I do with my eyes closed on a daily basis, but to explain it or write it down, is the difficult part. (extract from Interview 6)

The findings described above point to how individual expertise relates to the candidates' use of judgement for complex problem-solving in situations that go beyond just following procedures. They were required to draw on their vocational knowledge in order to make judgements on how to apply their various skills to fix problems. This process of making a judgement draws on both their tacit knowledge and sensory tacit knowledge particularly as well as their visualisation of the whole as it relates to the various parts of the beverage packaging process and the operation of the filler and labeller machines.

Practice-based expertise

The above discussion on individual expertise and the use of judgement by the candidates is only possible when considered within the context of the workplace that it is situated in. Practice-based expertise, as a recontextualisation of vocational knowledge (Hordern, 2014; Loo, 2019), and "honing of skills" (Guile and Unwin, 2019, p. 29) requires context. The exercise of skill, as it was surfaced through the RPL tools, was discussed in detail earlier in this chapter. What is useful to draw on here is how the vocational knowledge that the candidates demonstrated is recontextualised into the knowledge bases for exercising skill. This suggests that the analysis using Gamble's (2016b) four knowledge quadrants could be used in conjunction with the analysis of the 'knowing that'- 'knowing how' continuum to develop an understanding of how practice-based expertise is surfaced in the RPL tools, and the journals of workplace experience particularly.

The influence of the particular workplace context in developing practice-based expertise was highlighted by the way in which certain journal entries could not be coded as only one of Gamble's (2016b) four knowledge quadrants and required a combination of two knowledge types. As discussed in the previous chapter, the most common dual classifications related to a combination of specific and general procedural knowledge (K1/K2) and specific procedural and general principled knowledge (K1/K4). In considering entries coded as K1/K2 I proposed this coding for instances where candidates used their general procedural knowledge as the knowledge base but recontextualised it within the context of the specific work environment to explain the specific procedural knowledge and, thereby, the skills that they were exercising. An example provided for this related to a filler journal entry that Nkosi presented which described the procedures he followed on a maintenance day:

> When CIP was running on its own I went to the filler to proceed with autonomous maintenance. From 07:30 to 08:30 I lubricated crowner and cleaned up excess grease also topped up autolube machine and topped up oil for lift cylinders. At 08:30 to 10:00 (90 mins) I did autonomous maintenance by serviced valve parts, I replaced 154 spreader rubbers, 154 tulips and changed 20 cradle springs. (extract from Nkosi's labeller journal)

The explanation for the coding was that there are general procedures referred to, such as lubrication, which are then linked to the specific way in which the procedures are done in that work context. In considering the 'knowing that' – 'knowing how' continuum coding of the same entry, it was coded as H++, pointing to the way in which Nkosi used the general and specific procedural knowledge he presented as the knowledge bases for the exercise of the skills he needed to use to conduct the procedures.

In another dual coding example, this time for specific procedural knowledge and general principled knowledge (K1/K4), James' journal entry explained the procedure for a particular quality check, and he included a brief explanation of the reason why it is conducted:

> I put the vent tube bottle through the Post Fill Bottle Inspector (PFBI). (Sometimes while in the process of filling a vent tube will sometimes come loose and drop into the bottle). The PFBI, if it properly set up should reject this bottle every time. I do this twice at the start of the shift. (extract from James's filler journal, highlight in original)

For this entry, I had coded it as strongly knowing how (H++) as he was describing a specific exercise of a technique for conducting a quality check. Although the knowledge base was mostly specific procedural knowledge (K1), James did also draw on a form of general principled knowledge related to the machine's operating principles (K4), recontextualised as a vocational knowledge base to support the exercise of skill.

Returning to the coding of the data for skill on the 'knowing that' – 'knowing how' continuum, in line with Guile and Unwin's (2019) definition of practice-based expertise in the context of skill, the analysis of the RPL tools pointed to the way in which skill was exercised, drawing on procedural knowledge bases particularly. The explanation of how the candidates exercised their skill, in conjunction with the section that follows that on the use of normative appraisal to evaluate the quality of the skill that was exercised, pointed to the way in which practice-based expertise was demonstrated by the candidates. This was further supported by the examples above that provided insights into how the candidates were able to recontextualise their vocational knowledge within the workplace to provide the required knowledge bases for the exercise of skill.

Collective expertise

Expertise that is co-produced and distributed (Guile and Unwin, 2019), as suggested in the discussion in Chapter 3, may also draw on collective tacit knowledge. In terms of collective expertise, it was not specifically surfaced through the RPL tools but became evident in the explanations given by candidates in the interviews of certain journal entries, where they observed that the knowledge that they were referring to was not formally recorded but was transferred between the machine operators. In terms of the collective tacit knowledge (Collins, 2010) present, this was surfaced in the candidates' explanations of the dispositions and values present in their journals.

Two very clear examples of collective expertise were surfaced during the interviews when candidates were asked to elaborate on certain journal entries. In the first example, in my interview with Leon, while he was describing how he conducted problem-solving, he made the observation that there were

still certain elements on the machines where knowledge was transferred directly between operators and not recorded. For Leon's example it related to marks made on the machine by the electrician, as well as measurements that used to be recorded but that are no longer required. He explained that, as one of the experienced operators, he still made a note of the figures as they were useful for identifying possible problems on the labeller that the marks on the machine aided him in fixing.

The second example of collective expertise was from James. In his Filler Journal he explained how the operators determined how to run out the bottles on the line before changeover in order to match it directly to the number of litres to be used. When asked how the operators determine this, his response was that they "found it through extensive trial and error" and, upon further questioning about where it is written down, his response was that "we just know that that's what we have to do" (extract from Interview 2). In the journal entry, coded as specific, principled knowledge (K3) and moderately knowing how (H+), he put into language this very practical, specific contextual knowledge passed between operators and, although he could explain what they did, it was not recorded in any procedures and is passed on to new operators by word of mouth and showing them how to do it. This transfer between operators, and the fact that it was not captured in company documents, was confirmed by the subject matter expert, John.

Thus it was evident that there was a transfer of knowledge that was not codified where knowledge was shared between operators, enabling others to learn and then apply the knowledge to their own machines. As John stated in his interview:

> there are a few things that are not written at his machine, but they *would pick it up through problem solving or wanting to learn* further, during valve maintenance, or during a breakdown, where the machine owner is involved; (extract from Interview 3, emphasis mine)

Similarly to the presence of collective expertise was the presence of the collective tacit knowledge that related to the transfer of certain dispositions and values that contribute to expertise. While the dispositions and values surfaced in the RPL tools were discussed in detail previously, it was necessary to take them into account for the development of collective expertise. This was particularly true of values such as teamwork and the need to implement behaviours such as good timekeeping in order to be considerate of other employees. These dispositions and values formed part of the collective expertise of the candidates, together with the importance of the transfer of knowledge between operators that ensured that maintenance of the collective expertise within the work environment.

Definable and measurable

Guile and Unwin argue that a final feature of expertise is that is definable and measurable and that this occurs "Through formalized mechanisms such as qualifications and professional registration, or through customer endorsement" (2019, p. 30). While not all expertise may necessarily be definable and measurable due to its tacit elements, as suggested in the discussion on tacit knowledge in Chapter 2 the impact of tacit knowledge and, therefore, expertise, may be seen in its results. In the context of this case study, it could be seen in the way in which various other features of expertise were surfaced in the RPL tools.

Furthermore, the aim of this RPL programme was very specifically related to providing a model by which the candidates' prior learning and, therefore, expertise, could be measured in relation to the formal qualification that they were working towards. Much of the last two chapters has indeed been focused on defining and conceptualising what was surfaced through the RPL programme in ways that point to the demonstration of expertise by the candidates through the data.

CONCLUSION

Overall, the RPL programme's tools were aligned to the SAQA qualification and, as such, were coded more towards the knowing how side of the 'knowing that' – 'knowing how' continuum in terms of the knowledge bases that support the exercise of skill and technique. However, the knowledge bases surfaced by the tools pointed to the role of theoretical knowledge, knowing that, in the exercise of skill, suggesting that there is a much broader range of knowledge than an automated production environment implies, that the candidates draw on in their work environment. This included aspects such as the disposition and values that form part of the broader descriptions of knowledge and expertise, as well as highlighting the presence of tacit knowledge through some of the tools used.

This chapter started with a description of the organisation of work in the candidates' work environment, which suggested the presence of a measure of work of risk (Pye, 1968) despite the seemingly routinised and automated nature of the work. In considering the knowledge bases of skill, the inclusion of a broad range of knowledge bases further suggests that the candidates are able to demonstrate a significant range of vocational knowledge, recontextualised through their vocational practice and the logic of work (Hordern, 2014; Gamble, 2016b). However, despite the findings in the last two chapters, it must be noted that that RPL programme may not have surfaced all the different forms of knowledge that may have been present in this work environment. Because the RPL programme focused on meeting the outcomes of the qualification, the knowledge present may

actually have been much more extensive and diverse than the RPL programme was able to capture. The forms of knowledge surfaced by the RPL programme, although not necessarily comprehensive, did provide insight into the complexity of the knowledge present in this workplace.

The final section of this chapter drew on both the previous Chapter 5 and the findings related to the concepts of tacit and craft knowledge, as well as the exercise of skill, including dispositions and values. It presented findings that explore how the candidates demonstrated features of expertise (Guile and Unwin, 2019) in an interrelated way that produces a more holistic picture of occupational expertise conceptualised in the form of each individual candidate as an occupational expert. The interrelatedness of the various features of expertise is evident through the way in which the various features draw on various forms of knowledge, particularly sensory tacit and craft-like knowledge demonstrated by the candidates in their workplace.

CHAPTER 7: MOVING TOWARDS OCCUPATIONAL EXPERTS AND RECOGNISING THE COMPLEXITY OF WORKPLACE KNOWLEDGE

Introduction

In the first chapter I started with a question: "But aren't we just accrediting push-button operators?" This research study was born out of an attempt to answer that question by examining the types of knowledge that were surfaced during the RPL programme, combined with the research question: "What forms of workplace knowledge used in an automated production process can an RPL programme surface and how might such knowledge be categorised and conceptualised?"

In attempting to answer this question, I drew on a social realist theory of knowledge, as extended by the work of Jeanne Gamble (2004a, 2004b, 2006, 2016b), in order to conceptualise vocational knowledge. The use of Gamble's (2016b) model for analysing knowledge in work provided the first part of the analytical framework for my data analysis and allowed for the classification of knowledge types in the qualification, those surfaced through the RPL programme's assessment tools, and the candidates' evidence based on these tools. The process of analysing the data surfaced evidence, not just of the various knowledge types in Gamble's (2016b) classifications, but also suggested the presence of other types of knowledge. In trying to describe and conceptualise these, I needed to turn to the literature on craft knowledge and tacit knowledge.

I then extended the analytical framework to incorporate a conceptual tool that comprised a continuum between 'knowing that' and 'knowing how' as knowledge bases for the exercise of skill (Winch, 2012). Incorporating the exercise of skill into the analytical framework brought in the concept of dispositions and values as well as the use of judgement. This analysis provided a further basis for the last part of the analytical framework, which focused on expertise. Drawing on the notion of features of expertise proposed by (Guile and Unwin, 2019) allowed for the development of the last part of the analytical framework, while also providing a useful overarching framework that combined all the other elements of the conceptual framework into a more holistic picture of the complexity surfaced through the RPL programme.

In this chapter I will touch on some of the methodological challenges that arose during the data analysis and how these were addressed. I will also discuss some the key findings, and possible implications thereof, drawing on the more detailed analysis reported on in Chapters 5 and 6. The aim is to use these findings to attempt to answer my original question by suggesting how an occupational

expert can be conceptualised in a work environment that is, seemingly, focused on reducing risk through routinisation and automation. I will also discuss the implications of this research for how RPL is implemented as well as possible considerations for vocational curricula.

Methodological reflections – closing the 'gaps'

A challenge became apparent in the coding for specific principled knowledge – what Gamble (2016b) identifies as craft knowledge. In her earlier work that focused more directly on craft knowledge, Gamble (2004a) presented it in terms of the principle of visualisation where the individual draws on their context-independent knowledge in order to visualise the relationship between parts and the whole, particularly using diagrams. While this conceptualisation is applicable to the craft environment that Gamble's research focused on, for the analysis of knowledge in a manufacturing environment where the process differs, the use of this conceptualisation of craft knowledge made it difficult to identify possible instances where such knowledge was surfaced in the RPL programme. While there were certain instances where the candidates did use diagrams to visualise the relationship between parts of the packaging process and the process as a whole, what became apparent was that candidates were demonstrating craft-like knowledge in other ways as well.

Visualisation of the relationship between parts and whole was evident in the way in which the candidates were able to use their principled knowledge of the packaging machines and process to visualise the relationship between the parts of the packaging process and machines to form the overall 'whole' that is the production process. Furthermore, they were able to visualise individual elements from the 2-dimensional Human Machine Interface (HMI) screens in terms of how they formed part of the 3-dimensional whole of the machines and the packaging line. The extension of the visualisation principle (Gamble, 2004b, 2004a) in this way was also evident in how the candidates described their approach to problem-solving in the interviews. These descriptions confirmed the presence of craft-like knowledge, particularly in examples of complex problem-solving described by the candidates.

A further challenge with coding the data using Gamble's four knowledge types came from the coding of the Journals of Workplace Experience. As described in Chapter 5, not all journal entries could be coded for one single knowledge type. Thus, in order to accurately capture the types of knowledge present, it was necessary to have dual classifications. This combination of knowledge types occurred in several different forms, pointing to the presence of complex relationships between different knowledge types through their recontextualisation into the logic of work (Gamble, 2016a) and vocational practice (Young, 2006; Hordern, 2019; Loo, 2019) and requiring a re-conceptualisation of some of the original constructs of the analytical framework based on this finding.

It is important to note that Gamble discusses certain 'boundary-crossing' rules in her argument critiquing the particular form of 'integrated' curricula that were envisaged previously in South Africa (Gamble, 2009, p. 20). This is not what I am suggesting through the coding of the Journal of Workplace Experience entries with dual classifications. Rather I am proposing that, through the recontextualising logic of work, there are various combinations of different types of knowledge as they are drawn upon to support vocational practice. This is similar to the argument made in Chapter 2, which was that knowledge types may be 'enmeshed' with each other rather than just being present as differentiated forms of knowledge (Young, 2006), particularly within the vocational or workplace context (Billett, 1999).

One of the challenges with using an analytical framework based on a social realist approach to knowledge relates to the differentiated forms of knowledge it proposes. Gamble's (2016b) four quadrants model did not allow for the conceptualisation of different configurations of knowledge that began to emerge in the data. This was most evident in the examples discussed above where knowledge types in the data were present in combination and 'enmeshed' with each other. Thus, when analysing the data, it was necessary to consider the complex relationships *between* knowledge types rather than simply classifying the individual types of knowledge surfaced. The analysis required a process of *pulling apart* the various forms of knowledge present in order to conceptualise and classify them, before *recombining* them in order to develop a more holistic final picture of the complexity of workplace knowledge that was surfaced through the tools of the RPL programme.

Adding languages of description to address the gaps

There is a further reason why an analysis based only on Gamble's (2016b) four knowledge types could not fully capture the extent of the complexity of knowledge surfaced through the RPL programme. This is that vocational knowledge is often also present in recontextualised forms in vocational practice (Hordern, 2019; Loo, 2019). The concept of vocational practice requires not just the notion of knowledge but also that of the exercise of skill. Thus the first additional language of description drawn on came from Winch (2012) and his 'dimensions of expertise', particularly his concepts of 'knowing that' and 'knowing how', and the way in which each of these knowledge bases are drawn on to different degrees in order to support the exercise of skill. This in turn added further concepts such as disposition and values, and the use of judgement, to the analytical framework as Winch argues that skill cannot be separated from normative appraisal and disposition and values. In drawing on the concepts of 'knowing that' and 'knowing how' the same binary distinction that presented a challenge during the analysis of the data using Gamble's (2016b) quadrants also arose. However, because the focus of the analysis using this analytical tool was on the knowledge bases that support the exercise

of skill, I decided to make use of a continuum between 'knowing that' and 'knowing how'. This allowed me to develop a more detailed language of description for each of the four identified points on the continuum based on the combination of knowledge bases and degree of skill required; from 'knowing that' at one pole where only theoretical knowledge was present and no skill was required, to 'knowing how' at the other pole which required extensive practical knowledge that supported the exercise of skill.

Furthermore, as this was a programme focused on recognising candidates' prior learning that may have come through formal, informal, and non-formal contexts, it was necessary to allow for the presence of tacit knowledge in the candidates' evidence. However, as discussed in Chapter 2, tacit knowledge, by its very nature, is not easily languaged. Although the original conceptualisation of tacit knowledge drawing on Winch (2012) allowed for the presence of tacit knowledge in some form in all knowledge types, the data analysis surfaced a need to develop a very specific language of description in order to capture the tacit knowledge surfaced through the candidates' evidence and the interviews particularly. The inclusion of the notion of sensory tacit knowledge in its various forms allowed for the development of a language of description that was based more on skill and descriptions of elements of subsidiary awareness (Polanyi, 1958/1967) in relation to the focal awareness of the broader context in which they occurred – the so-called 'effects of the wind' that enabled an awareness of its presence.

