An analysis of how knowledge is differentiated in a vocationally based curriculum for a new profession

Linda Halliday

9 September, 2014

Higher Education Studies, University of Cape Town

Abstract

Inspired by Muller's (2009) '*Forms of Knowledge and Curriculum Coherence'* and his theories relating to types of knowledge and curricula differentiation, this study interrogates knowledge in a vocational qualification, asking how it is differentiated in a vocationally based curriculum intended for a new 'fourth generation' profession (as opposed to 'first generation' professions such as medicine or engineering). The study specifically examines and compares two recontextualising processes; a vocational, unit-standards-based qualification intended for the fitness profession and its curriculum that is designed to meet the qualification's requirements. The analysis reveals the type of knowledge developed in both. According to Muller (2009), market-related shifts have given rise to many new professions – fourth generation professions - which he claims lack the epistemic foundation of traditional disciplines. To meet the growing demand for these emerging professions, institutions of higher education are being asked to make knowledge and skills more accessible through a range of sector-based, vocational and higher education pathways, leading to clearly-defined outcomes. According to Wheelahan (2007), reducing knowledge to observable outcomes or competencies simply produces a 'fragmented and atomistic view of knowledge'. Thus, the concern is about knowledge and the call from many educational sociologists is for 'powerful knowledge'; that increases access, encourages cumulative learning and enables its transferability (Young, 2008a, Wheelahan, 2007). Acknowledging the socio-epistemic nature of knowledge, this study focuses on the epistemic, exploring different types of knowledge in a vocationally based higher education setting. Working within the recontextualising field of Bernstein's (2000) Pedagogic Device, the study explores types of knowledge and the organising principles that constitute knowledge practices within a South African vocational educational setting. Of particular interest to the study are ways in which conceptual knowledge increases through a process of concept-integration, and whether or not such knowledge informs practice. The analysis calls upon Maton's (2000) Legitimation Code Theory (LCT), specifically LCT Semantics, to explore meanings in curriculum texts in order to identify different types of knowledge. In using LCT Semantics, conceptual and practice-based knowledge is identified and graded according to differing levels of conceptual complexity and context-dependence. While the analysis exposes a range of theoretical knowledges, from simple to relatively complex concepts which emanate from the disciplines that form exercise science, it also explains the nature of contextually based knowledge, shaped by the demands of vocational practice (Muller, 2009, Shay, 2013). This study reveals that, despite the segmental nature of its unit-standards-based qualification, it is possible for vocational curricula to ensure concept-building, while being informed by its vocational requirements.

Keywords: knowledge, vocational education, curriculum, differentiation, unit standards, fourth generation professions, Pedagogic Device, Legitimation Code Theory

Acknowledgement

This acknowledgement begins with gratitude for my friend Lungisa Mkoka who planted the seed of this Masters programme. Thank you to Associate Professor Linda Cooper for enabling my access to the programme and to Associate Professor Jeff Jawitz who ensured my successful launch into its first course in 2011. The ruthless and invaluable feedback on my early academic writing came from my son Simon Halliday and my daughter-in-law Amy Halliday. Their tough love and encouragement improved my academic writing. My gratitude also goes to my supervisor Associate Professor Suellen Shay who provided just the right mix of academic questioning to challenge me coupled with advice and guidance that kept me going. My life partner Steve Harris backed me unceasingly, adding his own insights about post graduate studies that helped me to push through. Thanks also to my step-daughter Vanessa Harris, her husband Ashley and their son Jude as well as my colleagues at the college - thank you all for humouring me - this late start in post graduate studies has been supported by you all. Finally, gratitude must go to my son James Harris, for reasons that transcend the norm.

INDEX

Chapter 1

Differentiated knowledge in a vocationally based curriculum

1.1 South Africa's knowledge and skills gap

Since the first democratic election was held in South Africa in 1994, there have been successive revisions to the Acts and regulations governing education and training in this country. These on-going changes continue to affect regulatory structures, as well as the qualifications and curricula offered by educational institutions (Department of Higher Education & Training, 2007).[1] Both public and private institutions of higher education are asked to take into account the educational needs of those disadvantaged by the legacy of South Africa's previous apartheid government, which denied black South Africans access to knowledge through its structures for higher education. Institutions are now urged to offer the type of education and training that will address the knowledge and skills gaps in the country (SDA, 1998, DHET, 2007). While endeavouring to keep up with international trends by ensuring their qualifications bench-mark overseas best-practices, institutions also have to respond to the local demand for particular skills by making knowledge more accessible to those who have been denied it historically (Department of Higher Education & Training, 2013).

Within this socio-political context, new academic disciplines have arisen to serve emerging professions, and with them, knowledge structures that are a cause for concern to educational sociologists. Muller's (2009) comprehensive social and political history of the growth of knowledge and the evolution of knowledge institutions foregrounds his contemporary account of current knowledge production and curricula development. Adding to Bernstein's (1999) theories about knowledge structures and their different discourses and supporting his concern about the segmental nature of horizontal knowledge structures, Muller (2009) expresses deep concern regarding the erosion of independent disciplines or 'singulars' and the arbitrary selection of knowledge from them in order to form new academic 'regions'. Such clustering of disciplinary knowledge into new curricula is intended to meet the demands of the marketplace and its emerging new professions (Muller, 2009)

This criticism is not levelled at the emergence of new professions – new industries will arise ever-more rapidly in the 21st century (Muller, 2009): The issue is the 'commodification' of knowledge and a lack of concern for the epistemic foundations needed to ensure the knowledge-building required for professional practice (Young & Gamble, 2006). Thus, market-related shifts have given rise to, what Muller (2009) calls, fourth generation professions - newly formed vocations – of which the context-dependent and regionalised knowledge lacks the rigour of traditional professions. Muller's concern is that curricula in these new regions lack foundational knowledge and a strong disciplinary core.

Moreover, the new professions served by these regions are less organised and less regulated than their well-established, traditional counterparts, resulting in a weak professional identity (Muller, 2009). This lack of epistemic rigour and an absence of social coherence in new professions - which lack robust professional bodies or industry regulation - imply poor knowledge production in their disciplines and weak conceptual knowledge in their curricula. Additionally, knowledge for these new professions tends to be context-dependent, tying knowledge to its work-based environment (Muller, 2009).

The issue here relates to knowledge; how it is produced and what happens to it when it is re-located from its disciplinary field, reconfigured into new regions and recontextualised into a curriculum for an emerging vocation. It is the aim of this study to address this concern.

1.2 Rationale

This study is conducted in a private college which specialises in vocational higher education programmes for students wishing to work in the fitness industry. I specifically explore the curriculum of a National Certificate (NC) in Fitness, registered at level five, the first rung on the Higher Education Qualifications Sub-Framework (HEQSF). This is a one-year, unit-standards-based qualification enabling students to qualify as personal trainers.[2]

Within the fitness sector, Personal Trainer is one of seven professional designations on the Register for Exercise Professionals South Africa (REPSSA). Personal Trainers can qualify with an NC Fitness, via a curriculum which Muller (2009) claims lack the foundational disciplines considered important for producing people with “strong academic identities” (Muller, 2009, p. 214). Stimulating the motivation for this study is Muller’s concern about poor epistemic foundations of new professions.

At this point it is important to indicate my role and position in this study. As director of the college in which this study occurs this places me inside the empirical field. I hold an Exercise Teacher’s Diploma and worked in the fitness industry for twenty years. I also ran my own private practice before working at the college. Thus the knowledge and practical experience from this fitness-based background enabled me to teach subjects in Exercise Science at the college. This involvement inside the empirical field can seem like a double-edged sword; my position gives me insight into the socio-historical and socio-political factors that influence the design of the qualification, thus I have a perspective that an outside researcher may not. At the same time, my position increases the likelihood of personal partiality, thus the analytical tool that I use helps to minimise the potential bias that my role implies. These ethical factors are a reminder of how socially situated knowledge is. I find myself inside the empirical field whilst wanting to research it with impartiality and to analyse the data that I gather with objectivity. My intent is to safeguard the validity of the study using LCT Semantics (Maton, 2011) as the instrument of analysis, which I discuss in detail in chapter 5, while ensuring that data is gathered accurately and analysed objectively, and with the awareness that my personal involvement should not influence the outcomes.