The last language of description added to the analytic toolbox of this research was aimed at conceptualising expertise. In the process of analysing the data, it became evident that the various elements of knowledge and skill present could not exist independently of each other and that I needed to find a way of drawing them together as parts that exist in relationship to a broader whole. This broader whole was conceptualised through classification of the features of expertise (Guile and Unwin, 2019). The various features of expertise that were discussed in Chapter 3 presented ways in which the other, previously used, concepts could be combined into a broader whole. These interrelated concepts and features of expertise, therefore, allow for the description of what constitutes an occupational expert, which will be unpacked later in this chapter. Building on the findings that resulted from the analysis of the data for each of the previous lenses of knowledge, skill, and dispositions and values, the features of expertise identified by Guile and Unwin (2019) were used as a tool to draw together the various disparate findings in order to present a more holistic picture of what an individual who is an occupational expert in this particular automated production environment could look like.

Implications of this research for RPL practice

Knowledge surfaced in the RPL programme's assessment tools

One of the sub-questions for this research focused on which tools in the RPL Programme were able to surface the various forms of knowledge. While the breakdown of the forms of knowledge surfaced by each of the tools according to the different analytical lenses is presented in Chapters 5 and 6, in weighing up the value of each of the assessment tools, it is useful to consider each tool holistically. Although there are overlaps between the knowledge forms surfaced in some of the tools, each assessment tool surfaced a slightly different combination of knowledge forms. The complexity of the knowledge surfaced by each tool also varied.

The Technical Packaging Knowledge Screening Assessment was the first assessment that the candidates completed as it formed part of the application process for the RPL programme. This assessment tool surfaced mainly general principled knowledge (K4 of Gamble's (2016b) four quadrants) and strongly theoretical knowledge (H-- and H- on the 'knowing that' – 'knowing how' continuum). While some procedural knowledge (K1 and K2 of Gamble's (2016b) four quadrants) and questions containing more practical knowledge with less theoretical knowledge were also included (mainly H+ on the 'knowing that' – 'knowing how' continuum), these focused on specific procedures required in the qualification. In comparison to the qualification, the assessment tool had a much stronger focus on principled or theoretical knowledge. As the screening assessment for the RPL programme, it was designed to ensure that potential candidates had the required theoretical knowledge from the qualification but candidates who passed this assessment demonstrated substantial theoretical knowledge. The tool also surfaced evidence of disposition and values through a question based on the Critical Cross-Field Outcomes of the qualification. The need for candidates to demonstrate this level of theoretical knowledge in order to access the RPL programme became a direct counter to the question, "But aren't we just accrediting push-button operators?" This assessment tool, therefore, had a very specific purpose in surfacing the theoretical knowledge and was structured with questions that focused on this form of knowledge.

The Journals of Workplace Experience surfaced the most complex forms of knowledge as demonstrated by the analysis of the candidates' journals. As the aim of the journals was to align the candidates' workplace knowledge to the qualification requirements, it is not surprising that there was significant surfacing of procedural knowledge (K1 and K2 of Gamble's (2016b) four quadrants) and strongly practical knowledge (H++ and H+ on the 'knowing that' – 'knowing how' continuum) in the journal entries. General principled knowledge (K4 of Gamble's (2016b) four quadrants was also

surfaced in explanations of the principles underpinning certain procedures, as well theoretical knowledge that includes limited or no practical knowledge (H-- and H- on the 'knowing that' – 'knowing how' continuum) when candidates explained the theoretical knowledge bases of procedures.

While the above forms of knowledge could be anticipated to surface in a Journal of Workplace Experience by virtue of its purpose – which was to capture the candidates' experience and align it to the qualification Exit Level Outcomes and Associated Assessment Criteria – it was interesting to note that the journals also surfaced evidence of specific principled knowledge (K3 of Gamble's (2016b) four quadrants), or craft-like knowledge. Furthermore, evidence of sensory tacit and collective tacit knowledge was implied in some of the journal entries' recorded activities even though it was not directly described.

In terms of the features of occupational expertise several of the features were evident in the journals, specifically the sociomaterial, individual, practice-based, and collective features of expertise. Thus, the Journals of Workplace Experience were able to surface a broad range of knowledge forms and, using this data allowed me to capture some of the complexity of the workplace knowledge present in the production environment.

The third tool used for the RPL programme was the Workplace Observations. The assessment instrument was coded to determine the forms of knowledge that were likely to be surfaced during the assessment. The instrument focused mainly on specific procedural knowledge (K1 of Gamble's (2016b) four quadrants) in the observation points with procedural knowledge (K1 and K2 combined of Gamble's (2016b) four quadrants) overall being the most commonly coded forms of knowledge in the assessment instrument and at least some practical knowledge (H++, H+ and H- on the 'knowing that' – 'knowing how' continuum) present in over 80% of the observation points and questions.

There was a very limited presence of general principled knowledge (K4 of Gamble's (2016b) four quadrants) or solely theoretical knowledge (H-- on the 'knowing that' – 'knowing how' continuum), which was found in some of the questions that targeted the knowledge underpinning some of the observation points. There was no evidence of craft-like knowledge or tacit knowledge in this assessment instrument although its purpose was to capture the candidate's competence while operating the machine.

The assessment instrument provided a very structured set of observation points and questions aligned to qualification Exit Level Outcomes and Associated Assessment Criteria. By comparison, the knowledge surfaced in terms of the operator's own personal knowledge and practical experience in

operating the machines far exceeded what could be captured in the assessment tool. My research observation notes recorded while observing assessors conducting Workplace Observations captured a much more extensive range of knowledge than what was allowed for in the assessment tool. During the Workplace Observations, candidates demonstrated specific principled knowledge (K3 of Gamble's (2016b) four quadrants) or craft-like knowledge as well as sensory tacit knowledge and sociomaterial, individual, and practice-based expertise. While the tool did not reflect it, my research observation notes of the Workplace Observations identified various knowledge forms and provided insights into the complexity of the workplace knowledge that is present in the candidates' production environment.

The disjuncture between the forms of knowledge surfaced during the Workplace Observations and what was able to be captured by the assessment tool highlights again one of the key critiques of the 'credit exchange' model (Harris, 1999), namely that it upholds the dominant view of what counts as knowledge and shapes the individual's experience to fit external requirements (Fenwick, 2001). Indeed, each of the assessment tools in this RPL programme was designed to align to the qualification requirements and sought to shape the candidates' knowledge and skills to these requirements.

The comparison between the SAQA qualification and the RPL programme's assessment tools is discussed in the next section, but I would like to suggest that the findings above are useful to consider when designing RPL assessment tools. Although the need to align the assessments to the qualification requirements is valid, the tools used suggest that there may be a much broader scope for the types of tools that could be used for assessment in an RPL programme. The Journals of Workplace Experience not only provided an opportunity for the candidates to record evidence of their competence but, in line with the experiential learning tradition that the programme was based on, also encouraged candidates to critically reflect on their practices and thereby further extend their knowledge and skills.

The open-ended methodology employed by allowing candidates to record their evidence before aligning it to the qualification Exit Level Outcomes also meant that it was more probable that the journals would surface more complex forms of knowledge drawn from the candidates' workplace. Similarly, the forms and complexity of knowledge surfaced during the Workplace Observations was directly related to the candidates' workplace experiences, even though this was not captured in the assessment tool. This suggests that, for RPL candidates, using assessment tools that allow the candidate and assessor to capture a more holistic picture of the forms and complexity of workplace knowledge would provide a greater opportunity for the candidates to demonstrate the true extent of their occupational expertise. As Cooper argues, "an RPL process that acknowledges and seeks to work creatively with the inevitable tensions that arise between complex forms of 'everyday' knowledge and

those of the academy, opens up the possibility of new, richer and better forms of knowledge" (2006, p. 237).

Knowledge in the qualification versus what was surfaced through the RPL programme

Critiques of the use of learning outcomes for qualification development are extensive, one of the most common being the removal of disciplinary or principled knowledge from qualifications in favour of a focus on the procedural knowledge required to perform the work associated with the occupation (see, for example, Gamble, 2006; Young, 2006; Allais, 2014). In the South African context, occupational qualifications rely on the inclusion of 'Essential Embedded Knowledge' that underpins an outcome of the qualification to address any principled knowledge required.

The lack of a substantive disciplinary knowledge component in the SAQA qualification that the RPL programme was based on was evident in the coding of the qualification's Exit Level Outcomes and Associated Assessment Criteria, which were predominantly focused on procedural knowledge, and specific procedural knowledge in particular. As detailed in Chapter 5 and touched on above, the RPL programme's assessment tools followed the same overall pattern since they were developed to meet the qualification's requirements. While the Technical Packaging Knowledge Screening Assessment contained a significant number of questions that were coded for general, principled knowledge using Gamble's (2016b) four knowledge types, the more nuanced coding of the 'knowing that' – 'knowing how' continuum identified only 21 questions out of 49 that demonstrated extensive subject or theoretical knowledge. The high level of theoretical knowledge in this assessment may, in part, have been an attempt to address the concern regarding 'push-button operators' by demonstrating the candidates' substantial theoretical packaging knowledge. In so doing, the contrast between the candidates' knowledge and that required by the qualification became evident as the qualification as the candidates who passed the Technical Packaging Knowledge Screening Assessment demonstrated substantially more theoretical knowledge than the qualification required.

However, what became apparent in the coding of the candidates' evidence was that certain of the RPL tools were enacted by the candidates and assessors in ways that allowed for a much broader range of knowledge types to be surfaced. This was evident in the analysis of the Journals of Workplace Experience and my research observation notes on the Workplace Observations. The data from these sources included evidence of craft-like knowledge and tacit knowledge, as well as more principled knowledge. This suggests that, while the qualification may provide a starting point for new entrants to the labour market to learn the procedures and skills required for packaging machine operators, it

does not provide for sufficient knowledge across all the various forms of knowledge required to develop the features of occupational expertise necessary to become an expert machine operator.

Implications for the design of RPL assessment tools

From an RPL perspective this suggests that, although the aim of this RPL programme was to award the candidates with the NQF 3 National Certificate: Food and Beverage Packaging Operations, the candidates' knowledge and skills extended beyond the requirements of the qualification. In terms of the 'credit exchange' model (Harris, 1999) of RPL, the goal of awarding the qualification was sufficient. However, as Harris (1999) also points out, this model merely upholds the status quo of what counts as knowledge. For the candidates on this RPL programme, obtaining the certificate may have been the primary goal, but the RPL programme also provided an opportunity for them to present the much broader and more complex range of knowledge and skills that they have acquired through their years of experience. Whilst being mindful of not defaulting to a commodification of this knowledge (Cooper, 2016), RPL presents an opportunity to capture the candidates' knowledge and skills beyond just the qualification requirements but, rather, as a way of demonstrating the extent to which they could be considered as occupational experts in their workplace.

As discussed above, the findings of this research demonstrated that the various assessment methodologies employed in this RPL process enabled candidates to present a more diverse range of knowledge types in ways that reflected the complexity of their workplace knowledge and the extent of their occupational expertise. This points to the need for RPL, as an assessment process, to be envisaged as distinct from the traditional assessment processes used to award a qualification. Furthermore, the assessment methodologies and tools used to assess RPL candidates require more flexibility and openness in their design in order to allow for a broader conceptualisation of the knowledge forms, for example the sensory tacit knowledge and craft-like knowledge surfaced in this case study, to be recognised and accepted in the RPL process. This includes making provision for the candidates to engage with and critically reflect on their workplace practices in ways that foreground their occupational expertise.

Implications for the development of RPL practitioners

To use RPL for demonstrating occupational expertise, however, requires RPL practitioners who are able to move beyond their understanding of RPL as a 'credit exchange' model (Harris, 1999) based on meeting the mainly procedural knowledge requirements of the qualification. Fenwick (2001) cautions that the facilitator and assessor in an RPL process risk simply upholding the dominant views of

knowledge and shaping the candidate's individual experience to fit the institution's or, in this instance, the qualification's requirements. Even if the RPL programme's tools are capable of surfacing various forms of knowledge, unless the RPL assessor is able to recognise and validate these forms of knowledge, these forms of knowledge will remain unacknowledged.

Various researchers in the field have argued that RPL should extend beyond just a process of recognising prior learning that relates to measurable outcomes and should rather form its own pedagogical approach (Michelson, 1996a; Harris, 1999; Cooper, 2006; Evans et al., 2010; Cooper, Ralphs, and Harris, 2017). The notion of RPL as a 'specialised pedagogy' (Cooper and Ralphs, Eds, 2016) suggests that the RPL practitioners who are involved in RPL require more than just an understanding of conducting RPL assessments. To implement an RPL programme that does not just uphold the dominant view of knowledge, it is necessary for the RPL practitioners to be able to interpret the various forms of knowledge that may be surfaced and *mediate* between the end requirements of either an institution or a qualification, and the complex forms of knowledge presented for assessment by the candidates. This is only possible if the RPL practitioners and assessors have been trained to recognise forms of knowledge that lie outside of the knowledge requirements and to guide candidates on how best to present their prior knowledge and experience for validation. This research emphasises the importance of ensuring that RPL assessors and practitioners are familiar with the workplace and are already an occupational expert in the occupation that they are conducting RPL for so that they are able to conceptualise the complex forms of knowledge present in that occupation.

Defining an occupational expert

Central to this research was the need to determine whether the RPL programme could capture and surface the complexity of occupational knowledge. In order to do this, it was necessary to analyse the types of knowledge surfaced through the RPL programme, which led to further questions around how the full complexity of what was surfaced in the RPL programme could be conceptualised. This in turn raised the question of what constitutes an expert in this high-speed beverage packaging work environment.

This section draws on the findings of the previous two chapters in order to sketch out the various features of an occupational expert in this context, and how these features draw together the various types of knowledge, together with the exercise of skill, dispositions and values, and the use of judgement. It proposes a way of looking at them as interrelated and contributing to the concept of an occupational expert for this context. While some of the features and concepts of an occupational expert may be used in other occupational contexts, this is a single case study and the various parts

that contribute to this conceptualisation may not be present in other occupational contexts, or else could be surfaced in other ways and in differing amounts (Gamble, 2016a, 2016b).

Returning to the conceptualisation of expertise in Chapter 3, Guile and Unwin (2019) defined expertise as encompassing practical and theoretical elements related to the performance of work. For Winch (2012), expertise includes the concepts of skill and technique, and the related normative appraisal thereof, as well as the relationship between a combination of practical and theoretical knowledge, the role of dispositions and values, and the use of judgement. The discussion of expertise in Chapter 3 demonstrates that the conceptualisation of expertise arises from a number of different fields of research, of which the above definitions are only two out of many different definitions.

There do appear to be, however, certain common elements that reoccur in both the conceptual definitions as well as in this research study. The first is that expertise is contained in individuals as experts who possess their own specific combination of vocational knowledge and skill (Winch, 2012). Secondly, vocational knowledge consists of both principled and procedural knowledge that are both differentiated and interrelated. It is the capability to combine different knowledge types, that defines an expert (Hordern, 2019). Thirdly, an expert is able to draw on their vocational knowledge and vocational practice to make judgements about work in non-routine or complex scenarios (Dreyfus, 2004). Fourthly, the development of expertise is a process that occurs over time related to exposure to the work environment (Billett, 1999), and work of risk (Pye, 1968) particularly. Finally, the development of expertise is related to the development of craft-like knowledge and forms of tacit knowledge in the work environment (Gamble, 2004a, 2016b). These five key components seem to suggest that it is possible to identify an expert based on specific features.

Guile and Unwin (2019) have identified a slightly different set of features of expertise, although there are overlapping points between their conceptualisation of the various features of expertise and the components identified above. Analysing the data from the RPL programme using Guile and Unwin's features of expertise highlighted similar points and, in particular, the interrelatedness of the various features of expertise based on their underpinning concepts. What comes across very strongly in this research is that the interrelatedness of the features of expertise is not an accidental by-product of the development of expertise but the defining feature of an occupational expert. Similar to the way in which experts apply the visualisation principle in craft knowledge in order to visualise the relationship between the parts and whole in their particular work context, it is the relationship between the parts of expertise that contributes to the conceptualisation of an occupational expert as a whole that is greater than the sum of its parts.

The findings from Chapter 6 based on an analysis of the data in search of the features of expertise suggest that, for this context, an occupational expert is able to demonstrate five of the six features of expertise presented by Guile and Unwin (2019). The only feature of expertise not directly evident in the data was cross-occupational expertise, as the case study only focused on how the RPL candidates functioned in their own context and did not consider whether they would be able to apply their expertise in other occupational contexts. However, using the other five features of expertise still provided a clear enough picture of what constitutes an occupational expert in the context of high-speed packaging line machine operator. Drawing on a combination of Guile and Unwin's (2019) features of expertise, namely that it is individual, collective, sociomaterial, practice-based, and defined and measurable, in conjunction with the descriptions of how these features were surfaced in the data, an occupational expert in this context demonstrates all five features in very nuanced ways.

An occupational expert in this work environment demonstrates sociomaterial expertise through their use of sensory tacit knowledge, in this instance auditory, visual, and tactile tacit, to engage with the machines using their senses as a source of knowledge, as well using routinised and habituated skills when engaging in certain procedures that draw on specific skills and techniques. They further demonstrate their individual expertise through the way in which they are able to draw on both principled and procedural vocational knowledge, in tacit and explicit forms, to support their use judgement in their work. This is specifically evident in the way in which they conduct complex problem-solving in situations that may involve and an element of work of risk. The operator relies on their own knowledge and experience, which may include craft-like knowledge that allows them to visualise the parts of the packaging process in relation to the whole packaging operation, rather than just following company QFRs and procedures for problem-solving. This use of judgement also results in an "immediate intuitive situational response" (Dreyfus, 2004, p. 180) that draws on the operator's tacit knowledge in combination with their skills. The way in which operators use skill also forms part of the practice-based feature of expertise.

Practice-based expertise is demonstrated by an occupational expert in this context through their recontextualisation of vocational knowledge using the logic of work in order to produce the knowledge bases that they use in the exercise of skill. An occupational expert is also able to draw on the collective feature of expertise. This includes being able to incorporate collective expertise into their vocational practices, through the way in which they allow specific dispositions and values to influence their vocational practices and the exercise of skill, as well as by incorporating other operators' tacit knowledge and vocational practices into their own vocational practices. These four features of expertise and the way in which they are interrelated in the context of the particular work environment

paint a very clear picture of what an occupational expert looks like for a high-speed beverage packaging line.

The last feature of expertise, that it is definable and measurable, relates in part to the role of normative appraisal (Winch, 2012) in the exercise of skill. While expertise is not easily measurable, it could be construed in adjectives related to how 'well' the operator exercises certain skills. It could potentially also be measured through the ability of the operator to use their judgement to correctly solve complex problems. In terms of expertise being defined, this comes through the way in which the other features of expertise are demonstrated by an operator. For this research, an occupational expert could be defined in terms of the four previous features of expertise, as well as how well they meet the outcomes of the qualification that the RPL programme measures them against. Their ability to meet the outcomes of the qualification is, however, not a very good indicator of their occupational expertise as this research demonstrates that the qualification does not capture the full range of the candidates' knowledge, skills, and expertise, nor the complexity of the workplace knowledge that the candidates demonstrated.

The RPL candidate as an occupational expert

As discussed in the previous section, an occupational expert could be measured against the outcomes of qualification designed to train novices for the occupation. However, as this study has demonstrated, the complexity of knowledge required by the qualification appears to be much lower than the complexity of occupational knowledge surfaced through the RPL programme's candidate evidence. In terms of the 'credit exchange' model for RPL (Harris, 1999), the candidates were all found competent against the qualification, based on the evidence that they provided for assessment. While the awarding of the NQF 3: National Certificate Food and Beverage Packaging Operators was the final outcome of the RPL programme, it did not answer the question of whether we were just accrediting 'push-button operators' working in a deskilled, automated environment. What became clear in the findings presented in Chapters 5 and 6 is that the RPL programme's assessment tools did indeed capture some of the complexity workplace knowledge.

However, the ability of the assessment tools to surface the complexity of workplace knowledge was not based on their alignment to the very procedural-knowledge-based qualification but, rather through the way in which the RPL candidates enacted these tools and, thereby, were able to surface the complexity of their workplace knowledge and, more significantly, their expertise. The assessment tools did, however, provide the candidates the opportunity to do this. The depth and breadth of knowledge displayed by the operators suggests that there is far more to being a machine operator

than simply pushing buttons. An experienced high-speed beverage packaging machine operator can therefore be defined as an occupational expert based on the way in which they demonstrate their workplace knowledge, as captured in the features of expertise.

In conclusion then, the RPL programme surfaced more than just the complexity of workplace knowledge, it foregrounded the RPL candidates as occupational experts in their work context. Despite the routinisation and automation, the RPL candidates made use of a combination of their procedural and principled vocational knowledge, including collective expertise, craft-like knowledge, and tacit knowledge, interrelated with their vocational practices in order to make judgements. This use of their own judgement formed part of their decisions-making and ability to conduct complex problem-solving in an environment that included elements of work of risk. To even suggest that these candidates are 'just push-button operators' fails to acknowledge their role as occupational experts in their context and reinforces the argument that automation results in deskilling. It is far more valuable to acknowledge that, although it may have to be conceptualised differently, automated work environments can nevertheless provide for the development of expertise and experienced machine operators may also be occupational experts in their own work environment.

Returning to the deskilling debate

The complexity of the workplace knowledge identified and classified in this research, together with the identification of the features of an occupational expert in the RPL candidates, suggests that the argument made in Chapter 1 regarding automation leading to deskilling may be more complex than the literature implies. This research presented a case study of RPL in an automated production environment – a high-speed beverage packaging line. It would be expected that the impacts of automation on the organisation work would be clearly evident in this workplace and that the complexity of knowledge required, as well as the forms of knowledge employed, would be significantly reduced (Braverman, 1974; Hordern, 2014; Previtali and Fagiani, 2015; Gamble, 2016b).

The analysis of the organisation of work in Chapter 6 in conjunction with the findings in Chapters 5 and 6 around the forms of knowledge drawn on in that work context, however, do not support the argument that the increased automation has resulted in deskilling. While this may not be the case for other automated production environments, this research provides a different conceptualisation of workplace knowledge in an automated environment that enables the identification of forms of knowledge not easily describable such as craft-like knowledge and sensory tacit knowledge. It also points to the presence of more complex workplace knowledge than the notion of an automated production environment originally suggests.

The organisation of work in Chapter 6 also highlighted the presence of elements of uncertainty that were more closely related to work of risk (Pye, 1968), particularly with regard to problem-solving. Thus, the findings from this research align with Billett's (2000, 2003) argument that such work is not routine but, rather, can be highly complex and demanding. While certain tasks may have been automated, this has not removed the need for occupational experts in the workplace. Indeed, the need for occupational experts capable of exercising their professional judgement, particularly during problem-solving and for decision-making in uncertain situations, is vital (Kim, 2019). This research has highlighted that occupational experts, even in a highly automated production environment, draw on complex workplace knowledge in various forms. The section that follows will discuss how this could be considered in the development of vocational qualifications and curricula in order to support new learners' development of occupational expertise.

Possible considerations for vocational qualifications and curricula

While the focus of this research is not directly on vocational qualifications or curriculum, there are certain observations arising from this research that may be useful to consider for the purposes of developing vocational qualifications and curricula that feed into the development of occupational experts. Although their literature review focuses on schooling, Johnson and Majewska (2022, p. 6) suggest that "understanding non-formality in learning could contribute to our collective thinking around effective curriculum design and the structuring of learning".

While the focus of vocational education and training tends to be more on new entrants to the labour market, provision nevertheless needs to be made for the development of features like professional judgement (Winch, 2020). By considering the features of an occupational expert in terms of their relationship to vocational knowledge and practice, it may be possible to gain insights into how to better provide for the development of expertise through the curriculum. For this purpose, the section that follows raises several points for consideration.

The role of the workplace as a site of learning and knowledge production

In considering the development of a vocational curriculum that is based on occupational expertise, it is necessary to consider where the development of occupational expertise occurs. The inclusion of the workplace as a site of learning and knowledge production is argued for by Billett, amongst others, who states: "Knowledge secured in workplaces is likely to be different from that constructed in the schoolroom because the knowledge-constructing experiences are different" (Billett, 1999, p. 154). This is evident from the findings of this research as they point to the complexity of workplace

knowledge, and the development of tacit knowledge through exposure to the workplace. The development of sensory tacit knowledge, in particular, could not have occurred without exposure to the work environment and the machines it is based on.

I am not arguing for an approach that places all emphasis on the workplace as the only possible site of learning for occupations. While much of the knowledge surfaced in the RPL programme related to the candidates' workplaces, they were also exposed to informal and non-formal learning through the company's internal training courses, as well as given access to certain theoretical knowledge through the contact sessions of the RPL programme where they engaged with subject matter experts.

Where the workplace was critical, however, was for the development of occupational expertise, including the candidates' use of judgement and ability to visualise the parts of the packaging process in relation to the whole of the overall production line. Billett (1999) also argues that the workplace exposure is essential for the development of problem-solving skills. This relates back to the candidates' use of their own understanding of the machines in making judgements for complex problem-solving, which was developed through their exposure to a work environment which included elements of work of risk. As Eraut argues

> 'the workplace context brings new perspectives to research on learning because it encompasses a wide range of more or less structured environments, which are only rarely structured with learning in mind' (Eraut, 2004, p. 247).

This is not only true of the learning process, but also of the forms of knowledge being learned – knowledge production in the workplace is distinct from the forms of knowledge produced in educational institutions. There is also a wide range of complex knowledge combinations that may be present depending on the knowledge bases of the occupations in a specific workplace (Gamble, 2016b).

Winch (2020) proposes that initial vocational education, for the formation of professional judgement, should start in the college with the opportunity for candidates to make judgements in controlled conditions without exposure to the full operational conditions that may include work of risk. At the same time, he acknowledges that the development of judgement requires situational knowledge of the workplace. However, considering the candidate's use of sensory tacit knowledge and tacit knowledge in other forms as well in making judgements, exposure to the full extent of the work environment in which the learner will be required to operate and make judgements is essential to the development of the knowledge bases and skills necessary to make judgements and, thereby, begin the journey towards becoming an occupational expert.

Cook (1982) argues that apprentices learn to make judgements in the workplace by being allowed to make judgements, which are then validated by the master craftsman as correct or incorrect. It is from this process of making judgements and learning from their incorrect judgements that the apprentice progressively improves their ability to make correct judgements. It is possible to learn how to make judgements and for this ability can be passed on. The making of judgements can be taught through exposure to examples and having judgements 're-judged' by a 'master'. This is not possible in a controlled college environment, especially if learners are taught according to a curriculum that does not include the full range of both principled and procedural knowledge necessary for the occupation. While candidates may be able to develop certain skills, certain dispositions and values form part of the collective tacit knowledge (Collins, 2010) of the workplace and will also only be learned in the workplace.

Reconsidering vocational qualifications

While the role of colleges may be necessary for initial vocational education and training and the teaching of systematic, principled knowledge particularly, what is taught may require re-evaluation. The considerations discussed below are not new, although the focus of this research differs from much of the work on vocational education and training curricula in that it is focused specifically on a highly automated work environment. This differs substantially from the origins of vocational education which is rooted in apprenticeships and the craft and trade occupations (Gamble, 2018). Although the work environment and the way in which certain concepts such as craft knowledge have been interpreted differs from the original craft work environment, my research nevertheless supports the argument that vocational qualifications and curricula should include a broader scope of knowledge, both principled and procedural, to address the full extent of vocational knowledge required for the occupation (Gamble, 2006; Young, 2006).

It is, however, not sufficient to focus only on vocational knowledge. As the findings of this research demonstrate and as Gamble argues, both the 'theory' and 'practice' dimensions are required for vocational qualifications – an approach that she refers to as the 'middle road' between the 'high road' of a knowledge-based curriculum and the 'low road' of a curriculum based on the labour process (2018, p. 251). A curriculum based on the labour process could also be construed as being based solely on procedural knowledge and vocational practices in the form of skills and techniques.

The interrelationship between the two dimensions – theory and practice – in varying combinations provides a basis for the vocational knowledge required in a particular occupation. This is reinforced by Hordern's argument that

> Making effective use of the interrelation between theoretical concepts and practical examples, involving the capacity to oscillate between the conceptual and the contextual, can be seen as vital for vocational knowledge, learning and work. (2014, p. 29)

For machine operators in particular, workplace experience is critical to enable the development of the required tacit and craft-like knowledge that they need to be able to exercise professional judgement in their workplaces. This combination of sites of learning is similar to Wheelahan's argument that

> an exclusive focus on learning theoretical knowledge in college does not provide students with access to the tacit, context-dependent knowledge of the workplace. Both sites of learning are needed. (2019, p. 104)

Hordern (2019) argues that there must be a balance between acquisition of the knowledge bases and participation in the workplace practices in order to ensure both the disciplinary knowledge and the individual expertise necessary for the occupation are acquired. He also argues that participation in workplace practices allows access to occupational resources and expertise provided by experienced practitioners. He refers to the need not only to participate in the practice but also to commit to the practice and thereby develop the disposition and values required for the occupation.

Based on this, I would argue that a curriculum that addresses the interrelationship between vocational knowledge and vocational practices, including a strong workplace curriculum for the development of judgement and other features of expertise, could support the development of occupational experts who are able to use their judgement for complex problem-solving that are related to work of risk. This type of curriculum is described by Barnett (2006) as 'facing both ways' in that it considers both the workplace knowledge requirements and the disciplinary knowledge requirements of the occupation.

Qualifications for the future?

In considering the current demands placed on vocational qualifications to address technological developments and the changing organisation of work discussed in Chapter 1, while certain elements of the vocational qualification may change, the argument made by Gehrke *et al.* is that, despite the changes in the organisation of work as a result of the 4th Industrial Revolution,

> the core qualifications and skills that are mediated in a classical technical apprenticeship of today, such as the basic knowledge about materials or metal processing, will remain in the core of the education of the skilled labor (2015, p. 12).

This reinforces the need for the inclusion of principled knowledge in vocational qualifications going into the future. As Gamble (2016b) identifies in her analysis of the case studies in her research, while the amount of each type of knowledge is subject to change in response to changes in the organisation of work, both procedural and principled knowledge will still be required.

In considering how automation impacts the types of knowledge required, it is interesting to note that one of the technical qualifications and skills that Gehrke *et al.* argue must be included in the 'Qualifications and skills of workers in a factory of the future' is the 'Ability to interact with modern interfaces (human-machine / human-robot)' (2015, p. 13). While this may, in some cases, be closer to Zuboff's description of workers pushing buttons in cases such as the one described in this research, it may be that a form of manufacturing-related 'craft-like knowledge' is needed for the machine operators who are exposed to some of form of work of risk (Pye, 1968) despite the routinisation of a highly automated work environment.

While the role of tacit knowledge for manufacturing operators is not new – Wood, writing in 1987 mentions the tacit knowledge of experienced operators being necessary for problem solving – the argument for deskilling due to automation remains prevalent. However Winch argues that even the '[autonomous] kind of worker … is capable of solving problems, working in teams and managing projects, doing so through the effective exercise of professional judgement as well as action' (2020, p. 13). Similarly, the findings of this research suggest that, despite arguments about deskilling due to automation, tacit knowledge remains part of the knowledge required by machine operators, particularly for complex problem-solving and judgements used to make decisions that involves work of risk.

Conclusion

This research started with the question "But aren't we just accrediting push-button operators?" This led to the research question "What forms of workplace knowledge used in an automated production process can an RPL programme surface and how might such knowledge be categorised and conceptualised?" and the posing of three sub-questions:

1. What kinds of workplace knowledge used in an automated production environment can be surfaced through an RPL Programme?
2. How are such forms of knowledge surfaced, i.e. which tools in the RPL Programme are able to surface what forms of knowledge?
3. What languages of description can conceptualise such workplace and occupational knowledge?

In Chapters 2 and 3 I introduced my conceptualisation of workplace and occupational knowledge to provide the conceptual framework for this research. This formed the foundation of my analytical framework, as discussed in Chapter 4. However, it became apparent during the research that there was a 'discursive gap' (Ensor and Hoadley, 2004) between my analytical framework and what was being surfaced by the empirical data. While this gap will always exist in research, this thesis makes a

contribution to the understanding of knowledge in vocational contexts by extending the conceptualisations of workplace knowledge to incorporate the concepts of sensory tacit knowledge and craft-like knowledge, as well as the features of occupational expertise. In addition, a further contribution is made by demonstrating that workplace expertise cannot be understood via static conceptions of distinct knowledge types but must be conceptualised as comprising complex articulations of different knowledge types in dynamic interaction with one another.

The forms of knowledge surfaced by the RPL programme's assessment tools pointed to the complexity of workplace knowledge present, even in an automated production environment. As discussed in this chapter, the forms of knowledge surfaced provide a picture of what an occupational expert in this work environment could look like based on Guile and Unwin's (2019) features of expertise. These features allowed for the drawing together of the disparate forms of knowledge identified in the findings into a single holistic picture of what constitutes an occupational expert in this context.

This research was limited to a single case study and context – an RPL programme for machine operators in an automated high-speed beverage packaging environment. However, while the particular combination and forms of knowledge present will differ between contexts, this research provides a way of conceptualising and classifying the complexity of workplace knowledge that could potentially be applied to the conceptualisation of occupational experts in other contexts as well.

This chapter has also offered some implications of this research for RPL practices, as well as possible considerations for vocational qualifications and curricula arising from the research. These arise from the findings that answered sub-questions 1 and 2. Identifying the forms of knowledge surfaced by the different assessment tools has provided insights into how RPL programmes can be implemented in a way that makes allowances for the range of knowledge forms that candidates could demonstrate, as well as for capturing their occupational expertise.

The complexity of workplace knowledge surfaced in comparison to the SAQA qualification requirements also points to the need to revisit the knowledge requirements of vocational qualifications, as argued in the critiques of outcomes-based qualification design (Billett, 2003; Gamble, 2006, 2016a; Young, 2006, 2013; Wheelahan, 2015, 2019). From the perspective of an RPL programme, the complexity of the workplace knowledge surfaced also suggests that RPL practitioners need to be equipped with appropriate conceptual tools in order to be able to recognise and identify complex forms of knowledge in order to adequately support and assess RPL candidates.

Finally, I believe that the complexity of workplace knowledge surfaced and conceptualised through this research answers my original question: "But aren't we just accrediting push-button operators?"