1.3 Unit-standards-based vocational qualifications

Categorised by the South African Qualifications Authority (SAQA) as ‘National Qualifications’ because of their public availability on the National Qualifications Framework vocational qualifications take an outcomes-based approach by virtue of exit level outcomes of the qualification and the specific outcomes in each unit standard of the qualification. Unlike traditional qualifications designed and owned by each higher education institution, national qualifications consist of a number of unit standards which are defined by (SAQA) as, “registered statements of desired education and training outcomes” (SAQA, 1995).

Unit-standards-based qualifications are publically available on the National Qualifications Framework for uptake by any accredited institution that wishes to offer them. The qualification which I analyse in this study – the NC Fitness - was originally designed in 2000 by its Standard Generating Body, and mandated by SAQA.[3] Representing the sport, recreation and fitness sector, this Standards Generating Body was responsible for the design of the qualifications for its respective sub-sectors, particularly at level four and five on the

National Qualifications Framework. In the process of developing their qualifications, the Standards Generating Body identifies the knowledge and skills considered important for professional practice. As the SETA responsible for skills development in the sport, recreation and fitness sector, the Culture, Arts, Tourism, Hospitality and Sport Education and Training Authority (CATHSSETA) took responsibility for this three-year design process.

Because the NC Fitness was originally registered on the National Qualifications Framework as a level five qualification, it falls within the higher education band, which implies that the Council on Higher Education (CHE) should be its quality assuror. However, at the time, this qualification fell under education and training for the Department of Labour, thus its SETA – CATHSSETA - claimed responsibility for its quality assurance. This demonstrates the complexity of the regulative discourse and the market demands at the time which – wittingly or unwittingly – influenced the design of the qualification and the type of knowledge it contained. Calling on Bernstein's (2000) concept of the pedagogic device, which I expand on in chapter 3, I analyse what happens to knowledge and its practices during two unique yet significantly linked knowledge recontextualisation processes of the qualification's design - and its subsequent curriculum design (Bernstein, 2000).

1.4 Occupational and vocational learning programmes

Unlike the Australian and UK model for vocational learning, the South African model is less prescriptive about curricula and the details of their educational content. Australia's vocational model prescribes the qualification, its standards and the training packages that providers should use when teaching their programmes (Wheelahan, 2007). South Africa's model is currently more flexible: Although unit-standards-based qualifications are designed by Standards Generating Bodies and registered on the National Qualifications Framework by these bodies, curricula for these qualifications are designed by the institutions that offer them. These same institutions are accredited by their relevant quality assurance body.[4] SETA-accredited providers develop their own curricula; however their learning programmes must meet SETA's quality assurance criteria. Providers must show how their programmes align to a qualification, ensuring that its design achieves the intended competencies (knowledge and skills) prescribed to help them achieve the qualification.

The following programme approval criteria must be evidenced in a programme submission:

1. Programme strategy (the programme's overall purpose, modules, learning and delivery).
2. Unit standard analysis (learning outcomes defined from unit standards' specific outcomes, translated into units of knowledge and/or skills).
3. Assessment design (clear process of assessment, validity and relevance of assessment relative to the outcomes)
4. Learner support (resources, policies and staff).
5. Education and training material (the quality and relevance of the material).
6. Recognition of prior learning (RPL) (policies and processes to evaluate evidence of previous informal or formal learning).

(CATHSSETA, 2003)

Given this broad criteria, it is difficult to determine what knowledge is needed or legitimated in order to develop programmes that adequately meet SETA's guidelines.

There has been much criticism of outcomes-based or competence-based education within the discourse of educational sociology. Such programmes imply segmental learning, which ties learners to their context, resulting in knowledge being less transferable (Wheelahan, 2007). This acquisition process is unlikely to ensure cumulative learning, which is said to develop the cognitive skills necessary for epistemic growth, because learners are locked into their contexts, unable to venture further or access more challenging rungs on the ladder of higher education (Maton, 2014, Muller, 2009, Young, 2008). However, recent amendments to South Africa's Higher Education Act, 1997 have resulted in significant changes to the National Qualifications Framework, bringing three clearly defined sub-frameworks into play within the new framework. The sub-frameworks relevant to this study are the Higher Education Qualifications Sub Framework (HEQSF), responsible for higher education qualifications and the Occupational Qualifications Sub-Framework (OQSF), responsible for unit-standards-based qualifications. Along with further education and training, these two sub-frameworks are said to enable access, with articulation between the sub-frameworks, thus offering learners the opportunity to move up, or across, these frameworks.[5]

New higher education qualifications, registered between level five and seven on the HEQSF, are intended to be "primarily vocational or industry oriented with knowledge that emphasises general principles and application of technology transfer" (Department of Higher Education and Training, 2007, pp. 19-22). Supporting this higher education path through vocational qualifications, the CHE now offers providers an official guides in the practice and implementation of work-integrated learning (WIL), which is said to be an essential element of vocational programmes (Council on Hgher Education, 2011). But what is this emphasis on WIL saying about knowledge and about the type of knowledge now deemed relevant for this suite of vocational qualifications? Is it actually 'portable' knowledge that enables epistemic access along or across the sub-frameworks? And, does this knowledge provide its students with the quality of and the capability for reasoning, which Muller (2009) claims to be the factor that enables epistemic access?

Educational sociology is concerned with 'powerful knowledge' that increases access to higher learning and enables the transferability of knowledge (Young, 2008a, Wheelahan, 2007). Therefore the question we now have to ask is whether or not the regulative discourse of higher education views vocational programmes as offering such 'powerful knowledge'. Students with minimum admission requirements and a National Senior Certificate worth 30-39% can access Higher Certificates at level 5 on the National Qualifications Framework worth 120-credits and one year of study (Department of Higher Education & Training, 1997). Successful achievement of the Higher Certificate enables access to a 360-credit diploma at level six on the National Qualifications Framework. This vocational trajectory in higher education implies that access is possible, but it is not clear how epistemic access is considered in this. While the new HEQSF seems to enable upward mobility, providing explicit admission requirements at each level, the conceptual framework for knowledge and for its transferability is not explicit. With broad-brush guidelines in the form of level descriptors from SAQA (2007), which describe learners' knowledge, skills and capabilities at each level of the National Qualifications Framework and, armed with hand books from the Higher Education Quality Council (HEQC), providers assemble their curricula from what they understand to be the building blocks of knowledge, hoping to meet the CHE criteria for programme approval.

1.5 Fitness as a 'fourth generation' profession

Based on Muller's (2009) concept about different generations of professions and their academic disciplines, the fitness profession is a fourth generation profession and the discipline that serves the profession - exercise science - is a newly formed academic region. The recently formed professional register for fitness professionals – REPSSA - was registered as a professional body by SAQA in 2012. Compared to medicine, which Muller and Young (2013) define as a traditional first generation profession, with a region informed by the disciplinary 'singulars' of anatomy, physiology and chemistry, fitness is fourth generation profession. Because medicine is a natural science-based discipline and profession, its region is viewed as more robust (Muller & Young, 2013). Fourth generation professions however are still establishing their epistemic and their social identity (Muller, 2009). Thus, the rapid growth of the fitness industry with its voluntary professional register provides fresh and fertile ground for the aims of this study.