The FoodBev SETA accredited training provider who designed the RPL programme initially argued that this was not a “programme for novices” nor those without sufficient underpinning knowledge (Turner, 2015). This research supports the answer that the RPL candidates in this programme were definitively not just ‘push-button operators’ but, rather, occupational experts capable of drawing on complex forms of workplace knowledge to make professional judgements and function in uncertain workplace situations.

REFERENCES

Ackrill, M. (1987) *Manufacturing Industry since 1870*. Oxford: Philip Allan Publishers Limited.

Addis, M. and Winch, C. (2017) 'Introduction', *Journal of Philosophy of Education*, 51(3), pp. 557–573. Available at: https://doi.org/10.1111/1467-9752.12250.

Aitchison, J. (2004) 'Lifelong learning in South Africa: Dreams and delusions', *International Journal of Lifelong Education*, 23(6), pp. 517–544. Available at: https://doi.org/10.1080/026037042000311451.

van den Akker, J. *et al.* (2006) *Educational Design Research*. Edited by J. Van den Akker et al. London: Routledge. Available at: https://doi.org/10.4324/9780203088364.

Allais, S. (2014) *Selling out education: National Qualifications Frameworks and the Neglect of Knowledge*. Rotterdam: Sense Publishers. Available at: https://doi.org/10.1007/978-94-6209-578-6/COVER.

Anderson, J.R., Reder, L.M. and Simon, H.A. (1996) 'Situated Learning and Education', *Educational Researcher*, 25(4), p. 5. Available at: https://doi.org/10.2307/1176775.

Aploon-Zokufa, K. and Needham, S. (2023) 'Pathways of Early Childhood Development practitioners into higher education: A capabilities approach', *Journal of Vocational, Adult and Continuing Education and Training*, 6(1), p. 18. Available at: https://doi.org/10.14426/jovacet.v6i1.317.

Armsby, P., Costley, C. and Garnett, J. (2006) 'The legitimisation of knowledge: A work-based learning perspective of APEL', *International Journal of Lifelong Education*, 25(4), pp. 369–383. Available at: https://doi.org/10.1080/02601370600772368.

Avis, J. (2014) 'Workplace learning, VET and vocational pedagogy: the transformation of practice', *Research in Post-Compulsory Education*, 19(1), pp. 45–53. Available at: https://doi.org/10.1080/13596748.2014.872920.

Barnett, M. (2006) 'Vocational knowledge and vocational pedagogy', in M. Young and J. Gamble (eds) *Knowledge, Curriculum and Qualifications for South African Further Education*. Cape Town: Human Sciences Research Council, pp. 143–157.

Bernstein, B. (1996) *Pedagogy, Symbolic Control and Identity*. London: Taylor and Francis.

Bernstein, B. (1999) 'Vertical and Horizontal Discourse: An Essay', *British Journal of Sociology of Education*, 20(2), pp. 157–173. Available at: http://www.jstor.org/stable/1393106.

Bernstein, B.B. (2000) *Pedagogy, Symbolic Control, and Identity*. Revised. Lanham: Rowman & Littlefield Publishers.

Berryman, S.E. (1993) 'Learning for the Workplace', *Review of Research in Education*, 19, pp. 343–401. Available at: https://www.jstor.org/stable/1167346.

Bijsterveld, K. (2018) *Sonic skills: Listening for knowledge in science, medicine and engineering (1920s-Present)*, *Sonic Skills: Listening for Knowledge in Science, Medicine and Engineering (1920s-Present)*. Maastricht: Springer Nature Limited. Available at: https://doi.org/10.1057/9781137598295.

Billett, S. (1999) 'Guided learning at work', in D. Boud and J. Garrick (eds) *Understanding Learning at Work*. London and New York: Routledge, pp. 151–164.

Billett, S. (2000) 'Performance at work: Identifying smart work practice', in R. Gerber and C. Lankshear (eds) *Training for a Smart Workforce*. 1st edn. London: Routledge, pp. 135–162. Available at: https://doi.org/10.4324/9780203455746-12.

Billett, S. (2003) 'Vocational Curriculum and Pedagogy: An Activity Theory Perspective', *European Educational Research Journal*, 2(1), pp. 6–21. Available at: https://doi.org/10.2304/eerj.2003.2.1.11.

Billett, S. (2006) 'Constituting the workplace curriculum', *Journal of Curriculum Studies*, 38(1), pp. 31–48. Available at: https://doi.org/10.1080/00220270500153781.

Billett, S. (2019) 'Vocational Education and the Individual', in D. Guile and L. Unwin (eds) *The Wiley Handbook of Vocational Education and Training*. Hoboken, NJ, USA: John Wiley & Sons, Inc., pp. 41–62.

Bloch, M. (1998) *How we think they think: Anthropological approaches to cognition, memory and literacy*. Boulder, CO: Westview Press.

Bolton, H. *et al.* (2020) 'Recognition of Prior Learning and Flexible Learning Pathways in South Africa', in R. Duvekot et al. (eds) *Making Policy Work: Validation of Prior Learning for Education and the Labour Market*. Houte: European Centre Valuation of Prior Learning & Bertelsmann Stiftung, pp. 279–290.

Boud, D. (2001) 'Using Journal Writing to Enhance Reflective Practice.: Library resources', *New Directions for Adult and Continuing Education*, 90(9). Available at:

http://eds.a.ebscohost.com/eds/pdfviewer/pdfviewer?vid=8&sid=4e031835-d3ca-450e-96d6-a2b22fdbcf60%40sessionmgr4006.

Boud, D. and Walker, D. (1990) 'Making the most of experience', *Studies in Continuing Education*, 12(2), pp. 61–80. Available at: https://doi.org/10.1080/0158037900120201.

Boud, David. and Garrick, John. (1999) *Understanding Learning at Work*. London and New York: Routledge.

Braverman, H. (1974) *Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century*. 25th Anniv. New York: Monthly Review Press. Available at: https://doi.org/10.3817/0976029199.

Breier, M. (2011) 'South Africa: Research reflecting critically on Recognition of Prior Learning (RPL) research and practice', in J. Harris, M. Breier, and C. Wihak (eds) *Researching the Recognition of Prior Learning*. NIACE.

Breier, M. and Ralphs, A. (2009) 'In search of phronesis: Recognizing practical wisdom in the recognition (assessment) of prior learning', *British Journal of Sociology of Education*, 30(4), pp. 479–493. Available at: https://doi.org/10.1080/01425690902954646.

Broad, J.H. and Lahiff, A. (2019) 'Capturing the Elusive: How Vocational Teachers Develop and Sustain Their Expertise', in D. Guile and L. Unwin (eds) *The Wiley Handbook of Vocational Education and Training*. Hoboken, NJ, USA: John Wiley & Sons, Inc., pp. 433–454.

Brookfield, S. (1998) 'Against Naive Romanticism: from celebration to the critical analysis of experience', *Studies in Continuing Education*, 20(2), pp. 127–142. Available at: https://doi.org/10.1080/0158037980200202.

Buchanan, J. *et al.* (2020) 'The futures of work: what education can and can't do', *Paper commissioned for the UNESCO Futures of Education report*, pp. 1–24.

Butler, E. (1999) 'Technologising equity: the politics and practices of work-related learning', in D. Boud and J. Garrick (eds) *Understanding Learning at Work*. London and New York: Routledge, pp. 132–150.

Cameron, R. (2014) 'RPL and workforce development', in J. Harris, C. Wihak, and J. Van Kleef (eds) *Handbook of the Recognition of Prior Learning*. Leicester: NIACE, pp. 115–149.

Castells, M. (2001) 'The new global economy', in J. Muller, N. Cloete, and S. Badat (eds) *Challenges of Globalisation*. Cape Town: Maskew Miller Longman Ltd., pp. 2–21.

Cianciolo, A.T. *et al.* (2012) 'Tacit Knowledge, Practical Intelligence, and Expertise', *The Cambridge Handbook of Expertise and Expert Performance*, (January 2005), pp. 613–632. Available at: https://doi.org/10.1017/cbo9780511816796.035.

Cochran-Smith, M. and Lytle, S.L. (2009) 'Teacher Research as Stance', in. London: SAGE Publications Ltd, pp. 39–49. Available at: https://doi.org/10.4135/9780857021021.n5.

Coetzee, G. (2011) *Knowledge-based expertise as the hallmark of work of risk: an analysis of the curriculum and pedagogy of a National Diploma in Train-Driving*. Unpublished Thesis. University of Cape Town.

Collins, H. (2007) 'Bicycling on the moon: Collective tacit knowledge and somatic-limit tacit knowledge', *Organization Studies*, 28(2), pp. 257–262. Available at: https://doi.org/10.1177/0170840606073759.

Collins, H. (2010) *Tacit and Explicit Knowledge*. Chicago & London: The University of Chicago Press.

Collins, H. and Evans, R. (2007) *Rethinking Expertise*. Chicago and London: The University of Chicago Press. Available at: https://doi.org/10.1177/009430610803700656.

Collins, H.M. (2001) 'Tacit Knowledge, Trust and the Q of Sapphire', *Social Studies of Science*, 31(1), pp. 71–85.

Collins, R. (1979) *The Credential society: an historical sociology of education and stratification.* New York: Academic Press.

Cook, S.D. (1982) *Part of What a Judgement is: A Conceptual Framework for Understanding the Making of Judgements in the Contexts of Work*. Massachusetts Institute of Technology.

Cook, S.D.N. and Brown, J.S. (1999) 'Bridging Epistemologies: The Generative Dance between Organizational Knowledge and Organizational Knowing', *Organization Science*, 10(4), pp. 381–400. Available at: https://doi.org/10.1287/orsc.10.4.381.

Cooper, L. (2005) *Towards a theory of pedagogy, learning and knowledge in an 'everyday' context: a case study of a South African trade union*. Unpublished PhD thesis. University of Cape Town. Available at: https://open.uct.ac.za/handle/11427/13998 (Accessed: 24 September 2023).

Cooper, L. (2006) '"Tools of mediation": an historical-cultural approach to RPL', in P. Anderson and J. Harris (eds) *Re-theorising the recognition of prior learning*. Leicester: NIACE, pp. 221–240.

Cooper, L. (2016) 'Conceptual Starting Points', in L. Cooper and A. Ralphs (eds) *RPL as Specialised Pedagogy: Crossing the Lines*. Cape Town: Human Sciences Research Council, pp. 23–32.

Cooper, L. and Harris, J. (2013) 'Recognition of prior learning: exploring the "knowledge question"', *International Journal of Lifelong Education*, 32(4), pp. 447–463. Available at: https://doi.org/10.1080/02601370.2013.778072.

Cooper, L. and Ralphs, A. (eds) (2016) *RPL as Specialised Pedagogy: Crossing the Lines*. Cape Town: Human Sciences Research Council.

Cooper, L., Ralphs, A. and Harris, J. (2017) 'Recognition of prior learning: the tensions between its inclusive intentions and constraints on its implementation', *Studies in Continuing Education*, 39(2), pp. 197–213. Available at: https://doi.org/10.1080/0158037X.2016.1273893.

Corbell, C. (2014) 'The Missing "Voice" of Knowledge in Knowledge and Skills', in B. Barrett and E. Rata (eds) *Knowledge and the Future of the Curriculum*. Basingstoke: Palgrave Macmillan, pp. 74–122.

Daniels, H. (2004) 'Cultural Historical Activity Theory and Professional Learning', *International Journal of Disability, Development and Education*, 51(2), pp. 185–200. Available at: https://doi.org/10.1080/10349120410001687391.

Deller, K. (2007) *Towards the design of a workplace RPL implementation model for the South African insurance sector*. Unpublished PhD thesis. University of Johannesburg.

Deller, K. (2016) 'RPL and occupational competence', in L. Cooper and A. Ralphs (eds) *RPL as Specialised Pedagogy: Crossing the Lines*. Cape Town: Human Sciences Research Council, pp. 102–123.

Deller, K. (2019) '"RPL-ing" Farm Workers and Bankers: Tailoring Method to Context', *SAQA Bulletin*, 19(1), pp. 85–111.

Department of Higher Education and Training (2020) 'Determination of the Sub-Frameworks that Comprise the National Qualifications Framework'. Pretoria: Government Gazette, pp. 33–36.

DHET (2013) 'White Paper for Post-School Education and Training: Building and Expanded, Effective and Integrated Post-School System'. Pretoria: Department of Higher Education and Training, p. 96. Available at: http://www.dhet.gov.za/SiteAssets/Latest News/White paper for post-school education and training.pdf.

DHET (2016) ‘Recognition of Prior Learning (RPL) Coordination Policy’. Pretoria: Department of Higher Education and Training. Available at: http://www.greengazette.co.za/pages/national-gazette-37230-of-17-january-2014-vol-583_20140117-GGN-37230-003.

Diedrich, A. (2013) ‘Translating validation of prior learning in practice’, *International Journal of Lifelong Education*, 32(4), pp. 548–570. Available at: https://doi.org/10.1080/02601370.2013.778078.

Donlevy, V. *et al.* (2016) *Study on Obstacles to Recognition of Skills and Qualifications - Final Report*. Brussels.

Dreyfus, H.L. and Dreyfus, S.E. (2005) ‘Peripheral Vision: Expertise in Real World Contexts’, *Organization Studies*, 26(5), pp. 779–792. Available at: https://doi.org/10.1177/0170840605053102.

Dreyfus, S.E. (2004) ‘The five-stage model of adult skill acquisition’, *Bulletin of Science, Technology and Society*, 24(3), pp. 177–181. Available at: https://doi.org/10.1177/0270467604264992.

Durkheim, É. (1912) *The Elementary Forms of the Religious Life*. 5th edn. London: George Allen & Unwin Ltd. Available at: https://www.gutenberg.org/ebooks/41360.

Duvekot, R. *et al.* (2020) ‘Making Policy Work: Validation of Prior Learning for Education and the Labour Market’, in *VPL-Biennale nr. 7*. Houten/Berlin: European Centre Valuation of Prior Learning & Bertelsmann Stiftung. Available at: https://medium.com/@arifwicaksanaa/pengertian-use-case-a7e576e1b6bf.

Engeström, Y. (2000) ‘Activity theory as a framework for analyzing and redesigning work’, *Ergonomics*, 43(7), pp. 960–974. Available at: https://doi.org/10.1080/001401300409143.

Engeström, Y. (2001) ‘Expansive Learning at Work: Toward an activity theoretical reconceptualization’, *Journal of Education and Work*, 14(1), pp. 133–156. Available at: https://doi.org/10.1080/13639080020028747.

Engeström, Y. (2015) *Learning by expanding: An Activity-Theoretical Approach to Developmental Research*. 2nd edn. Cambridge: Cambridge University Press.

Engeström, Y. (2015a) ‘Learning by Expanding: Origins, Applications, and Challenges’, in *Learning by Expanding: An Activity-Theoretical Approach to Developmental Research*. 2nd edn. Cambridge: Cambridge University Press. Available at: https://doi.org/DOI: 10.1017/CBO9781139814744.

Engeström, Y. (2015b) 'The Emergence of Learning Activity as a Historical Form of Human Learning', in *Learning by Expanding: an Activity-Theoretical Approach to Developmental Learning*. 2nd edn. Cambridge: Cambridge University Press, pp. 25–108. Available at: https://doi.org/10.1017/cbo9781139814744.004.

Ensor, P. and Hoadley, U. (2004) 'Developing languages of description to research pedagogy', *Journal of Education*, 32, pp. 81–104.

Erasmus, J. (2019) *Early Childhood Development Level 4 Learnership: A qualitative study of the curriculum responsiveness to the needs of experienced ECD teachers*. Unpublished Masters thesis. University of Cape Town.

Eraut, M. (2004) 'Informal learning in the workplace', *Studies in Continuing Education*, 26(2), pp. 247–273. Available at: https://doi.org/10.1080/158037042000225245.

Ericsson, K.A. and Lehmann, A.C. (1996) 'Expert and Exceptional Performance: Evidence of Maximal Adaptation to Task Constraints', *Annual Review of Psychology*, 47(February 1996), pp. 273–305. Available at: https://doi.org/10.1146/annurev.psych.47.1.273.

European Union (no date) *The European Qualifications Framework*. Available at: https://europass.europa.eu/en/europass-digital-tools/european-qualifications-framework (Accessed: 8 April 2024).

Evans, K. *et al.* (2010) 'Putting knowledge to work: A new approach', *Nurse Education Today*, 30(3), pp. 245–251. Available at: https://doi.org/10.1016/J.NEDT.2009.10.014.

Evans, K. (2019) 'Vocational Learning: Fresh Perspectives', in S. McGrath et al. (eds) *Handbook of Vocational Education and Training*. 1st edn. Cham, Switzerland: Springer International Publishing, pp. 951–962.

Fenwick, T. (2003) *Learning through experience: troubling orthodoxies and intersecting questions*. Malabar, Florida: Krieger.

Fenwick, T.J. (2001) *Experiential Learning: A Theoretical Critique Explored Through Five Perspectives*. Educational Resources Information Centre. Available at: http://www.eric.ed.gov/PDFS/ED454418.pdf%5Cnfile:///C:/Users/uvp/Dropbox/PhD/Literature/Paradigms/Fenwick. Experiential learning A theoretical critique explored through five perspe.htm.

Foley, G. (2001) 'Radical adult education and learning', *International Journal of Lifelong Education*, 20(1–2), pp. 71–88. Available at: https://doi.org/10.1080/02601370010008264.

FoodBev SETA (2023) *Atlas of Emerging Jobs: South African Food and Beverages Manufacturing Sector*. Johannesburg.

Frankham, J. (2006) 'Network utopias and alternative entanglements for educational research and practice', *Journal of Education Policy*, 21(6), pp. 661–677. Available at: https://doi.org/10.1080/02680930600969191.

Frick, L. and Albertyn, R. (2011) 'Recognition of prior learning in promoting lifelong learning: A pedagogy of hope or a shattering of dreams?', *South African Journal of Higher Education*, 25(1), pp. 145–156.

Fuller, A. and Unwin, L. (2011) *Rethinking apprenticeship*, *Rethinking apprenticeships*. London.

Gamble, J. (2001) 'Modelling the invisible: The pedagogy of craft apprenticeship', *Studies in Continuing Education*, 23(2), pp. 185–200. Available at: https://doi.org/10.1080/01580370120101957.

Gamble, J. (2004a) 'Retrieving the general from the particular: The structure of craft knowledge', in J. Muller, B. Davies, and A. Morais (eds) *Reading Bernstein, Researching Bernstein*. London and New York: Routledge Falmer, pp. 189–203. Available at: https://doi.org/10.4324/9780203461877.

Gamble, J. (2004b) *Tacit knowledge in craft pedagogy: a sociological analysis*. Unpublished thesis. University of Cape Town. Available at: https://open.uct.ac.za/items/ca6fe072-0843-4c04-b398-8537dfe895b0.

Gamble, J. (2006) 'Theory and practice in the vocational curriculum', in M. Young and J. Gamble (eds) *Knowledge, Curriculum and Qualifications for South African Further Education*. Cape Town: HSRC Press, pp. 87–103.

Gamble, J. (2009) *The relation between knowledge and practice in curriculum and assessment*. Pretoria.

Gamble, J. (2014) 'Sequencing Rules as a Condition of Knowledge Structure', in B. Barrett and E. Rata (eds) *Knowledge and the Future of the Curriculum*. Basingstoke: Palgrave Macmillan, pp. 169–180.

Gamble, J. (2016a) 'From labour market to labour process: finding a basis for curriculum in TVET', *International Journal of Training Research*, 14(3), pp. 215–229. Available at: https://doi.org/10.1080/14480220.2016.1254367.

Gamble, J. (2016b) *Work and Qualifications Futures for Artisans and Technicians*. Pretoria.

Gamble, J. (2018) 'Conceptualising vocational knowledge: the high road the middle road and the low road', in D. Guile, D. Lambert, and M.J. Reiss (eds) *Sociology, curriculum studies and professional knowledge. New perspectives on the work of Michael Young.* Abingdon: Routledge, pp. 250–264.

Gardner, J.W. (1961) *Excellence: Can We Be Equal and Excellent Too?* New York: Harper & Row Publishers Inc.

Garrick, J. (1999) 'The dominant discourses of learning at work', in D. Boud and J. Garrick (eds) *Understanding Learning at Work*. London and New York: Routledge, pp. 216–231.

Garrick, J. and Usher, R. (2000) 'Flexible Learning, Contemporary Work And Enterprising Selves', *Electronic Journal of Sociology* [Preprint], (August). Available at: http://sociology.org/content/vol005.001/garrick-usher.html.

Gau, W.B. (2016) 'How to Construct Shared Repertoire in Older Adults' Communities of Practice', *Journal of Adult Development*, 23(3), pp. 129–139. Available at: https://doi.org/10.1007/S10804-016-9229-6/TABLES/1.

Gehrke, L. *et al.* (2015) *A Discussion of Qualifications and A German and American Perspective*. Düsseldorf, Germany.

Groener, Z. and Andrews, P. (2019) 'Agency, access and barriers to post-school education: The TVET college pathway to further and higher learning', *Journal of Vocational, Adult and Continuing Education and Training*, 2(2), pp. 43–60. Available at: https://doi.org/10.14426/jovacet.v2i2.71.

Guile, D. (2011) 'Workplace Learning in the Knowledge Economy: The Development of Vocational Practice and Social Capital', in M. Malloch et al. (eds) *The SAGE Handbook of Workplace Learning*. Thousand Oaks, California: SAGE Publications Inc., pp. 385–394.

Guile, D. and Unwin, L. (2019) 'VET, Expertise, and Work: Situating the Challenge for the Twenty-First Century', in D. Guile and L. Unwin (eds) *The Wiley Handbook of Vocational Education and Training*. 1st edn. Hoboken, NJ, USA: John Wiley & Sons, Inc., pp. 19–40. Available at: https://doi.org/10.1002/9781119098713.

Harris, J. (1999) ‘Ways of seeing the Recognition of Prior Learning (RPL): What contribution can such practices make to social inclusion?’, *Studies in the Education of Adults*, 31(2), pp. 124–139. Available at: https://doi.org/10.1080/02660830.1999.11661407.

Harris, J. (2000) *RPL: Power Pedagogy and Possibility*. Cape Town: HSRC Press.

Harris, J. (2014) ‘Advances in theorising RPL’, in J. Harris, C. Wihak, and J. Van Kleef (eds) *Handbook of the Recognition of Prior Learning*. Leicester: NIACE, pp. 43–61.

Harris, J. and Andersson, P. (eds) (2006) *Re-theorising the Recognition of Prior Learning*. Leicester: NIACE.

Harris, J. and Wihak, C. (2014) ‘Introduction and overview of chapters’, in J. Harris, C. Wihak, and J. Van Kleef (eds) *Handbook of the Recognition of Prior Learning*. Leicester: NIACE, pp. 13–24.

Harris, J.A. (2004) *The Hidden Curriculum of the Recognition of Prior Learning: A Case Study*. Open University. Available at: https://doi.org/10.21954/ou.ro.0000e8a0.

Hendon, J.A. (2006) ‘Textile production as craft in Mesoamerica: Time, labor and knowledge’, *Journal of Social Archaeology*, 6(3), pp. 354–378. Available at: https://doi.org/10.1177/1469605306067841.

Holy Bible: New International Version (2011). Biblica, Inc.

Hordern, J. (2014) ‘How is vocational knowledge recontextualised?’, *Journal of Vocational Education & Training*, 66(1), pp. 22–38. Available at: https://doi.org/10.1080/13636820.2013.867524.

Hordern, J. (2019) ‘Knowledge, Practice, and Workplace Learning’, in S. McGrath et al. (eds) *Handbook of Vocational Education and Training*. Cham, Switzerland: Springer Nature, pp. 1121–1134.

Johnson, M. and Majewska, D. (2022) *Formal, non-formal, and informal learning: What are they, and how can we research them?* Cambridge.

Johnson, T.L. *et al.* (2019) ‘How and why we need to capture tacit knowledge in manufacturing: Case studies of visual inspection’, *Applied Ergonomics*, 74, pp. 1–9. Available at: https://doi.org/10.1016/j.apergo.2018.07.016.

Kanwar, A., Balasubramanian, K. and Carr, A. (2019) ‘Changing the TVET paradigm: new models for lifelong learning’, *International Journal of Training Research*, 17(sup1), pp. 54–68. Available at: https://doi.org/10.1080/14480220.2019.1629722.

Kim, S.Y. (2019) 'The Fourth Industrial Revolution: Trends and Impacts on the World of Work', in S. McGrath et al. (eds) *Handbook of Vocational Education and Training*. Cham, Switzerland: Springer Nature, pp. 177–194.

Kolb, D.A. (1984) *Experiential Learning: Experience as The Source of Learning and Development*. Available at: https://doi.org/10.1016/B978-0-7506-7223-8.50017-4.

Koshy, V. (2005) *Action Research for Improving Practice: A Practical Guide*. 1st edn. London: SAGE Publications.

Krebs, S. (2012) 'Automobilgeräusche als Information: Über das geschulte Ohr des Kfz-Mechanikers', in A. Schoon and A. Volmar (eds) *Das geschulte Ohr: Eine Kulturgeschichte der Sonifikation*. Bielefeld: Transcript PP, pp. 95–110.

Krebs, S. and Van Drie, M. (2014) 'The Art of Stethoscope Use: Diagnostic Listening Practices of Medical Physicians and "Auto-Doctors"', *Icon*, 20(2), pp. 92–114. Available at: https://about.jstor.org/terms (Accessed: 10 January 2023).

Kuhn, T. (1962) *The structure of scientific revolutions*. 1970 Revis, *International Encyclopedia of Unified Science*. 1970 Revis. Chicago: The University of Chicago Press. Available at: https://doi.org/10.5840/philstudies196413082.

Lave, J. and Wenger, E. (1991) *Situated learning: legitimate peripheral participation*. Cambridge: Cambridge University Press.

Lilliedahl, J. (2015) 'The recontextualisation of knowledge: towards a social realist approach to curriculum and didactics', *Nordic Journal of Studies in Educational Policy*, 2015(1). Available at: https://doi.org/10.3402/nstep.v1.27008.

Livingstone, D. (2013) 'Workplace Power and Visibility of Lifelong Learning: A Theoretical Starting Point and Some Empirical Evidence of Economic Class Differences', in *Proceedings of the 8th International Conference on Researching Work and Learning*. Stirling: Unpublished paper presented at 8th International Conference on Researching Work and Learning.

Lloyd, S.A. (2013) 'The Present and Future Challenges of Learning and Development - Key Challenges in South Africa'. Stirling: Unpublished paper presented at 8th International Conference on Researching Work and Learning.

Loo, S. (2019) 'Working and Learning from a Bernsteinian Perspective', in S. McGrath et al. (eds) *Handbook of Vocational Education and Training*. Cham, Switzerland: Springer Nature, pp. 1037–1052.

Marchand, T.H.J. (2008) 'Muscles, Morals And Mind: Craft Apprenticeship and the Formation of Person', *British Journal of Educational Studies*, 56(3), pp. 245–271. Available at: https://doi.org/10.1111/j.1467-8527.2008.00407.x.

Maree, J. (2007) 'Skills and phases of the labour process: Trying to line up work, knowledge and dexterity', in *Proceedings of the RWL5 Conference*. Cape Town, pp. 586–590.

Marsick, V.J. and Watkins, K.E. (2001) 'Informal and Incidental Learning', *New Directions for Adult and Continuing Education*, 2001(89), pp. 25–34. Available at: https://doi.org/https://doi.org/10.1002/ace.5.

Maslen, S. (2015) 'Researching the senses as knowledge a case study of learning to hear medically', *Senses and Society*, 10(1), pp. 52–70. Available at: https://doi.org/10.2752/174589315X14161614601565.

Maton, K. (2013) *Knowledge and knowers: Towards a realist sociology of education*, *Knowledge and Knowers: Towards a realist sociology of education*. Taylor and Francis. Available at: https://doi.org/10.4324/9780203885734/KNOWLEDGE-KNOWERS-KARL-MATON.

Matthews, J.H. and Candy, P.C. (1999) 'New dimensions in the dynamics of learning and knowledge', in D. Boud and J. Garrick (eds) *Understanding Learning at Work*. London and New York: Routledge, pp. 47–64.

Maurer, M. (2021) 'The "recognition of prior learning" in vocational education and training systems of lower and middle income countries: An analysis of the role of development cooperation in the diffusion of the concept', *Research in Comparative and International Education*, 16(4), pp. 469–487. Available at: https://doi.org/10.1177/17454999211061244.

Maurer, M. (2023a) 'Recognizing prior learning in vocational education and training: global ambitions and actual implementation in four countries', *Comparative Education*, 59(1), pp. 1–17. Available at: https://doi.org/10.1080/03050068.2022.2132445.

Maurer, M. (2023b) 'The limits of reforming access to vocational qualifications: the slow expansion of recognition of prior learning (RPL) in Sweden and Switzerland', *Journal of Vocational Education and Training*, 75(3), pp. 543–563. Available at: https://doi.org/10.1080/13636820.2021.1904438.

McGrath, S. (2004) 'Introduction: The shifting understandings of skills in South Africa since industrialisation', in S. McGrath et al. (eds) *Shifting understandings of skills in South Africa: overcoming the imprint of a low skills regime*. Cape Town: HSRC Press.

McGrath, S. (2012) 'Vocational education and training for development: A policy in need of a theory?', *International Journal of Educational Development*, 32(5), pp. 623–631. Available at: https://doi.org/10.1016/J.IJEDUDEV.2011.12.001.

Merriam, S.B. and Tisdell, E.J. (2009) *Qualitative Research: A Guide to Design and Implementation*. San Francisco: John Wiley & Sons, Ltd (The Jossey-Bass higher and adult education series).

Merriam, S.B. and Tisdell, E.J. (2016) *Qualitative Research: A Guide to Design and Implementation*. San Francisco, CA: Jossey-Bass (The Jossey-Bass Higher and Adult Education Series). Available at: http://ezproxy.uct.ac.za/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1022562&site=ehost-live.

Mezirow, J. (1990) *Transformative Dimensions of Adult Learning*. San Francisco: Jossey-Bass.

Mezirow, J. (2003) 'Transformative Learning as Discourse', *Journal of Transformative Education*, 1(1), pp. 58–63. Available at: https://doi.org/10.1177/1541344603252172.

Michelson, E. (1996a) 'Beyond Galileo's Telescope: Situated Knowledge and the Assessment of Experiential Learning', *http://dx.doi.org/10.1177/074171369604600401*, 46(4), pp. 185–196. Available at: https://doi.org/10.1177/074171369604600401.

Michelson, E. (1996b) 'Usual suspects: experience, reflection and the (en) gendering of knowledge', *International Journal of Lifelong Education*, 15(6), pp. 438–454. Available at: https://doi.org/10.1080/0260137960150604.

Michelson, E. (1998) 'Re-membering: the return of the body to experiential learning', *Studies in Continuing Education*, 20(2), pp. 217–233. Available at: https://doi.org/10.1080/0158037980200208.

Michelson, E. (1999) 'Carnival, paranoia and experiential learning', *Studies in the Education of Adults*, 31(2), p. 140. Available at: http://10.0.4.56/02660830.1999.11661408.

Michelson, E. (2020) 'Truthiness, Alternative Facts, and Experiential Learning', *New Directions for Adult and Continuing Education*, 2020(165), pp. 103–114. Available at: https://doi.org/10.1002/ACE.20371.

Miettinen, R. (2000) 'The concept of experiential learning and John Dewey's theory of reflective thought and action', *International Journal of Lifelong Education*, 19(1), pp. 54–72. Available at: https://doi.org/10.1080/026013700293458.

Millar, R. and Miller, S. (2014) 'Prior Learning Assessment Strategies for Workplace Learning: Translating Practice Into Theory', *Prior Learning Assessment Inside Out*, 2(2).

Moore, R. (2000) 'For Knowledge: Tradition, progressivism and progress in education - reconstructing the curriculum debate', *Cambridge Journal of Education*, 30(1), pp. 17–36. Available at: https://doi.org/10.1080/03057640050005753.

Moore, R. (2013) 'Social Realism and the problem of the problem of knowledge in the sociology of education', *British Journal of Sociology of Education*, 34(3), pp. 333–353. Available at: https://doi.org/10.1080/01425692.2012.714251.

Moore, R. and Young, M. (2001) 'Knowledge and the curriculum in the sociology of education: Towards a reconceptualisation', *British Journal of Sociology of Education*, 22(4), pp. 445–461. Available at: https://doi.org/10.1080/01425690120094421.

Morgan, J., Hoadley, U. and Barrett, B. (2018) 'Social realist perspectives on knowledge, curriculum and equity', in B. Barrett, U. Hoadley, and J. Morgan (eds) *Knowledge, Curriculum and Equity*. 1st edn. London and New York: Routledge, pp. 1–16. Available at: https://doi.org/10.4324/9781315111360.

Morgan, J. and Lambert, D. (2018) 'For knowledge – but what knowledge? Confronting social realism's curriculum problem', in B. Barrett, U. Hoadley, and J. Morgan (eds) *Knowledge, Curriculum and Equity*. London and New York: Routledge, pp. 33–44.

Morris, T.H. (2020) 'Experiential learning – a systematic review and revision of Kolb's model', *Interactive Learning Environments*, 28(8), pp. 1064–1077. Available at: https://doi.org/10.1080/10494820.2019.1570279.

Muller, J. (2000) *Reclaiming Knowledge: Social theory, curriculum and education policy*. London and New York: Routledge Falmer.

Muller, J. (2009) 'Forms of knowledge and curriculum coherence', *Journal of Education and Work*, 22(3), pp. 205–226. Available at: https://doi.org/10.1080/13639080902957905.

Naudé, L. (2016) 'Rethinking the Role of RPL Assessment Within an Interactive Activity System', *PLA Inside Out: An International Journal on Theory, Research and Practice in Prior Learning Assessment*, 0(5), pp. 1–12.

Naudé, L. (2022) 'Competencies and the Recognition of Prior Learning: Bridging the Divide', *Prior Learning Assessment Inside Out*, 8(8).

Needham, S. and Papier, J. (2018) 'Professional qualifications for the insurance industry: Dilemmas for articulation and progression', *Journal of Vocational, Adult and Continuing Education and Training*, 1(1), p. 52. Available at: https://doi.org/10.14426/jovacet.v1i1.13.