1.6 Research question

The study asks the following question: *How is knowledge differentiated in a vocational curriculum intended for a new profession?* In the context of the problems foregrounded, I examine what happens to knowledge as it goes through two recontextualisation processes: The first recontextualisation process is the design of the qualification by its Standards Generating Body and the second is the design of the curriculum by the college.[6]

1.7 Overview of the study

Having foregrounded this study in chapter 1, in chapter two I elaborate on the history of the fitness profession and the evolution of exercise science as the academic region of this profession. The focus of the study is vocational curricula with an analysis of the type of knowledge that serves the fitness profession, identifying how its knowledge is differentiated. I do this with the use of an analysis instrument based on Maton's (2000) Legitimation Code Theory (LCT), which I explain and expand on in chapter 5. Chapter 5 explains the methodology, elaborating on the texts chosen for the analysis and explaining the reasons for the choice of the data. In chapter 6 I address the analysis of the data, providing explanatory tables to support the analysis. Chapter 7 discusses the findings, offering insights into the specifics of vocational knowledge and how it is different to the unit-standards-based or competency-based knowledge referred to in the study. Chapter 8 concludes the study.

Page break

Chapter 2

Fitness and its field of practice

2.1 The growth of the fitness profession

This study emphasises knowledge in the vocational setting of fitness, with qualification and curriculum pertaining to exercise science. Because this 'fourth generation' profession emerged as recently as the 1970s, it is useful to highlight some studies which informed its development; how it was affected by its field of knowledge production – exercise science - and how this new knowledge informed the fitness qualifications and their curricula. I then use Bernstein's (2000) pedagogic device – which I discuss in chapter 3 - to study the recontextualisation of this knowledge, analysing how it affects fitness curricula.

Interest in exercise and its commercialisation gained rapid momentum in the early 1970s following the popularity of a range of exercise videos launched by Jane Fonda. Informed by advances in exercise science, Fonda became a popular voice for aerobic exercise to music, purporting the health and weight-management benefits, which exercise science had advocated (Fonda, 2005). Fonda's claims about the efficacy of her workouts were based mainly on Cooper's (1968) research that exposed the health benefits of endurance exercise; Cooper was famous for coining the term 'Aerobics' in his book of the same name. Thus, aerobics became synonymous with the fitness industry and the growth of its broad range of exercise classes to music (Cooper, 1968).

One ground-breaking study that influenced British National Health policy in the 1950s was '*Coronary heart-disease and physical activity of work'* (Morris, Heady, Raffle, Roberts, & Parks, 1953). Their study analysed the differences in heart health between London bus drivers and conductors, comparing the heart health of these two groups. In comparing the heart health of the conductors - whose daily work involved walking and climbing the decks of their busses – to that of the drivers who spent most of their working hours seated, Morris et al. demonstrates a positive correlation between cardio-vascular health and on-the-job physical activity (Morris, Heady, Raffle, Roberts, & Parks, 1953). Morris was an outspoken protagonist for physical activity as a means of reducing the cost of chronic disease to the British National Health Service, and his many studies positively influenced public health policy in England in the 1950s (Paffenbarger, Blair, & Lee, 2001).

Verifying the work of the Morris Group (1953) and Cooper (1968), Paffenbarger's (1986) study on Harvard graduates demonstrates a positive correlation between physical activity and longevity: In tracking thousands of Harvard graduates for his epidemiological study, Paffenbarger demonstrates the long term benefits of physical activity for graduates who maintained life-long physical activity. Paffenbarger's studies added more weight to the early body of research exposing the benefits of exercise.

Following his migration from treating disease as a medical practitioner to promoting exercise as a means of disease prevention and health promotion, Travis (1975) explains how physical activity promotes health and wellness. Travis developed his concept of the wellness continuum to demonstrate the difference between medicine and its practices – on one end of the continuum - and health promotion practices on the opposite end of the continuum (figure 2.1 refers). Reiterating exercise as a primary tool for health promotion this adds weight to fitness activities and validates the fitness profession (Travis & Ryan, 2004).[7]

Figure 2.1: Wellness Continuum. Source: Adapted from "*The Wellness Inventory*" by J. Travis, 1975

Bringing the research to South Africa and to more current times, Noakes (2003) has published prolifically on the physiological and psychological benefits of exercise and such studies contributed to changes in medical aid insurance which now rewards members who exercise regularly. These examples represent a small percentage of the body of research from exercise science exposing exercise as a tool which reduces chronic disease, brings down the cost of insurance, and, as a result, contributes to the growth of the fitness industry and its related professions.

2.2 The field of knowledge production for exercise science

To investigate the current field of knowledge production in exercise science, I investigated information relating to knowledge production in the exercise science disciplines. Bernstein's (2000) concept of the pedagogic device (which I explain in more detail in chapter 3), describes knowledge as having three distinctly different fields – production, recontextualisation and reproduction. One significant contributor to knowledge production for exercise science in South Arica is the Sport Science Institute of South Africa and its Medical Research Council of the University of Cape Town. The Mission Statement of the Medical Research Council (MRC) for Exercise Science states the following:

> "The UCT/MRC Research Unit for Exercise Science and Sports Medicine exists to research factors influencing physical performance and to disseminate knowledge and skills through education." (Exercise Science and Sports Medicine, 2012).

It is apparent from this mission statement that the knowledge of exercise science is used to provide information about physical performance, thereby legitimating the professional field that works in fitness and applies the knowledge and the principles of exercise science. Equally, the aim of the MRC is to ensure that their knowledge and skills are used and applied in education. Thus, by implication, knowledge and the transmission of it is important to the MRC. In terms of its knowledge production, the research of the MRC aims to:

> "develop novel understanding of integrated human function during exercise and to use this knowledge to promote health and well-being, to treat and prevent specific chronic diseases, to treat and prevent injuries and medical conditions associated with sport and exercise and to optimise exercise performance" (Exercise Science and Sports Medicine, 2012).

Besides using the knowledge produced by the MRC to prevent chronic disease, thereby supporting the wellness aims of Travis (1975), the research goal of the MRC claims to use their knowledge to promote health, thereby legitimating the fitness professionals who use this knowledge to inform their practice.

The American College of Sports Medicine (ACSM) is considered the 'gold standard' in terms of science and its application to sport and exercise science. The ACSM also offer certification in fitness in the USA implying that they knowledge they produce is then recontextualised for programme purposes in the form of certification for the various jobs in the fitness industry. The ACSM claims to be the largest sports medicine and exercise science organization in the world, stating that they aim to:

> "provide educational and practical applications of exercise science and sports medicine. ACSM promotes and integrates scientific research, education and

> practical applications of sports medicine and exercise science to maintain and enhance physical performance, fitness, health and quality of life" (American College of Sports Medicine, 2012).

As with the MRC, the emphasis is to produce and use new knowledge for education purposes and for its application to be used in exercise science. In so doing, exercise science is used to improve physical performance, fitness and health. Such knowledge production provides adequate opportunities for this knowledge to be recontextualised for qualifications that serve the needs of the fitness profession and the curricula which serve its industry.

These examples demonstrate exercise science and its scientific research as the basis for educational knowledge in fitness, implying that its scientific principles also influence the recontextualisation of knowledge in curriculum and its practical application informs fitness practices. Thus, the legitimation exercise science – its field of knowledge production – is dependent on the dissemination of its science for education and for this knowledge to be applied in vocational or professional practice. The inference is that the rules of its field of knowledge production influence the field of knowledge recontextualisation determining how this knowledge is recontextualised for curriculum purposes.

2.3 Employment practices in the fitness industry

In her attempt to examine the fitness industry in the USA and its connections to the consumer culture, Maguire (2001) analyses the working environment for personal trainers, exploring the explicit and implicit attitudes of employers in the industry towards their fitness recruits. Maguire's research is concerned with the fitness industry and its relation to the consumer culture with 'emotional service work' being a requirement for fitness employers and for the consumer culture (Maguire, 2001, p. 380). According to Maguire one important factor that has contributed to the legitimation of fitness, and by implication, its associated professions is that scientific research substantiates the health promotion and disease prevention benefits of exercise. This legitimation by science has resulted in the medical profession legitimating the fitness industry and its associated professions.