Noffke, S. (2009) 'Revisiting the Professional, Personal, and Political Dimensions of Action Research', in S.E. Noffke and B. Somekh (eds) *The SAGE Handbook of Educational Action Research*. London: SAGE Publications Ltd, pp. 6–23. Available at: https://doi.org/10.4135/9780857021021.

O'Connor, E. (2005) 'Embodied knowledge: The experience of meaning and the struggle towards proficiency in glassblowing', *Ethnography*, 6(2), pp. 183–204. Available at: https://doi.org/10.1177/1466138105057551.

Olsson, M. and Lloyd, A. (2017) 'Losing the art and craft of know-how: capturing vanishing embodied knowledge in the 21st century', *Information Research: an international electronic journal*, 22(4). Available at: www.informationr.net/ir/22-4/rails/rails1617.html.

Orr, J.E. (1990) *Talking About Machines: An Ethnography of a Modern Job*. Cornell University.

De Paor, C. (2023) 'Lessons from an Evaluation of an RPL Project in Further Education and Training in Ireland', *PLA Inside Out: An International Journal on Theory, Research and Practice in Prior Learning Assessment*, (Mic), pp. 1–11. Available at: https://www.plaio.org/index.php/home/article/view/232 (Accessed: 19 December 2023).

Perkins, D.N., Jay, E. and Tishman, S. (1993) 'Beyond abilities: a dispositional theory of thinking', *Merrill-Palmer Quarterly*, 39(1), pp. 1–21.

Pokorny, H. (2023) 'Recognition of Prior Learning Translation and Transfer (RPLTT): using Actor-Network-Theory to develop a specialised pedagogy', *Assessment and Evaluation in Higher Education*, 0(0), pp. 1–13. Available at: https://doi.org/10.1080/02602938.2023.2166015.

Polanyi, M. (1958) *Personal Knowledge: Towards A Post-Critical Philosophy*. Repub. 201. Mansfield, CT: Martino Publishing.

Polanyi, M. (1967) *The Tacit Dimension*. London: Routledge and Kegan Paul Ltd.

Polanyi, M. (1969) *Knowing and being: essays*. Edited by M. Grene. London: Routledge & K. Paul.

Previtali, F.S. and Fagiani, C.C. (2015) 'Deskilling and degradation of labour in contemporary capitalism: the continuing relevance of Braverman', *Work Organisation, Labour and Globalisation*, 9(1), pp. 76–91. Available at: https://doi.org/10.13169/workorgalaboglob.9.1.0076.

Pye, D. (1968) *The nature and art of workmanship*. London: Cambridge University Press. Available at: https://doi.org/LK - https://worldcat.org/title/996944.

QCTO (2021a) 'National Qualifications Framework Act: Occupational Qualifications Sub-Framework Policy'. Pretoria: Department of Higher Education and Training, pp. 3–36.

QCTO (2021b) 'QCTO Recognition of Prior Learning (RPL) Policy'. Pretoria: Quality Council for Trades and Occupations.

QCTO (no date a) 'A Brief History of the QCTO'. Pretoria: Quality Council for Trades and Occupations. Available at: https://www.qcto.org.za/publications%2C-policies%2C-guidelines---forms.html.

QCTO (no date b) 'Realignment of Historically Registered Qualifications into Occupational Qualifications'. Pretoria: Quality Council for Trades and Occupations.

Ralphs, A. (2016) 'Overview', in L. Cooper and A. Ralphs (eds) *RPL as Specialised Pedagogy*. Cape Town: Human Sciences Research Council, pp. 1–22.

Rata, E. and Barrett, B. (2014) 'Introduction: Knowledge and the Future of the Curriculum', in B. Barrett and E. Rata (eds) *Knowledge and the Future of the Curriculum*. Basingstoke: Palgrave Macmillan. Available at: https://doi.org/10.1057/9781137429261.

Reber, A.S. (1989) 'Implicit learning and tacit knowledge', *Journal of Experimental Psychology: General*, 118(3), pp. 219–235. Available at: https://doi.org/10.1037/0096-3445.118.3.219.

Reddy, J. (2019) 'Inclusivity in learning-and-work pathways in South Africa and beyond', *SAQA Bulletin*, 19(1), pp. i–iii.

Ribeiro, R. (2013) 'Levels of immersion, tacit knowledge and expertise', *Phenomenology and the Cognitive Sciences*, 12(2), pp. 367–397. Available at: https://doi.org/10.1007/s11097-012-9257-z.

Rintala, H., Nokelainen, P. and Pylväs, L. (2019) 'Informal Workplace Learning', in S. McGrath et al. (eds) *Handbook of Vocational Education and Training*. Cham, Switzerland: Springer Nature, pp. 729–742.

Roberts, L. (1995) 'The death of the sensuous chemist: The "new" chemistry and the transformation of sensuous technology', *Studies in History and Philosophy of Science*, 26(4), pp. 503–529. Available at: https://doi.org/10.1016/0039-3681(95)00013-5.

Roth, W.-M. (2004) 'INTRODUCTION: "Activity Theory and Education: An Introduction"', *Mind, Culture, and Activity*, 11(1), pp. 1–8. Available at: https://doi.org/10.1207/s15327884mca1101_1.

Ryle, G. (1963) *The Concept of Mind*. London: Hutchison & Co. (Publishers) Ltd.

Sabel, C.F. (1995) 'Design, Deliberation, ad Democracy: on the New Pragmatism of Firms and Public institutions', *Paper presented to the conference on Liberal Institutions, Economic Constitutional Rights, and the Role of Organizations, European University Institute, Florence, December 15-16, 1995*, p. 62. Available at: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://charlessabel.com/papers/Design, Deliberation, and Democracy.pdf.

Salomon, G. and Perkins, D.N. (1998) 'Individual and Social Aspects of Learning', *Review of Research in Education*, 23, pp. 1–24. Available at: https://doi.org/10.2307/1167286.

SAQA (2019) 'National Policy and Criteria for the Implementation of RPL'. Pretoria: South African Qualifications Authority.

SAQA (no date a) 'National Certificate: Food and Beverage Packaging Operations'. Pretoria: South African Qualifications Authority, pp. 1–18. Available at: https://allqs.saqa.org.za/showQualification.php?id=57694.

SAQA (no date b) 'Operate filling process on a food automated packaging line'. Pretoria: South African Qualifications Authority. Available at: https://allqs.saqa.org.za/showUnitStandard.php?id=242779.

SAQA (no date c) *What is a learnership?* Available at: https://www.saqa.org.za/docs/webcontent/2014/web0310.html (Accessed: 12 July 2021).

Schmidt, H.G. and Boshuizen, H.P.A. (1993) 'On Acquiring Expertise in Medicine', *Educational Psychology Review*, 5(3), pp. 205–221.

Schön, D. (1996) 'From technical rationality to reflection-in-action', in R. Edwards, A. Hanson, and R. Raggett (eds) *Boundaries of Adult Learning*. London, New York: Routledge.

Scribner, S. (1985) 'Knowledge at Work', *Anthropology & Education Quarterly*, 16(3), pp. 199–206. Available at: https://www.jstor.org/stable/3216564.

Scribner, S. (1997) *Mind and social practice: selected writings of Sylvia Scribner*. Edited by E. Tobach et al. Cambridge: Cambridge University Press.

Senge, P.M. (2006) *The fifth discipline: The art and practice of the learning organization*. Broadway Business.

Shalem, Y. and Slonimsky, L. (2014) 'Practical Knowledge of Teaching: What Counts?', in B. Barrett and E. Rata (eds) *Knowledge and the Future of the Curriculum*. Basingstoke: Palgrave Macmillan, pp. 198–212.

Singh, A.M. (2011) 'Let the Doors of Learning Be Open to All - A Case for Recognition of Prior Learning', *South African Journal of Higher Education*, 25(4), pp. 803–818.

Small, R. (2013) 'Social Realism, Critical Realism and Educational Theory'. Melbourne. Available at: https://www.researchgate.net/publication/318783809_Social_Realism_Critical_Realism_and_Educational_Theory/references (Accessed: 25 November 2023).

Snook, C. (1925) 'Automobile-Noise Measurement', *The Journal of the Society of Automobile Engineers*, 17(1), pp. 115–124.

Spöttl, G. and Windelband, L. (2021) 'The 4th industrial revolution – its impact on vocational skills', *Journal of Education and Work*, 34(1), pp. 29–52. Available at: https://doi.org/10.1080/13639080.2020.1858230.

Tennant, M. (1999) 'Is learning transferable?', in D. Boud and J. Garrick (eds) *Understanding Learning at Work*. London and New York: Routledge, pp. 165–179.

Tennison, C. (2014) *Historical Shifts in Knowledge, Skill and Identity in the South African Plant Baking Industry: Implications for Curriculum*. Unpublished Masters thesis. University of Cape Town.

Tennison, C. (2019) 'A Case Study of Recognition of Prior Learning (RPL) in a Food and Beverage Manufacturing Environment', *SAQA Bulletin*, 19(1), pp. 115–130.

Thurnell-Read, T. (2014) 'Craft, tangibility and affect at work in the microbrewery', *Emotion, Space and Society*, 13, pp. 46–54. Available at: https://doi.org/10.1016/j.emospa.2014.03.001.

Travers, N. (2023) 'Learning Recognition and Credentialing: Expanding Prior Learning Assessment', *Prior Learning Assessment Inside Out*, pp. 1–14.

Turner, D. (2015) 'FoodBev SETA RPL Opportunity'. Competence Performance Consulting (Pty) Ltd.

Turner, D. (2016) 'SAB Candidate Journal Guidelines'. Competence Performance Consulting (Pty) Ltd.

Tyler, W. (2004) 'Silent, invisible, total: Pedagogic discourse and the age of information', in J. Muller, B. Davies, and A. Morais (eds) *Reading Bernstein, Researching Bernstein*. London and New York: Routledge Falmer, pp. 15–29.

Usher, R. (1993) 'Experiential Learning or Learning from Experience: Does it Make a Difference?', in D. Boud, R. Cohen, and D. Walker (eds) *Using Experience for Learning*. Bristol, Philadelphia: Open University Press, pp. 169–180.

Victor, B. and Boynton, A.C. (1998) *Invented here: maximizing your organization's internal growth and profitability*. Boston: Harvard Business School Press.

Villalba, E. and Bjørnåvold, J. (2023) 'The European Center for the Development of Vocational Education and Training (Cedefop): More than 20 years Working on Validation', *Prior Learning Assessment Inside Out*, 1(2), pp. 1–14.

Wenger, E. (1998) *Communities of Practice: Learning, Meaning and Identity*. New York: Cambridge University Press. Available at: https://doi.org/10.1017/CBO9780511803932.

Wertsch, J. V. (1991) 'A sociocultural approach to socially shared cognition', in L.B. Resnick, J.M. Levine, and S.D. Teasley (eds) *Perspectives on socially shared cognition*. Washington, D.C.: American Psychological Association, pp. 85–100. Available at: https://philpapers.org/rec/WERPOS (Accessed: 1 January 2024).

Wheelahan, L. (2007) 'How competency-based training locks the working class out of powerful knowledge: a modified Bernsteinian analysis', *British Journal of Sociology of Education*, 28(5), pp. 637–651. Available at: https://doi.org/10.1080/01425690701505540.

Wheelahan, L. (2012) *Why Knowledge Matters in Curriculum*. London and New York: Routledge. Available at: https://doi.org/10.4324/9780203860236.

Wheelahan, L. (2015) ‘Not just skills: what a focus on knowledge means for vocational education’, *Journal of Curriculum Studies*, 47(6), pp. 750–762. Available at: https://doi.org/10.1080/00220272.2015.1089942.

Wheelahan, L. (2019) ‘Knowledge, Competence, and Vocational Education’, in D. Guile and L. Unwin (eds) *The Wiley Handbook of Vocational Education and Training*. Hoboken, NJ, USA: John Wiley & Sons, Inc., pp. 97–111.

Wihak, C. (2014) ‘Researching the Recognition of Prior Learning: The emergence of a field’, in J. Harris, C. Wihak, and J. Van Kleef (eds) *Handbook of the Recognition of Prior Learning*. Leicester: NIACE, pp. 25–42.

Winch, C. (2012) *Dimensions of Expertise*. London and New York: Continuum International Publishing Group.

Winch, C. (2020) ‘Forming and exercising professional judgement’, *Journal of Vocational Education and Training*, 00(00), pp. 1–19. Available at: https://doi.org/10.1080/13636820.2020.1860117.

Wood, S. (1987) ‘The Deskilling Debate, New Technology and Work Organization’, *Acta Sociologica*, 30(1), pp. 3–24. Available at: https://doi.org/10.1177/000169938703000101.

Young, M. (2003) ‘Durkheim, Vygotsky and the Curriculum of the Future’, *London Review of Education*, 1(2), pp. 99–117. Available at: https://doi.org/10.1080/1474846032000098473.

Young, M. (2006) ‘Conceptualising vocational knowledge’, in M. Young and J. Gamble (eds) *Knowledge, Curriculum and Qualifications for South African Further Education*. Cape Town: Human Sciences Research Council, pp. 104–124.

Young, M. (2008) *Bringing Knowledge Back In: From social constructivism to social realism in the sociology of education*. London and New York: Routledge. Available at: https://doi.org/10.4324/9780203073667.

Young, M. (2009) ‘Education, globalisation and the “voice of knowledge”’, *Journal of Education and Work*, 22(3), pp. 193–204. Available at: https://doi.org/10.1080/13639080902957848.

Young, M. (2013) ‘Overcoming the crisis in curriculum theory: a knowledge-based approach’, *Journal of Curriculum Studies*, 45(2), pp. 101–118. Available at: https://doi.org/10.1080/00220272.2013.764505.

Young, M. and Muller, J. (2013) 'On the powers of powerful knowledge', *Review of Education*, 1(3), pp. 229–250. Available at: https://doi.org/10.1002/rev3.3017.

Young, M. and Muller, J. (2014) 'On the Powers of Powerful Knowledge', in B. Barrett and E. Rata (eds) *Knowledge and the Future of the Curriculum*. Basingstoke: Palgrave Macmillan, pp. 41–64.

Zeni, J. (2009) 'Ethics and the "Personal" in Action Research', in S.E. Noffke and B. Somekh (eds) *The SAGE Handbook of Educational Action Research*. London: SAGE Publications Ltd, pp. 254–266. Available at: https://doi.org/10.4135/9780857021021.

Zuboff, S. (1988) *In the age of the smart machine: the future of work and power*. United States of America: Harper Collins Publishers.

APPENDIX A: SAQA QUALIFICATION DOCUMENT (SAQA, no date a)

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

REGISTERED QUALIFICATION:

National Certificate: Food and Beverage Packaging Operations

SAQA QUAL ID	**QUALIFICATION TITLE**			
57694	National Certificate: Food and Beverage Packaging Operations			
ORIGINATOR				
SGB Food				
PRIMARY OR DELEGATED QUALITY ASSURANCE FUNCTIONARY			**NQF SUB-FRAMEWORK**	
FOODBEV - Food and Beverages Manufacturing Industry Sector Education and Training Authority			OQSF - Occupational Qualifications Sub-framework	
QUALIFICATION TYPE	**FIELD**		**SUBFIELD**	
National Certificate	Field 06 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	**MINIMUM CREDITS**	**PRE-2009 NQF LEVEL**	**NQF LEVEL**	**QUAL CLASS**
Undefined	120	Level 3	NQF Level 03	Regular-Unit Stds Based
REGISTRATION STATUS		**SAQA DECISION NUMBER**	**REGISTRATION START DATE**	**REGISTRATION END DATE**
Passed the End Date - Status was "Reregistered"		SAQA 06120/18	2018-07-01	2023-06-30
LAST DATE FOR ENROLMENT		**LAST DATE FOR ACHIEVEMENT**		
2024-06-30		2027-06-30		

In all of the tables in this document, both the pre-2009 NQF Level and the NQF Level is shown. In the text (purpose statements, qualification rules, etc), any references to NQF Levels are to the pre-2009 levels unless specifically stated otherwise.

This qualification replaces:

Qual ID	**Qualification Title**	**Pre-2009 NQF Level**	**NQF Level**	**Min Credits**	**Replacement Status**
20507	National Certificate: Food and Beverage Packaging	Level 3	NQF Level 03	121	Complete

This qualification is replaced by:

Qual ID	**Qualification Title**	**Pre-2009 NQF Level**	**NQF Level**	**Min Credits**	**Replacement Status**
121148	Intermediate Occupational Certificate: Food and Beverage Packaging Operator	Not Applicable	NQF Level 03	123	Will occur as soon as [NEW] is registered

PURPOSE AND RATIONALE OF THE QUALIFICATION

Purpose:

A person acquiring this qualification will be able to produce a packaged food or beverage product by operating, controlling and maintaining a primary or secondary packaging process within a food manufacturing environment whilst applying food safety, personal safety, quality assurance and monitoring critical control points.

This qualification will contribute to the full development of the learner within the food and beverage packaging environment by providing recognition, further mobility and portability within the field of food manufacturing and sensitive fast moving consumer goods environment.

The skills, knowledge and understanding required to achieve this qualification are essential for the social and economic transformation of the South African food manufacturing environment and will contribute to the upliftment and skills development of the people therein.