Maguire's research indicates that employers tend to emphasise employee qualities such as customer interaction, relational skills and appearance management more than their knowledge, their level of qualification or their professional registration (Maguire, 2001). For employers in the USA fitness industry, it is customer-related skills and personal appearance that are deemed important, with the knowledge levels of personal trainers being tacitly assumed when recruiting and employing staff. Maguire's research points to an emphasis on people skills in the fitness industry, legitimating knower qualities, despite employers claiming that employees' are recruited on the basis of their qualifications, knowledge or technical skills (Maguire, 2001).

Finding a similar emphasis on employees' psycho-social skills as opposed to employee knowledge, Lloyd (2008) examines the fitness industry in the United Kingdom (UK). According to Lloyd, with skills uppermost in governmental policies, there is a drive to make employers more responsible for the education and training of their employees through their Sector Skills Councils (SSCs). Thus, with the SSCs acting as the voice of employers, the attainment of qualifications is now more employer-led (Lloyd, 2008). Lloyd defines fitness instruction as a 'mid-level' occupation, requiring a reasonable level of knowledge and skill for an interactive service-sector job. Skills-Active (the SSC for the fitness sector) has codified and published the types of knowledge and skills for the range of professional designations in the UK fitness industry. Like South Africa, the UK fitness profession has a voluntary licence to practice, managed by the Register of Exercise Professionals (REP). Lloyd asserts that although the SSC and the REP claim that qualifications are an important consideration for their sector, her research indicates that employers do *not* necessarily recruit on the basis of qualifications or quality of knowledge.

There is, in fact, a perception in the UK that qualified fitness practitioners are over-supplied. However, while employers recruit on the basis of knowledge and qualifications, they also view recruits as lacking the psycho-social skills deemed important for their service-based jobs (Lloyd, 2008). As with Maguire's (2001) USA study, Lloyd's research on the UK fitness industry emphasises knower qualities, implying a strong social relation to knowledge and its field of practice. However, in both studies, qualifications are a requirement of employment in the fitness industries thus knowledge itself is both inferred and assumed.

Maton (2000) asserts that every knowledge claim is both about something (knowledge) and by someone (knower) signifying that knowledge has two co-existing but analytically distinct sets of relations; knowledge/knower or epistemic/social (Maton, 2000). While knowledge is a requirement for *employment*, these studies on employment practices indicate that knower qualities are deemed important for job *retention*. But, while recognising that knower qualities are relevant for customer satisfaction, without knowledge, the job cannot be accessed. The emphasis with this study is the knowledge, and the analysis reveals the knowledge deemed important for a fitness qualification and its curriculum. The next chapter explores knowledge as an object of study, addressing concerns about vocational knowledge and its types of curriculum.

While these studies point to an emphasis on the social relation to knowledge in the fitness industry with an assumption that knowledgeable practitioners are a requirement of employment. The South African fitness industry has yet to be researched in terms of its relationship to knowledge, but the emphasis with this study is knowledge as the component in the socio/epistemic equation, thus I now discuss particular studies relating to knowledge and to concerns about different types of knowledge in higher and in vocational education.

Chapter 3

Knowledge as an object of study

3.1 Notions about knowledge

Because the aim of this study is to characterize the epistemic, the theory discussed in this chapter relates to knowledge and its structures, supported by its fields of production, recontextualisation and reproduction (Bernstein, 2000). Based on Bernstein's concept of the pedagogic device (which I explain below), this study acknowledges the field of knowledge production for fitness as exercise science exploring how its knowledge is recontextualised and differentiated for the fitness qualification and curriculum. Thus the literature review and discussion in this chapter puts knowledge 'at centre stage' recognizing the concerns about knowledge and that there is more to be discovered about how it is differentiated for diverse purposes.

While much of the literature anchored in social-constructivism proposes that knowledge is socially situated and that its production, recontextualisation and reproduction is affected by the socio-political and socio-historical events of the time, this study takes a social realist perspective in that it supports the premise that knowledge can claim its own ontological reality. It is the intent of this paper to explore that assertion, to interrogate the spaces that knowledge occupies and to uncover how it is differentiated from one context to another. Because I analyse the curriculum of an outcomes-based qualification, the literature I emphasise is concerned with knowledge in a vocational, higher education context.

To expand this ontological perspective on knowledge, I begin with Bernstein's (1999) theory about knowledge and its different structures. On the basis that knowledge has its own internal structure and that knowledge-building arises in different ways, (Bernstein, 1999) asserts that there are two distinct knowledge discourses; vertical discourse and horizontal discourse. He defines vertical discourse as "a coherent, explicit, and systematically principled structure with specialised languages and modes of interrogation" which is found in formal higher education (Bernstein, 1999, p. 157). Compared to this formalised environment, horizontal discourse - which occurs in the home and in the workplace - is viewed as informal 'common sense' discourse and in these less formalised environments, knowledge is viewed as localised and context-dependent. This implies that it is less transferable and only meaningful in its work-based environment (Bernstein, 1999).

Benstein's seminal work provides educational sociology with profound insights into knowledge structures, as well as the socio-political and socio-historical factors that have influenced these structures. Nonetheless, while providing insights into vertical/horizontal discourses and perspectives about hierarchical/horizontal knowledge structures, he has left questions unanswered about the underlying principles that produce different types of knowledge within these discourses or structures. These questions were picked up by Karl Maton (2000), whose project has been to develop a diverse range of empirical tools to explore knowledge structures and practices, uncovering the underlying principles that produce particular types of knowledge.

Maton claims that the sociology of educational knowledge has "long been developed without a theory of knowledge" or even a rigorous empirical tool with which to analyse its own discipline (Maton K. , 2000, p. 148). Thus, he calls for a close analysis of how knowledge is structured; an endeavour he undertakes through the development of Legitimation Code Theory (LCT) (Maton K. , 2000). Maton's wide range of studies show that it is possible to use LCT in many different social and educational contexts and his range of analytical tools allays concerns about social science's empirical field. These searches for empirical tools have resulted in Maton's earlier concepts of LCT's specialisation codes to explore epistemic and social relations to knowledge. Then, interdisciplinary dialogue between social realism and systemic functional linguistics resulted in Maton's codes gaining more ground with LCT Semantics (Maton, 2011). This study calls on LCT semantics to inform the language of description, and I elucidate on the specific application of LCT semantics as an analytical tool in chapter 5.

Continuing with the theme of knowledge as an object of study, Young (2008) emphasizes the need for 'powerful knowledge'. According to Young, powerful knowledge is knowledge that gives the acquirer the insight and ability to "engage in ideas that enable new ways of thinking about the world" (Young, 2008, p. 14). Reiterating the notion that knowledge can claim its own existence, Maton & Moore (2010) make a plea for "ontological realism, epistemological relativism and judgemental rationality" (p. 4). To make claims about knowledge, they argue, we should acknowledge its existence, understand its relative nature, while accepting our role in its production and reproduction (Maton & Moore, 2010). According to Muller (2009), knowledge is becoming increasingly specialised, differentiating itself within different academic domains that serve traditional academic regions and their established professions as well as new academic regions and their emerging professions. Consequently, this rallying call emerges as a particularly urgent project, to be applied to a possibly under-theorised fitness profession.

Responding to Young's (2008) notion of 'powerful knowledge', yet calling for a clearer definition of what constitutes powerful knowledge, Beck (2013) stresses that "the critical and emancipatory potential" of knowledge and epistemic access is determined by the autonomy of its disciplines (p. 187). Such autonomy, according to Beck, enables disciplines to develop their concepts, to interrogate their own ideas and to conduct the kind of research that gives the disciplines their powerful knowledge (Beck, 2013). However, it is the self-referential nature of disciplinary knowledge that gives it its 'esoteric' and hard-to-achieve quality and simply widening access to it, without giving students the required immersion in it, is counter-productive (Beck, 2013). Beck's powerful paper exposes the socio-epistemic challenges relating to the achievement of powerful knowledge, adding more factors to the discussion on the relevance of conceptual knowledge and how it may or may not be woven into vocational education.

These studies provide rich material for the conceptual framework of this paper and, meaningful to it, is the opportunity to use LCT as a tool when analysing the data. I explore particular knowledge practices, using LCT semantics to expose the organising principles of these practices, interrogating curricula knowledge in a vocationally based programme for the fitness profession.

3.2 Concerns about unit-standards-based curriculum

Discussing differentiation in tertiary education and the current drive towards more vocationally based curricula, Grubb (2006) asserts that one of the implications of the knowledge revolution is the major change in higher education structures towards a greater vocational emphasis. While Grubb recognises the need for greater equity that enables access to higher education, he cautions us to be conscious of the particular demands that vocationalism brings through its differentiation and its drive towards vocation–based curriculum. Of particular relevance to this study is that vocational programmes can either emphasise procedural knowledge or they can highlight the conceptual requirements that underpin a vocation's practice. With the demand for credit transfer as a factor in upward mobility in higher education, it is important to ensure that vocational education provides the conceptual knowledge needed to access the higher rungs of tertiary education (Grubb, 2006).

Barnett (2006) adds more; asking how it is possible to link disciplinary knowledge to vocational pedagogy. While situated knowledge is often a requirement of vocational education, disciplinary knowledge by its very nature is context-independent (Barnett, 2006). Barnett therefore asserts that vocational curricula needs to 'face both ways'; while vocational practice shapes the recontextualisation rules of vocational pedagogy, disciplinary knowledge remains an important component for academic progress (Barnett, 2006, p. 152).

Making just as clear case for the socio-epistemic nature of knowledge, Hordern (2014) shows how, in work-based vocational learning environments in the UK, knowledge is recontextualised in a variety of ways at a range of sites by those responsible for its acquisition (teachers and learners). He examines the process through which work-based learners access and recontextualise knowledge relevant for their practice, showing that it is the inter-relationship between different knowledge types and their educational and vocational dynamics which provide the environment for knowledge recontextualisation (Hordern, 2014). Of particular concern to Hordern is that when recontextualised in such environments "the epistemic character of knowledge" can often be misconstrued (Hordern, 2014, p. 23). Unlike traditional environments which sequence and pace learning in a logical way, in some work-based contexts, knowledge recontextualisation is often haphazard: It is the hands of different role-players, at different times and in different places (Hordern, 2014). Thus his concern is to examine how such work-based processes may or may not assure epistemic access.

Taking a different perspective, van Oers (1998) claims that there is no empirical evidence to say that knowledge has to be independent of context for it to be transferable. The environment of practice is one where knowledge is recontextualised, and concepts are adapted and applied in practice: It is within this environment of recontextualisation that knowledge recontextualisation processes contribute to knowledge-building and problem-solving (van Oers, 1998). While acknowledging that context-dependent concept-building may occur in the workplace, Hordern (2014) doubts that such vocational socio-epistemic practices enable concepts to transcend practice and become context-independent.

Unit-standards-based and specifically, unit-standards-based programmes in South Africa are viewed as environments which tie knowledge to its context, limiting its transfer and reducing opportunities for cumulative leaning (Maton, 2014, Maton & Muller, 2007, Muller, 2009, Wheelahan, 2007). Young (2008) shows additional concern about the difficulty of integrating vocational knowledge into the curriculum of formalised higher education because, in the absence of a theory of knowledge, it is difficult to know *how* to integrate college-based and work-based knowledge (Young, 2008) and it is these many concerns about vocational knowledge and curricula which prompts the exploration in this study.

Wheelahan (2007) asserts that theoretical knowledge matters and it is the inadequacy of this type of knowledge in competency-based training that reproduces social inequality. In her examination of competency-based training in Australia, she expresses deep concerns about the limits of its approach, as well as how its education has been regulated and delivered. Simply reducing knowledge to observable 'competencies', produces a "fragmented, atomistic and instrumental view of knowledge" (Wheelahan, 2007, p. 647). As opposed to this segmented approach, knowledge produced in traditional education structures provides the foundational knowledge needed to achieve its desired outcomes. Such approaches are said to ensure epistemic access to knowledge, providing cumulative learning that builds understanding based on the underpinning logic of the discipline. (Wheelahan, 2007).

Young & Gamble (2006) add their concerns about the 'commodification' of education with outcomes as the 'currency' (p. 3) and that this drive to produce more qualified students does not necessarily mean that they gain the understanding of what it means to be more productive. Nevertheless, the negative effects of South Africa's apartheid history, its current democratically driven ideology and its desperate lack of skills all accelerate the drive for knowledge with 'outcomes' as one of the currencies in the country's economy. However, Young and Gamble's concern is for knowledge as opposed to outcomes and about ensuring that knowledge remains central to the theme of education and training; thus their plea for a clear concept of knowledge and its differentiation is addressed here.

Shay (2013) joins hands with the social realists, campaigning for more in-depth analysis of knowledge and asking whether it has been 'gutted out' of educational policy-making (p. 2). In subordinating conceptual knowledge to outcomes, curriculum discourse brushes over the importance of conceptual knowledge, underestimating its significance in educational policy. Shay asserts that that there is a clear 'boundary' between everyday practical knowledge and theoretical knowledge and that "one type of knowledge cannot be derived from the other" (p. 2). Such strong classification could imply that the boundaries between the different types of knowledge are impermeable, yet Shay demonstrates that there are nuanced differentiations which can be demonstrated along a continuum of knowledge types (2013).

Adding to the concerns about context-dependent knowledge, Maton (2009) looks at ways in which curriculum design enhances or hinders learning. He asserts that for cumulative learning to occur, knowledge needs to transcend its context. His study analyses the relationship between types of curricula in formal learning environments (which are said to encourage cumulative learning) and whether or not they encourage cumulative learning and enhance knowledge–building. He demonstrates that even curricula in these environments have the capacity to trap knowledge to its context, thereby constraining cumulative learning, despite the intent to promote it.

Muller (2009) claims that different curricula each fulfil an intended academic or context-bound purpose, but the concerns about context-dependent knowledge and the segmental curriculum prompts the need to interrogate more about these curricula . If they are meant to vary for different occupational fields, depending on their conceptual or contextual demand, is this concern about knowledge as significant? Perhaps the question we need to ask is what types of knowledge are relevant to specific professions and what purposes do these kinds of knowledge serve?

Based on Muller's (2009) curriculum coherence model, which I expand on later in this chapter, the NC Fitness is a curriculum with contextual coherence using science-based knowledge to inform its curriculum. Its knowledge comes from the inter-disciplinary field of

Exercise Science. This is a region which builds its inter-disciplinary curriculum from the natural science-based 'singulars' of anatomy, chemistry, physiology and mechanical physics. Bernstein (1999) defines singulars as 'vertical discourse' with hierarchical knowledge structures that "create general propositions and theories that integrate concepts and subsume knowledge at lower levels" (Bernstein, 1999, p. 161). On this basis, exercise science is formed by the inter-disciplinary relationship of the singulars that underpin it.

Although exercise science is the discipline which informs the NC Fitness, this is a vocational qualification which, by virtue of its unit standards base, implies "segmentally connected modules; relevant for their context and sufficient for their purpose" (Muller, 2009, p. 210). How does the knowledge of exercise science get recontextualised into a segmental, contextually coherent curriculum? This study explores this process, addressing these questions about the type of knowledge that emerges during its recontextualisation process for unit-standards-based qualification.

3.3 The pedagogic device

Bernstein (1999) asserts that knowledge structures are not the same as curriculum structures, because curricula knowledge is recontextualised knowledge that has been dislocated from its original disciplinary structure. Thus, curricula knowledge cannot take on the same form as its original discipline. Bernstein ((2000) defines knowledge as having distinct discourses; vertical or horizontal discourse and these discourses form different types of knowledge structures. For example, he describes the knowledge structures of the natural sciences as ones which build knowledge hierarchically (Bernstein, 1999).