Rationale:

This qualification is aimed at learners requiring a qualification in the primary packaging process within a specific food or beverage context.

This qualification reflects the workplace-based needs of the primary and secondary packaging industry that is expressed by employers and employees, both now and for the future.

This qualification, although developed specifically for the food and beverage industry, also provides the flexibility for learners to articulate to other manufacturing environments such as fast-moving consumable products, the pharmaceutical, and chemical industries.

The level of flexibility within the range of electives will allow the individual to peruse a career within an applied technical packaging environment, in the specific contexts of dairy, confectionery, food processing, coffee, tea, spice manufacturing, carbonated soft drinks and distilling and brewing.

LEARNING ASSUMED TO BE IN PLACE AND RECOGNITION OF PRIOR LEARNING

It is assumed that learners are already competent in:

- Communication and Mathematical Literacy at NQF Level 2.

Recognition of Prior Learning:

This qualification may be achieved in part or completely through the recognition of prior learning, which includes formal, informal and non-formal learning and work experience. Evidence can be presented in a variety of forms, including previous international or local qualifications, reports, testimonials, mentoring functions performed, portfolios, work records and performance records. As such, evidence should be judged according to the general principles of assessment. Learners who have met the requirements of any unit standard that forms part of this qualification may apply for recognition of prior learning to the relevant ETQA. The applicant must be assessed against the specific outcomes and assessment criteria for the relevant unit standards. A qualification will be awarded should a learner demonstrate that all the exit level outcomes of the qualification have been attained.

Access to the qualification:

Access to this qualification is open. However it is preferable that learners have already completed the following unit standards:

- 120417: "Understand the control of pests and waste materials as part of a food safety system", NQF Level 2, 3 Credits.
- 120416: "Apply personal safety practices in a food or sensitive consumer product environment", NQF Level 2, 5 Credits.
- 120403: "Apply good manufacturing practices as part of a food safety system", NQF Level 2, 4 Credits.

RECOGNISE PREVIOUS LEARNING?

Y

QUALIFICATION RULES

The rules of combination will be:

Fundamental and Core are compulsory components of this qualification and the learner is require to select 48 credits within the Elective component of the qualification and within this component at least 24 credits must be obtained from Primary Packaging.

• Fundamental: 36 credits.

• Core: 41 credits.

• Electives: 43 credits of which at least 24 credits must be obtained from Primary Packaging as indicated below:

> 242791: "Operate a coding process on a food automated packaging line", Level 4, 4 Credits.
> 242782: "Operate a Washing Process on a food automated packaging line", Level 3, 8 Credits.
> 242779: "Operate filling process on a food automated packaging line", Level 3, 18 Credits.
> 242777: "Operate a closing process on a food automated packaging line", Level 3, 6 Credits.
> 242778: "Operate a labelling process on a food automated packaging line", Level 4, 10 Credits.
> 242780: "Operate Unpacking Process on a food automated packaging line", Level 4, 4 Credits.
> 242790: "Operate an inspection process on a food automated packaging line", Level 4, 4 Credits.
> 242794: "Operate electronic weigh head system to package products on a food automated packaging line", Level 3, 10 Credits.
> 242785: "Operate a forming, filling and sealing process on a food automated packaging line", Level 4, 18 Credits.
> 242792: "Operate a wrapping process on a food automated packaging line", Level 4, 18 Credits.
> 242789: "Operate hoppers on food automated packaging line", Level 3, 3 Credits.
> 242788: "Operate Packing Process on a food automated packaging line", Level 3, 6 Credits.
> 242783: "Operate packaged pasteurising process on a food automated packaging line", Level 3, 6 Credits.
> 123312: "Operate and control the filling and sealing of cans for food products", Level 3, 12 Credits.

EXIT LEVEL OUTCOMES

1. Communicate in a variety of ways in a food and beverage manufacturing environment.

2. Maintain quality assurance and monitor critical control points in a food and beverage packaging manufacturing environment.

3. Operate a context specific range of automated packaging equipment.

4. Solve problems and improve an automated packaging process.

ASSOCIATED ASSESSMENT CRITERIA

1:
• Relevant production plans are interpreted according to organisational operations procedures.
• Measuring instruments are used to measure production inputs and outputs and record information according to organizationally acceptable methods.
• Technical packaging operating equipment terminology is identified and explained according to supplier specifications and standard operating procedures.
• Operating data is collected and recorded according to generally accepted norms and practices and standard operating policies and procedures.
• Deviations from required standards are identified and recorded according to organizationally acceptable methods.

• Team members are informed of production plans, shift objectives and problem-solving solutions to recorded deviations according to organizationally acceptable methods.

2:
• Critical control points in a packaging line are identified, monitored and maintained to ensure health and safety standards are met.
• Micro-biological concepts and practices are applied to a primary packaging operating line in order to prevent contamination and cross-contamination of products.
• Quality control and quality assurance practices are applied in a packaging operating environment.

3:
• Preparation and planning to operate context specific packaging equipment is conducted and documented to ensure quality and correct quantity of output is obtained.
• Packaged products are produced within the context of organisation's primary production process.
• Personal health, hygiene and food safety procedures are applied throughout the packaging operating process.

4:
• Deviations from required standards are identified and recorded according to standard operating procedures.
• Problems, challenges and matters within the operating process requiring a decision are identified to ensure efficient ongoing operation.
• A proposed solution is identified and implemented according to recognized organisational methods or standard operating procedures.
• The solution is evaluated and assessed in accordance with organizationally accepted methods or standard operating procedures.

Integrated assessment:

The applied competence (practical, foundational and reflexive competencies) of this qualification will be achieved if a candidate is able to produce a range of craft fermented products within a craft baking environment whilst applying food safety, personal safety, quality assurance and monitoring critical control points.

The identification and solving of problems, team work, organizing one-self, the using of applied science, the implication of actions and reactions in the world as a set of related systems must be assessed during any combination of practical, foundational and reflexive competencies assessment methods and tools to determine the whole person development and integration of applied knowledge and skills.

Applicable assessment tool(s) to establish foundational, reflexive and embedded knowledge, problem solving and the application of the world as a set of related systems within the craft baking environment.

A detailed portfolio of evidence is required to prove the practical, applied and foundational competencies of the learner.

Assessors should develop and conduct their own integrated assessment by making use of a range of formative and summative assessment methods and should assess combinations of practical applied, foundational and reflexive competencies. Assessors should assess and give credit for the evidence of learning that has already been acquired through formal, informal and non-formal learning and work experience.

Unit standards in the qualification must be used to assess specific and Critical Cross-Field Outcomes.

INTERNATIONAL COMPARABILITY

Benchmarking was done against the AQF from Australia, NVQ from England, Wales Scotland and Northern Ireland, and the NQF from New Zealand. These countries were chosen because of the automated nature of their packaging qualifications. It was required to identify qualifications that represented a fast moving automated packaging line. These countries not only have an internationally recognized vocational qualification system but also have developed their qualifications

specifically for automated packaging process.

The Australian Qualification Framework contains an equivalent one year qualification in what is known as a composite level programmes:

- Registration 21283VIC Certificate 111 in Beer Packaging.

The Australian Qualifications are packaged in two ways either what is known as 'Single level programmes' where it is assumed that a person on entry has completed the lower level qualification or 'Composite level programs' where the person has not completed a lower level qualification and reflect the minimum requirement and this person would be expected to complete any pre-requisites as additional mandatory units in order to complete the qualification.

The combined qualification in the composite format covers many of the units from the level 2 certificate regarding occupational health and safety and food safety, communication and mathematics. In addition it covers aspects regarding monitoring and implementation of quality systems, food and safety plans and the ability to diagnose and respond to product and process faults.

The units that cover the same aspects as the South African qualifications are:

- Communicate in the work place.
- Coordinate promotional activities.
- Apply basic mathematical concepts.
- Apply safe work procedures.
- Apply basic quality assurance.
- Apply basic food safety practices.
- Collect, present and apply workplace information.
- Implement occupational health and safety principles and procedures.
- Monitor the implementation of quality systems.
- Diagnose and respond to product and process faults (bread, cakes and cookies, pastry).
- Monitor the implementation of the environmental management programme.
- Participate in a Hazard Analysis Critical Control Points (HACCP) team.
- Calculate and present statistical data.
- Manage personal work priorities and professional development.
- Pest prevention and control.
- Start packaging operating equipment.
- Diagnose and rectify equipment faults.
- Control packaging operating equipment.
- End packaging operating equipment.

The qualification covers the same processes although the design of a qualification and a unit standard within the South African context differs from the Australian design.

The National Qualifications Framework (NQF) for England, Wales Scotland and Northern Ireland contains the following equivalent qualification in Packaging operations and Packaging technology:

- Registration Q1051085 PAA/VQSET Level 1 NVQ in Packaging Operations.
- Registration Q1051086 PAA/VQSET Level 2 NVQ in Packaging Operations.
- Registration 100/3202/2 PIABC Level 3 Certificate in Packaging Technology.
- Registration 100/3188/1 PIABC Level 4 Diploma in Packaging Technology.

These are four separate qualifications that are awarded by the Packaging Industry Awarding Body Company accredited by National qualification framework of the United Kingdom. The Level 1 qualification equates to NQF level 2, the level 2 equates to a level approximately between level 3 and level 4 and the Level 3 equates to NQF level 5 and level 4 equates to NQF level 6. Therefore the Level 2 NVQ in Packaging Operations reflects most closely the proposed South African qualification.

The units that cover the same aspects as the South African qualification:

- Mandatory Units:
> Working in a team.
> Start packaging operations.

> Respond to incidents, hazardous conditions or emergencies.
> Work safely.
> Control packaging operations.
> End packaging operations.

- Optional Units:

> Producing product by simple processing operations.
> Providing workplace instruction.
> Communicating information.
> Control materials movement.
> Carry out routine machine changeover.
> Work in aseptic or clean room conditions.
> Work with hazardous materials.
> Prepare and clean area and equipment.
> Contribute to the health and safety of the workplace and the environment.
> Carry out simple sampling operations.
> Carry out simple testing operations.
> Solve processing problems.

The major difference between the UK qualifications and South African Qualifications is the UK deals with all the secondary packaging operations in their Level 1 qualification and all the primary packaging in the level 2 qualification whereas the South African qualification incorporates primary and secondary packing operations in this qualification. Secondly the South African qualification has developed packaging unit standards focused of the specific process i.e. filling labelling closing, washing, packing and unpacking whereas the UK qualification develops the unit standard from the task required of the learner i.e. "start up, control and end". Each alternative has its merits but the UK methodology may exclude potential portability from liquid packaging to confectionary packaging.

The NQF from New Zealand:

There are no qualifications registered at this level but there are 18 Unit standards registered from level 1, to level 6. The level 3 unit standards form electives for the Certificate in Food and Related Products Processing at Level 3.

The unit standards that relate to this qualification are:

- Demonstrate knowledge of packaging for food or related products.
- Fill and package casks with liquid food products using automated equipment.
- Implement a packaging line operations plan in a food or related products environment.
- Package food and related products using automated gas flush packaging equipment.
- Form packaging for food and related products using automated equipment.
- Label food and related product containers using automated labelling equipment.
- Operate food and related product identification process.
- Pack filled liquid food or related product containers using automated packaging equipment.
- Package canned food or related products using automated equipment.
- Package food products using automated electronic weigh head systems.

There is a significant similarity between the unit standards of this qualification and these unit standards. However, the South African packaging qualification contains additional learning to the New Zealand qualification e.g. Fundamentals (Communication and Mathematical Literacy).

ARTICULATION OPTIONS

This qualification will allow a person to articulate to other baking, hospitality or food processing qualifications.

Vertical articulation is possible with the following NQF Level 4 Qualifications:

- Further Education and Training Certificate: Dairy Processing (under development)
- Further Education and Training Certificate: Brewing Processing (under development)

Horizontal articulation is possible with the following NQF Level 3 Qualifications in the food industry:

• National Certificate: Biscuit Manufacturing (under development)
• 50305: National Certificate: Food Laboratory Analysis
• National Certificate: Food and Beverage Processing (under development)

MODERATION OPTIONS

Moderation of assessment and accreditation of providers shall be at the discretion of a relevant ETQA as long as it complies with the SAQA requirements. The ETQA is responsible for moderation of learner's achievements, of learners who meet the requirements of the qualification.

Particular moderation and accreditation requirements are:

• Any institution offering learning that will enable achievement of this qualification must be accredited as a provider with the relevant ETQA.

• Moderation of assessment will be overseen by the relevant ETQA according to the moderation guidelines in the relevant qualification and the agreed ETQA procedures.

Moderation must include both internal and external moderation of assessments at exit points of the qualification, unless ETQA policies specify otherwise. Moderation should also encompass achievement of the competence described both in individual unit standards, exit level outcomes as well as the integrated competence described in the qualification.

CRITERIA FOR THE REGISTRATION OF ASSESSORS

Any person assessing a learner must be:

• Registered as an assessor with the relevant ETQA.
• Possess a similar qualification at one level higher than the level of the qualification and appropriate working experience.

REREGISTRATION HISTORY

As per the SAQA Board decision/s at that time, this qualification was Reregistered in 2012; 2015.

NOTES

This qualification replaces qualification 20507, "National Certificate: Food and Beverage Packaging", Level 3, 121 credits.

UNIT STANDARDS:

	ID	UNIT STANDARD TITLE	PRE-2009 NQF LEVEL	NQF LEVEL	CREDITS
Core	114952	Apply problem-solving techniques to make a decision or solve a problem in a real life context	Level 3	NQF Level 03	2
Core	12315	Demonstrate an understanding of basic machine operations in a manufacturing and or packaging environment	Level 3	NQF Level 03	7
Core	120235	Demonstrate an understanding of the concept of microbiology in a food handling environment	Level 3	NQF Level 03	6
Core	120239	Monitor critical control points (CCPs) as an integral part of a hazard analysis critical control point (HACCP) system	Level 3	NQF Level 03	6
Core	9913	Perform first line maintenance	Level 3	NQF Level 03	14

Core	119802	Perform quality control practices in a food or sensitive consumer product operation	Level 3	NQF Level 03	6
Fundamental	119472	Accommodate audience and context needs in oral/signed communication	Level 3	NQF Level 03	5
Fundamental	9010	Demonstrate an understanding of the use of different number bases and measurement units and an awareness of error in the context of relevant calculations	Level 3	NQF Level 03	2
Fundamental	9013	Describe, apply, analyse and calculate shape and motion in 2-and 3-dimensional space in different contexts	Level 3	NQF Level 03	4
Fundamental	119457	Interpret and use information from texts	Level 3	NQF Level 03	5
Fundamental	9012	Investigate life and work related problems using data and probabilities	Level 3	NQF Level 03	5
Fundamental	119467	Use language and communication in occupational learning programmes	Level 3	NQF Level 03	5
Fundamental	7456	Use mathematics to investigate and monitor the financial aspects of personal, business and national issues	Level 3	NQF Level 03	5
Fundamental	119465	Write/present/sign texts for a range of communicative contexts	Level 3	NQF Level 03	5
Elective	12258	Identify computerised systems in a manufacturing or processing system	Level 2	NQF Level 02	7
Elective	9055	Operate and control the tamperproof sealing of already filled and closed containers	Level 2	NQF Level 02	2
Elective	242787	Operate Tape Sealing equipment on a food automated packaging line	Level 2	NQF Level 02	2
Elective	242781	Pack manually	Level 2	NQF Level 02	2
Elective	9322	Work in a team	Level 2	NQF Level 02	3
Elective	114892	Dispatch stock	Level 3	NQF Level 03	10
Elective	14665	Interpret current affairs related to a specific business sector	Level 3	NQF Level 03	10
Elective	13919	Investigate and explain the structure of a selected workplace or organisation	Level 3	NQF Level 03	10
Elective	242777	Operate a closing process on a food automated packaging line	Level 3	NQF Level 03	6

Elective	242782	Operate a Washing Process on a food automated packaging line	Level 3	NQF Level 03	8
Elective	123312	Operate and control the filling and sealing of cans for food products	Level 3	NQF Level 03	12
Elective	242786	Operate cellophaning equipment on a food automated packaging line	Level 3	NQF Level 03	3
Elective	242794	Operate electronic weigh head system to package products on a food automated packaging line	Level 3	NQF Level 03	10
Elective	242779	Operate filling process on a food automated packaging line	Level 3	NQF Level 03	18
Elective	242789	Operate hoppers on food automated packaging line	Level 3	NQF Level 03	3
Elective	242783	Operate packaged pasteurising process on a food automated packaging line	Level 3	NQF Level 03	6
Elective	242788	Operate Packing Process on a food automated packaging line	Level 3	NQF Level 03	6
Elective	242784	Operate Shrink-wrapping equipment on a food automated packaging line	Level 3	NQF Level 03	4
Elective	13932	Prepare and process documents for financial and banking processes	Level 3	NQF Level 03	5
Elective	114896	Receive stock	Level 3	NQF Level 03	12
Elective	242791	Operate a coding process on a food automated packaging line	Level 4	NQF Level 04	4
Elective	242785	Operate a forming, filling and sealing process on a food automated packaging line	Level 4	NQF Level 04	18
Elective	242778	Operate a labelling process on a food automated packaging line	Level 4	NQF Level 04	10
Elective	242792	Operate a wrapping process on a food automated packaging line	Level 4	NQF Level 04	18
Elective	242790	Operate an inspection process on a food automated packaging line	Level 4	NQF Level 04	4
Elective	242793	Operate the seaming of cans on a food automated packaging line	Level 4	NQF Level 04	18
Elective	242780	Operate Unpacking Process on a food automated packaging line	Level 4	NQF Level 04	4

LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION:

When qualifications are replaced, some (but not all) of their learning programmes are moved to the replacement qualifications. If a learning programme appears to be missing from here, please check the replaced qualification.