Scaffolding Bernstein's notion of knowledge structures and the curricula that form from them, Muller (2009) defines science-based curricula as vertical curricula, explaining that, the "more vertical the curriculum, the more crucial is the conceptual coherence, and the more sequencing matters" (p. 216). To elaborate on the exercise science-based curriculum and the recontextualisation context within which this study occurs, I call on Bernstein's (2000) theorisation of knowledge and its practices in the pedagogic device.

Bernstein's concept of the pedagogic device demonstrates how disciplinary knowledge is dislocated from its original source of production and relocated into a curriculum where it is recontextualised in preparation for pedagogic practice (Bernstein, 2000). Bernstein developed the pedagogic device as a theoretical model to explain the entire environment of pedagogic discourse, showing how knowledge is produced, managed, recontextualised and pedagogised. The pedagogic device demonstrates how new knowledge is generated at the top level of the device, through its academic disciplines, then recontextualised at the next, and lower, level of the device, through policy and curriculum. Once recontextualised, knowledge is then reproduced via pedagogic practice in the classroom. The pedagogic device is thus a tiered, hierarchical conceptual framework, which consists of three distinct fields within the device: the field of knowledge production, the field of knowledge recontextualisation and the field of knowledge reproduction (Bernstein, 2000).

The pedagogic device not only describes the way knowledge is produced, recontextualised and reproduced, it also exposes the nature of relations between its three fields, as well as the rules relating to its fields (Bernstein, 2000). In its field of production, where knowledge is created, there are distributive rules which determine who has access to the knowledge being produced. Once generated in the field of production, knowledge is then interpreted into policy and curricula. At this second level of the device and dependent on the social context within which the knowledge is recontextualised, the recontextualising rules at this level of the pedagogic device regulate the knowledge that is validated and selected for curriculum. In this way, the device then establishes the knowledge that is taught and assessed through pedagogic practice at the third level of the device (Bernstein, 2000).

Figure 3.1 shows the three layers of the pedagogic device and their relationship to each other. Because I address a qualification and its curriculum, this study is located in the second layer of the pedagogic device, in the field of recontextualisation.

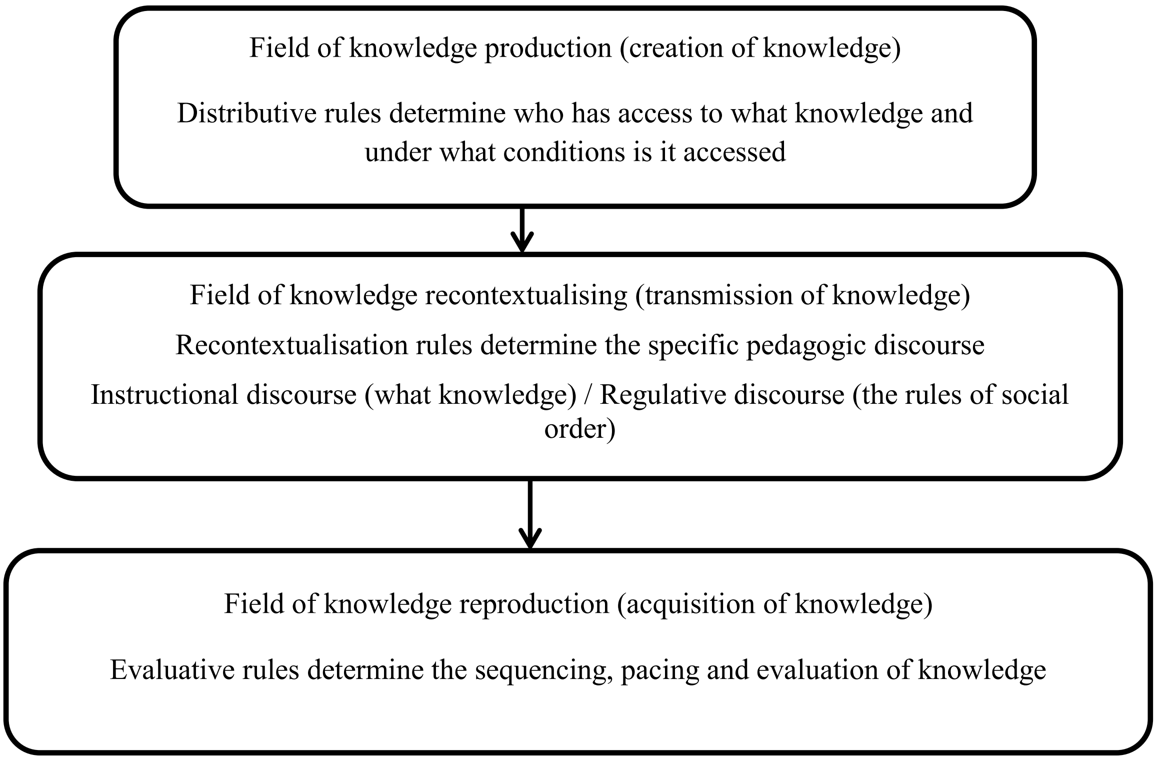

Figure 3.1 the pedagogic device. Source: Adapted from Bernstein, B. (2000, p. 37)

Bernstein's theory shows that the recontextualising rules at this level of the device consist of two discourses: regulative discourse and instructional discourse. Regulative discourse is a discourse of *order* which translates the dominant values of society and regulates the form of *how* knowledge is transmitted. Instructional discourse is a discourse of competence; it refers to *what* knowledge is transmitted. The two discourses are incorporated in such a way that regulative discourse always dominates instructional discourse, thus instructional discourse is embedded in regulative discourse (Bernstein, 2000).

According to Bernstein, the recontextualising rules preside over curriculum design determining the context of a curriculum and its subject selection. When the fitness qualification was designed, the exit level outcomes, assessment criteria were all prescribed in the qualification's design by the Standards Generating Body. This demonstrates the extent to which the regulative discourse embedded its rules about knowledge in the device (Bernstein, 2000).

No doubt, the drive to recognise the achievement of knowledge and skills in the labour sector influenced the design of the fitness qualification and, while it is not within the scope of this paper to analyse the regulatory bodies' influences, it is relevant to acknowledge their hegemony at the time. Such influence would have affected the type of knowledge and skills deemed relevant for the qualification at the time.

Turning from knowledge as an object of study and the social context in which it is generated and recontextualised, in the next chapter, I discuss different types of knowledge and curriculum to explore what this means for the aims of this study.

Chapter 4

Knowledge and curriculum differentiation

4.1 Differentiation models for knowledge and curriculum

Concerns about knowledge, vocational curricula and discussions about the structures in which knowledge is produced and recontextualised forms the backdrop for this chapter.

In their exploration of curriculum differentiation, Shay, Oosthuizen, Paxton, & van der Merwe (2011) develop their conceptual framework for knowledge and curriculum distinctions, drawing on Gamble (2009) who distinguishes different types of knowledge. Practical knowledge is then differentiated into procedural knowledge - or everyday practices learned in the workplace - and principled procedural knowledge. Further, theoretical knowledge is differentiated into conceptual knowledge and procedural conceptual knowledge. Unlike principled procedural knowledge, which is informed by the principles of practice, procedural conceptual knowledge is informed by its underpinning theories (Shay et al, 2011). These typologies enable an understanding of what happens to knowledge when it is called upon for curriculum purposes. Forming an additional backdrop for this study, the researchers provide a perspective on *how* knowledge can be differentiated, particularly in an occupational setting (figure 4.1).

Procedural knowledge		**Conceptual knowledge**	
Procedural knowledge	Principled Procedural knowledge	Applied theory	Pure theory

Figure 4.1 Knowledge Typologies. Source: Adapted from Shay, Oosthuizen, Paxton, & van der Merwe (2011, Figure 4.1)

Based on Muller's (2008) premise that curricula are informed by different logics, Shay et al develop their *curriculum typology* (figure 4.2), demonstrating that when knowledge is recontextualised into a curriculum it can, at its most practical, be defined as a 'contextually based curriculum with procedural knowledge' (C1) and, at its most theoretical, be defined as 'conceptually based curriculum with conceptual knowledge' (C5) (Shay, Oosthuizen, Paxton, & van der Merwe, 2011, p. 107). Between these two ends of the, coherence continuum is a 'curriculum with contextual coherence and procedural conceptual knowledge' (C3), indicating that C3 curriculum develops knowledge-based practices informed by the logic of its discipline (Shay, Oosthuizen, Paxton, & van der Merwe, 2011, p. 107).

Typologies can offer useful categorisations, for the purposes of this study, knowledge and curricula logic are shown on a continuum. While, as Shay (2013) asserts, 'one type of knowledge cannot be 'derived from the other' (p. 2) at each academic level, certain kinds of concepts underpin practice and rules or procedures support concept-building (Muller, 2009). Because this study explores the type of knowledge that has emerged through the recontextualisation processes of a qualification and its curriculum, these typologies prove to be relevant building blocks for differentiating between knowledge types.

Curriculum typologies: Recontextualisation of Knowledge into Curriculum				
+Contextual coherence/ -conceptual coherence				-Contextual coherence/ +conceptual coherence
C1	C2	C3	C4	C5
Contextual coherence with procedural knowledge	Contextual coherence with principled procedural knowledge	Contextual coherence with procedural conceptual knowledge	Conceptual coherence with procedural conceptual knowledge	Conceptual coherence with conceptual knowledge

Figure 4.2 Curriculum typologies. Source: Adapted from Shay, Oosthuizen, Paxton, & van der Merwe (2011, Figure 4.2)

Expanding these theories of knowledge and curriculum differentiation, Shay (2013) compares different curricula in higher education - revealing different types of knowledge within them. In analysing academic texts intended for different curricula and disciplinary domains, Shay offers a conceptualisation of knowledge differentiation and the different types of knowledge which emerge from them. Of particular relevance, is her distinction between theoretical curricula, practical curricula and vocational/professional curricula. Shay asserts that the differentiating factor between unit-standards-based (or practical) curricula and professional curricula is that unit-standards-based curricula evolve out of a set of recontextualised concepts and procedures informed by practice, whereas, in addition to being informed by practice, professional curricula are informed by the theories that emanate from their underpinning disciplines (Shay, 2013). On the other hand, theoretical curricula are shaped by the recontextualised theory from their fields of knowledge production (Bernstein, 2000a, Shay, 2013).

The analysis for this paper hones in on the specifics of a qualification which can be described as straddling unit-standards-based and vocationally based curricula at level 5 on the HEQSF. The qualification borders two frameworks because the NC Fitness was originally regulated by the Department of Labour and quality assured by its SETA, making it an occupational qualification. But, because it is registered at level 5 on the framework, this places it in the higher education band. The Council on Higher Education registers level 5 Certificates, which they define as vocational qualifications intended for specialist field (Department of Higher Education & Training, 2007). Thus, these two quality assurors reign over occupational and vocational qualifications, occupying two sub-frameworks at the same level, which are said to serve different educational needs.

Supporting Shay (2013), I propose that it is both conceptual *and* context-dependent knowledge that informs fitness practice, which I explore using LCT Semantics (Maton, 2014) and I expand on this in chapter 5.

4.2 Occupational, vocational and professional qualifications

Because these terms are often used interchangeably the difference between 'occupational', 'vocational' and 'professional' qualifications is clarified below. With 'knowledge' and 'curriculum' at centre-stage, these qualifications infer unique differences that are important for this study in the context of knowledge differentiation.

4.2.1 Occupational qualifications

Occupational qualifications can be registered between levels 1 and 8 on the Occupational Qualifications Sub-Framework (OQSF) - signalling levels which equate to the higher education levels of 5 to 8. SAQA's intention is that these occupational qualifications should articulate with cognate qualifications on other frameworks (SAQA, 2010). Admission criteria are minimal (although there is talk of a foundational certificate for language, literacy and numeracy as an entry requirement) and subject requirements are usually undefined. These programmes consist of 20% knowledge, 20% practical and 20% work experience. While this minimum of 20% per category is pre-determined, the ratio can increase in any of the three categories, depending on the level of the programme and its particular knowledge requirements (Quality Council for Trade and Occupations, 2013). The Quality Council for Trades and Occupations (QCTO) defines an *occupational* qualification as:

> "A qualification that consists of a minimum of 25 credits associated with a trade, occupation or profession. It results from work-based learning, consists of three components (knowledge, practical skills and work experience) and has an external summative assessment." (Quality Council for Trade and Occupations, 2013, p. 5).

4.2.2 Vocational qualifications

Vocational qualifications are registered between levels 5 and 7 on the National Qualifications Framework. The HEQSF defines their level 5, Higher Certificate, as "primarily vocational or industry oriented, providing students with the knowledge, cognitive and conceptual tools and practical techniques for further higher education studies in their chosen field of study." (Department of Higher Education & Training, 2007, p. 19). Admission criteria to the Higher Certificate is a National Senior Certificate (NSC) achievement of 30-39%, additionally, providers can set their own subject-specific entry criteria, based on their programmes' disciplines or intended outcomes. The level 6 diploma, however, is defined as "primarily professional, vocational or industry specific". (Department of Higher Education & Training, 2007, p. 21), implying a shift from vocational to professional as the level increases and admission criteria become more rigorous.

4.2.3 Professional qualifications

Professional qualifications require specialised knowledge for admission and for the achievement of their qualifications. Usually requiring a minimum of a 4-year undergraduate degree in a higher education programme, admission is based on specific subject criteria with an emphasis on higher National Senior Certificate pass levels. Students enter professional degrees at level 5 and exit at level 8 (Department of Higher Education & Training, 2007). The HEQSF defines their degree as "providing a well-rounded broad education that equips graduates with the knowledge base, theory and methodology of disciplines, and enables them to demonstrate initiative and responsibility in an academic or professional context." (Department of Higher Education & Training, 2007, p. 23). Figure 4.3 shows this range of qualifications on a 'qualifications continuum', based on the sub frameworks and their levels on the National Qualifications Framework.

Qualifications Sub-framework, Levels, Admission Criteria

OQSF Levels 2 - 8	HEQSF Levels 5 – 7	HEQSF Levels 5 – 10
No / minimal NSC (depending on the level)	NSC minimum pass 30-39%, non-specific subject choices	NSC minimum 40-49% or higher pass requirement Specific subject choices
Occupational	Vocational	Professional

Figure 4.3 Qualifications Continuum - depicting qualifications on the South African Qualifications Sub-Frameworks

Can a graduate with the knowledge from a unit-standards-based certificate at level 5 on the Occupational Qualifications Sub-Framework access a vocational diploma at level 6 on the Higher Education Qualifications sub-Framework? What knowledge articulation is possible with a vocationally based diploma at level 6 for a degree at level 7? While extensive consideration seems to have been given to market demands, there are few guidelines as to how the frameworks and their different qualifications will articulate. It remains in the hands of the institutions to make decisions about the recognition of prior learning and whether to accept the knowledge inferred in a particular qualification or not. And the final question is whether these different qualification pathways ensure epistemic access.

The field of knowledge that supports the fitness profession is a science-based academic region. This analysis uncovers the different types of knowledge that emanate from this region and become recontextualised for the qualification as well as its curriculum.

Having foregrounded here with the conceptual framework for the study and the context of South Africa's educational sociology, I turn now to the research methodology and the analysis of the data - collected from the qualification and curricula texts - in chapter 5.