NONE

APPENDIX B: LIST OF WORKPLACE OBSERVATIONS

Workplace Observation no.	**RPL Candidate**	**Assessor**	**Packaging Machine**
WO1	Matthew	Lucas	Labeller
WO2	Themba	Steven	Filler
WO3	Leon	Lucas	Filler
WO4	Neville	Lucas	Labeller
WO5	Neville	Lucas	Filler
WO6	James	Lucas	Pressure Sensitive Labeller

APPENDIX C: INTERVIEW LIST AND SCHEDULES

List of interviews

Interview no.	Date	Interviewee
1.	01 November 2018	Matthew – RPL Candidate
2.	01 November 2018	James – RPL Candidate
3.	01 November 2018	John – Subject Matter Expert (SME)
4.	07 November 2018	Nkosi – RPL Candidate
5.	28 November 2018	Shaun – RPL Candidate
6.	20 March 2019	Leon – RPL candidate

Interview schedule: Candidates

1. Why did you decide to be part of this RPL project?
2. What was your experience as a candidate on the RPL project?
3. When you started, what did you think you would need to do in order to get the qualification?
4. How did this compare to the actual process of the RPL project?
5. How well did the assessments guide you in what you needed to do?
6. What do you think the important things are that you need to know in order to do your job?
7. Are these similar or different compared to what the RPL project required?
8. What values do you think are the most important for an operator at [your packaging plant]?
9. Further questions related to candidate-specific evidence from Journals of Workplace Experience and Workplace Observations.

Interview schedule: SME

1. How important is the operator's own machine knowledge in the problem-solving process?
2. How much of the process is documented – is there anything that is not specifically written down somewhere?
3. Please explain the difference between SOPs and Work Instructions at [the company]?
4. What are the most important things that a new operator needs to learn?
5. How much background technical knowledge do operators need to know?
6. What is considered the most important knowledge for an operator?
7. How well do you think the qualification addresses these?
8. What values do you think are the most important for an operator at [this packaging plant]?
9. Explain to me how you think an operator would solve a problem on the machine – do they always follow the QFRs or are there times when they need to think outside the box'?

APPENDIX D: CODING EXAMPLE OF JOURNAL OF WORKPLACE EXPERIENCE: JAMES

Pages	Entry type	Description	Coding		Reasons for Coding
			K	H	
5	L	label stock reconciliation record sheets - pallet counting, recording number of labels	K1	H++	Knowing how to do this removes risk and results are predetermined. Filled in as per SOP - specific way of filling it in and only practical knowledge required.
6-8	L Day 1 written entry	description of pre-shift meeting and referenced interpreting production plan	K1		Context specific, no procedure
		narrative account of what he did with regard to machines operated	K2	H++	No risk, basic practical knowledge needed.
		mentions filling trays with labels and removing broken bottles		H++	Technique - filling label trays is done in a specific way
		explanation of how he did the 'recon' of the production run	K1	H++	recon is based on practical know how
		reference to 'running sheets' which are attached, indicating maintenance tasks completed such as lubrication	K1	H++	Specific tasks to be completed, techniques used
		description of how records of process inputs and outputs are recorded including identified problems	K1	H++	Knowledge of how to record data removes risk and ensures repeatable result
9-11	L Day 2 written entry	description of principles of pressure sensitive labelling	K4	H--	Used words to describe scientific principles - abstraction.
		description of how the labeller operates to maintain steady flow of labels	K2/K4	H-	Systems knowledge with procedure.
		pictures of recording label faults and fixing a broken web	K1	H++	Technique - specific ways of doing both activities, very practical
		description of interpreting error message on machine and	K1	H+	Judgement of which procedure with some interpretation to apply but still follow procedure.

Pages	Entry type	Description	Coding		Reasons for Coding
			K	H	
		then rectifying error (web break)			
		explanation of how the web break was fixed	K1	H++	practical knowledge of how to do correctly - technique
		explanation of the impact of web break on KPIs	K4	H-	higher level of theoretical knowledge demonstrated
		description of a further problem identified (glue pump alarm) and resolved with evidence of problem solving	K2	H-	Judgement applied and use of knowledge to increase likelihood of predetermined result and decreasing risk
11-12	L Day 3 written entry	labelled picture showing reject versus accept bottles for underfills	K3		visualisation of principles, knowledge reducing risk
		description of noticing line was still running previous product and discussing this with the other operator	K1	H++	accepted practice for context
		explanation of label quality check that was done	K2	H++	procedure to be followed
		explanation of a further quality check that was done - linked to labelled picture	K2	H++	explained procedure
		comment on the line running smoothly with very few label faults and underfills	K1		Use of line knowledge to make a judgement call on running line
13-16	L	picture of PIMS/POMS sheet section for date coding	K1		context specific procedural knowledge
	L Day 4 written entry	noticed air pipes attached to aggregate stations and explained why	K4		link identified between problem and scientific principle in order to solve it
		date coding procedure for checking all is correct	K1	H++	basic procedure to be followed with predetermined result
		description of process for dealing with label faults (floating labels)	K1	H++	basic procedure to be followed with predetermined result
17-18	L Day 5 written entry	picture of visual management board with problem solving -	K1	H++	

Pages	Entry type	Description	Coding		Reasons for Coding
			K	H	
		description of how he updated the boards			
		descriptions of procedures for running out the line and dealing with labeller parts	K1	H++	done as per SOPs with techniques for each step
		explanation of an action plan that he was involved in regarding testing of new vent tubes	K3		application of operating principles to machine function and judgement made on correct vent tubes to be used
19-22	L Day 6 written entry	document attached showing machine parts with explanation of operation	K4	H--	explanation of operating principles using scientific terminology - parts/whole
		explanation of maintenance schedules with regard to completion plus photos of how he completed lubrication of the machine	K1	H++	techniques used as per schedule and knowledge removes risk
		description of how the labeller changeover was completed including picture with labelled parts	K2	H++	changeover forms part of work instruction for machine
		machine setup techniques touched on	K1	H++	specific machine settings are given for each type of bottle run
23-26	L Day 7 written entry	photo of labeller pressure settings with labels written on to show main dial and use thereof	K3		link between procedure and how it is implemented on machine to solve problem
		description of how he changed to the pressure on the machine to solve a problem		R+	use of judgement in problem solving but didn't explain how he knew this (tacit?) use of machine knowledge with skilful operation
		explanation of how he calculates label faults and underfills for the hour	K2	H+	transferrable skill (numeracy) - standard calculation
		explanation of terminology used by the company	K4		
		noted that he did recon and reset counters	K1	H++	practical knowledge of how to and technique for doing it

Pages	Entry type	Description	Coding		Reasons for Coding
			K	H	
		justification for not completing specific tasks as per standard process			use of judgement - risk involved
		description of tasks completed as per procedure	K1	H++	standard procedures followed eliminating risk
27-28	L Day 8 written entry	picture of taptone machine plus description of the taptone survey procedure and background information on why it is done	K2	H-	background knowledge on machine plus procedure on conducting survey as per company requirements
		description of how ice proof test is done with photos of him conducting test as per procedure	K2	H++	
		link to broader use for recall/trade complaints	K4		
29-32	L Day 9 written entry	photos showing correct label alignment and how checks label alignment as well as showing labeller cameras	K1	H++	company specific procedure and technique for checking alignment - knowledge that eliminates risk
		description of cleaning labeller pallets	K1	H++	basic practical procedure
		testing checkmat operation	K1	H++	basic practical procedure
		explanation of labeller parts/checkmat function	K4	H-	application of theoretical knowledge
		explanation of how alignment is checked	K1		procedure to be followed is bottle specific
		explanation of what to do if checkmat is reading incorrectly with corresponding photo of machine.	K3	H++	application of principles to adjust checkmat
34	L Day 10 written entry	general description of tasks competed for the day	K1	H++	very basic procedures followed
276-273	F Day 1 written entry	description of putting vent tube bottle through PFBI with explanation of why this is done and including photo of bottle	K1/K4	H++	basic procedure plus understanding of principle behind it
		procedure followed to start machine with photo of buttons	K1	H++	no risk as basic procedure is followed from SOP

Pages	Entry type	Description	Coding		Reasons for Coding
			K	H	
		photo of production plan with explanation of its use	K1		contextual knowledge of production requirements
		detailed explanation of TPO test procedure and what to do if there is a problem with photos of machine and TPOs recorded	K2	H+	clear, generalised procedure for if machine doesn't work - has to make a judgement on how to proceed
		explanation of procedure followed to conduct ASEBI test bottle check	K1	H++	routine procedure/technique
		detailed information on test principles plus problem solving during test	K4	H+	principles behind test explained - test failed therefore judgement needed on further procedure to follow but skill still required
272-269	F Day 2 written entry	copy of formal counselling from attached which was issued for not adhering to safety rules	K1	H++	context specific safety
		explanation of how dissolved oxygen is checked with corresponding photo	K2	H++	procedure to be followed
		terminology explained as well as scientific principle involved	K4	H-	application of scientific principle
		explanation of calculations involved	K4	H+	skill required in combination with knowledge
		description of how results are interpreted, and decision made on in spec/out of spec results	K2	H+	judgement to be made on results involves interpreting results - knowledge application
268-265	F Day 3 written entry	explanation of terms used in their plant but includes explanation of how operators figured out a specific technique for ensuring line is cleared before changeover	K1/K3	H+	puts into language very specific contextual operator knowledge passed between operators calculation used but requires judgement to apply technique, yet outcome involves risk as not always accurate
		note that quality checks were done	K1	H++	
		reference to procedure for changeover with photo	K1	H++	

Pages	Entry type	Description	Coding		Reasons for Coding
			K	H	
		document showing pasteuriser graph with photos of pasteuriser interface	K4	H-	requires understanding of scientific principle behind it
		document showing downtime record plus screen photo together with comment on how he entered it onto the computer system	K2	H++	standard procedure requires specific technique, no abstract knowledge
		explanation of hot sprays including reference to microbiological contamination	K4	H-	applied theory leading to likely result
264-261	F Day 4 written entry	document for recording EBI test bottle results with description of procedure followed for test as well as what to do if a test bottle fails	K1/K2	H++	clear procedure to be followed - technique used leads to predetermined result plus instruction on how to remove risk
		list of abbreviations used in this entry with their meaning - e.g. CO2	K4		standard technical terms
		explanation of how he identified underfilling valves	K1	H++	technique/procedure is straight forward
		explanation of why they underfill	K3	H-	has to evaluate information to decide on which technique to use
		including photos of relevant parts with labels and how he fixed them	K1	H++	technique used
		explanation of how he conducts a crimp test	K1	H++	specific technique used
		further explanation of how this impacts the consumer and product	K4	H--	Abstract knowledge with critical reasoning
260-257	F Day 5 written entry	comment on running CO2 and missing vent tube quality checks	K1	H++	
		reference to calculating how to make plan	K3	H+	see day 3 notes
		detailed description of how he conducted a pasteurising unit check with photo and relevant recording document	K1	H+	requires limited abstract knowledge to conduct procedure

Pages	Entry type	Description	Coding		Reasons for Coding
			K	H	
		description of adaption made due to concerns about meter functionality	K3	H+	judgement made about technique to use plus application of test principles to functionality of machine skill to use equipment
		detailed description of process followed after cut-off to conduct CIP	K2	H++	codified process for CIP on filler as per machine specifications with specific techniques to follow and no abstraction
256-251	F Day 6 written entry	definition of plant terminology 'running start'	K1		context specific term
		explanation of technical terms	K4		general technical/scientific terms
		detailed description of bottle sampling for volumes with photos of him doing volume checks	K2	H++	
		including how to ensure correct readings from scales	K3	H+	skill and judgement required
		documents completed for fill heights and volume checks	K1	H++	
		references to scientific terms with their definitions	K4		
		further description of how he performs fill heights using machine and identifies over/underfills	K2	H-	requires application of knowledge to identify deviations and judge correctly
		extensive explanation of procedure to conduct volume checks	K2	H++	very specific techniques used
		including how to calculate volumes using weight and density	K2/K4	H-	involves skill but requires abstract knowledge to interpret
		with further description of how he applied knowledge in order to resolve identified deviation in results	K2	H+	judgement on how to proceed if results are not in specification
		and impact on company (beer loss)	K4		

Pages	Entry type	Description	Coding		Reasons for Coding
			K	H	
249-247	F Day 7 written entry	explanation of production plan with interpretation of what this means for his operation	K1/K2	H++	
		description of how they fixed a problem with underfills using tools and spares at the machine with photos	K1	H++	knowledge of procedures to be followed in context
		reference to quality checks and hot sprays completed	K2	H++	
		explanation of how crowns are managed	K1	H++	
		with reference to how they calculate the number of crowns needed per hour	K2	H+	
		plus how to deal with leftover crowns and empty boxes	K1	H++	
246-243	F Day 8 written entry	explanation of company specific terms	K1		
		description of handover with reference to overfills and calculating the production for the shift	K1	H++	application of knowledge to procedures calculation skill
		extensive explanation of how he dealt with the problem of overfills	K4	H+	
		the impact of overfills on the processes that follow (pasteuriser and labelling	K4		use of critical reasoning about parts/whole interaction
		comment on trying to fix crown jam problem before getting process artisan to fix it	K1	H++	requires application of context specific procedural knowledge with minor theoretical application
		lists all quality checks done during shift	K2	H++	
242-241	F Day 9 written entry	comments on factory efficiency and relates to smooth running of filler during shift	K1/K4		
		brief description of quality checks completed with photo of computer system used	K1	H++	

Pages	Entry type	Description	Coding		Reasons for Coding
			K	H	
240-237	F Day 10 written entry	explanation of maintenance terminology as well as standard maintenance practices e.g. lockout	K2/K4		
		detailed description of how maintenance was conducted with procedures	K1	H++	very specific techniques to be used and procedures followed ensure predetermined result
		explanation of cleaning and what is used or cleaned and why	K4		
		explanation of plant specific term 'change parts' linked to comment about preparing machine to run	K1	H++	
1	Fundamentals	Communication examples such as coaching learners/BOP operators and talking to others on the team	K1	H+	
		emails and meetings	K2	H+	
		PIMS/POMS	K1	H++	
5		description of informal team meetings (pre-shift), safety meetings - described how he presents an incident	K1	H+	
6-7		explanation of what a packaging plan is and what it contains	K1	H+	
8-10		description of handover from previous operator	K1	H++	
		description of doing quality test then noted that production started	K1	H++	
		explained how he calculated production remaining	K1/K4		
		explanation of how DO quality check is done	K2	H++	
		note on crown jam problem identified and how it was resolved			
		further description of quality tests	K2	H++	

Pages	Entry type	Description	Coding		Reasons for Coding
			K	H	
14-15		extensive list of terminology	K4		

APPENDIX E: CODING OF SAQA QUALIFICATION

Associated Assessment Criteria	Coding	
	K	H
Communicate in a variety of ways in a food and beverage manufacturing environment.	**K1/K2**	**H+**
Relevant production plans are interpreted according to organisational operations procedures.	K1	H+
Measuring instruments are used to measure production inputs and outputs and record information according to organizationally acceptable methods.	K2	H++
Technical packaging operating equipment terminology is identified and explained according to supplier specifications and standard operating procedures.	K4	H--
Operating data is collected and recorded according to generally accepted norms and practices and standard operating policies and procedures.	K1/K2	H++
Deviations from required standards are identified and recorded according to organizationally acceptable methods.	K1	H+
Team members are informed of production plans, shift objectives and problem-solving solutions to recorded deviations according to organizationally acceptable methods.	K1	H+
Maintain quality assurance and monitor critical control points in a food and beverage packaging manufacturing environment.	**K2/K4**	**H-**
Critical control points in a packaging line are identified, monitored and maintained to ensure health and safety standards are met.	K2/K4	H+
Micro-biological concepts and practices are applied to a primary packaging operating line in order to prevent contamination and cross-contamination of products.	K4	H-
Quality control and quality assurance practices are applied in a packaging operating environment.	K2	H-
Operate a context specific range of automated packaging equipment.	**K1/K2**	**H++**
Preparation and planning to operate context specific packaging equipment is conducted and documented to ensure quality and correct quantity of output is obtained.	K1/K2	H++
Packaged products are produced within the context of organisation's primary production process.	K1/K2	H++
Personal health, hygiene and food safety procedures are applied throughout the packaging operating process.	K2	H+
Solve problems and improve an automated packaging process.	**K1/K4**	**H+**
Deviations from required standards are identified and recorded according to standard operating procedures.	K1	H+

Associated Assessment Criteria	Coding	
	K	H
Problems, challenges and matters within the operating process requiring a decision are identified to ensure efficient ongoing operation.	K1	H+
A proposed solution is identified and implemented according to recognized organisational methods or standard operating procedures.	K1/K4	H+
The solution is evaluated and assessed in accordance with organizationally accepted methods or standard operating procedures.	K1	H+