Chapter 5

Design of the study and methodology

5.1 Selected data: Unit standards and assessment

Sector Education and Training authority (SETA) programme approval requirements stipulate that the accreditation of a provider's learning programme is based on how well the curriculum design considers the content of each unit standard in a qualification. The aim of a coherent learning programme is to align with a qualification and to ensure that the programme contains the relevant knowledge and skills inferred in the qualification and its unit standards (CATHSSETA, 2003). There are a number of steps to this alignment process. The first step is to match the exit level outcomes and associated assessment criteria in the qualification with the particular unit standards in the qualification. Therefore, the achievement of a unit-standards-based qualification means the achievement of the qualification's outcomes and all of its unit standards (Appendix 1; NC Fitness).

The total credit value of the qualification is 137, with 86 credits allocated to core unit standards, 41 to fundamental unit standards and 10 to elective unit standards. Thus the six unit standards in this analysis represent 47 of the 86 core credits in the qualification (54%). The selected unit standards for this analysis are listed in the table in figure 5.1, showing how they align to seven of the nine exit level outcomes in the qualification. The remaining two exit level outcomes relate to business administration and professional conduct.

5.2 Designing curriculum for unit standards

Given that this study explores knowledge that emerges from the two re-contextualisation processes of a qualification design and curriculum, it is useful to explain how this alignment process unfolds in order to understand how knowledge is recontextualised during the unit standard mapping and curriculum design.

Exit Level Outcome	Unit Standards
Column A	Column B
1. Demonstrate knowledge of the fitness environment and the context in which physical activity takes place. 2. Conduct and interpret pre-participation screening for physical activity. 3. Assess, evaluate and monitor health related fitness components. 4. Feedback and refer as it relates to physical activity. 5. Design, demonstrate and lead exercise programmes. 6. Implement, monitor and modify exercise programmes. 7. Motivate and support fitness participants in making activity related and wellness decisions.	1. Apply anatomical and biomechanical principles to physical activity (15-credits) 2. Apply principles of sport and exercise physiology (15-credits) 3. Conduct a screening procedure (5 credits) 4. Test and evaluate health related fitness components (4 credits) 5. Motivate and encourage participation in physical activity (3 credits) 6. Design exercise programmes (5 credits)

Figure 5.1: **Alignment of exit level outcomes to unit standards**

Once unit standards have been identified in terms of their alignment to their respective exit level outcomes and associated assessment criteria in the qualification, modules are developed to ensure the transfer of necessary knowledge to achieve the unit standards in the qualification. This requires curriculum developers to analyse unit standards' texts which I will define later in this chapter. Unit standards also contain Critical Cross-Field Outcomes (CCFO) which the South African Qualifications Authority (SAQA) defines as "generic outcomes that inform all teaching and learning" (South African Qualifications Authority, 2013). Relating mainly to students' capacities for problem-solving and their ability to access information, critical cross field outcomes have not formed part of the data for this analysis of knowledge.

The aim of the alignment process is to ensure that all the knowledge and skills envisaged in each unit standard are considered and taught in the intended curriculum. A small example of such an alignment is demonstrated in the table in figure 5.2. This example looks at specific outcome 1 from the unit standard '*Apply anatomical and biomechanical principles to physical activity'* and illustrates its learning outcome and assessment task. While more than one learning outcome may be developed for a specific outcome, this example shows how the competence (knowledge and skill) articulated in a specific outcome is achieved from a learning outcome and assessment.

Unit Standard: Apply anatomical and biomechanical principles to physical activity				
Specific Outcomes	**Range statements/ Outcome Notes**	**Associated Assessment criteria**	**Critical cross field outcomes**	**Embedded knowledge**
1. Describe anatomical structures and systems of the human	For example: • Composition of muscles, bones, ligaments, tendons • Structures, locations and functions of anatomical systems	1. Locates an anatomical structure and describes its involvement in movement 2. Composition of anatomical structures is explained	When anatomical structures and systems of the human body are described, the following CCFO are embedded into the learning: Problem solving Information evaluation Inter-relatedness of systems	2. Anatomical structures 3. Anatomical terminology 4. Systems e.g. circulatory, respiratory, nervous, endocrine
Subject: Anatomy				
Learning outcome 1				
1. Describe the anatomical structures (anatomical position, body planes and regions; skeletal system; joints, ligaments and cartilage; muscular system): 1.1 Understand anatomical systems and the terminology of these systems 1.2 Understand anatomical components and their composition 1.3 Understand the anatomical structures and their locations Part 1: Anatomical position, body planes and regions of the body Part 2: Skeletal system Part 3: Joints, tendons, ligaments and cartilage Part 4: Muscular system				
Assessment for Learning Outcome 1: Written Knowledge Test				
Anatomical systems, anatomical components, anatomical structures, knowledge of the anatomical position, anatomical planes and their role in movement, bones and muscles of the musculoskeletal system, joints, tendons and ligaments				

Figure 5.2: **Example of unit-standard alignment to certain learning outcomes in one module**

The final step in this alignment process is to ensure that assessments are appropriate for the achievement of the criteria of each unit standard. I.e. if an outcome requires both theory and practice-based knowledge, then the assessment should factor theoretical and practical knowledge. Therefore, tasks need to elicit relevant evidence which is valid and appropriate to the outcome. According to programme accreditation criteria, assessment methods should produce ‘knowledge’, ‘product’ and ‘process’ (CATHSSETA, 2003). In terms of these criteria, ‘knowledge’ relates to the conceptual knowledge necessary to achieve each unit standard. ‘Product’ relates to particular evidence that signifies competence in a particular vocation. For example, a personal trainer designs an exercise programme with written training routines. In this case, the ‘product’ would be a researched and well-designed exercise programme with a written set of activities, based on exercise science and on the criteria stated in the unit standard. ‘Process’ relates to the observable evidence of practical capabilities; the knowledge and skills demonstrated in professional practice. In the context of a fitness practitioner, an example would be the demonstration of correct techniques in the execution and instruction of an exercise session, according to current scientific principles (CATHSSETA, 2003).

Figure 5.3 depicts the relationship between the six selected unit standards (column A) with their associated modules (column B) and assessments (column C). Module 1 (Exercise Science) consists of 30 credits with four subjects: (1) Anatomy, (2) Physiology, (3) Applied Kinesiology and (4) Training Principles and Methods. Module 2 (Screening, Assessment and Programme Design) consists of 17 credits with four subjects: (1) Screening, (2) Assessment and Fitness Testing, (3) Motivation and Communication and (4) Programme Design. Module 2 achieves unit standards 3 to 6.

Column A	Column B	Column C
Achievement (competency)	**Teaching & learning**	**Assessment**
Unit standards	**Module 1: Exercise Science**	**Assessment tasks**
1. Apply anatomical and biomechanical principles to physical activity. 2. Apply principles of sport and exercise physiology	Subject 1: Anatomy Subject 2: Exercise physiology Subject 3: Applied kinesiology Subject 4: Training principles and methods	2A: Question paper – anatomy 2B: Question paper – exercise physiology 2C: Oral/demo – movement principles (2 2D: Practical demo: exercise
Unit standards	**Module 2: Screening, Assessment and Programme Design**	**Assessment Tasks**
3. Conduct a screening procedure 4. Motivate and encourage participation in physical activity 5. Test & evaluate health related fitness 6. Design exercise programmes	Subject 1: Screening Subject 2: Motivation & communication Subject 3: Assessment and fitness testing Subject 4: Exercise programme design	4A: Question paper – risk screening 4B: Practical demo – Fitness testing 4D: Practical project - long term case study with a real client

Figure 5.3 Unit standards: Aligned modules and assessments

While the qualification document for the National Certificate in Fitness prescribes the achievement of its unit standards, it does not prescribe the sequencing or the pacing of learning or the type of assessment used. Therefore, the curriculum designers decide on the order of module delivery, the pacing of the required learning and the type of assessment. The curriculum design is guided by the qualification's outcomes, the assessment criteria, the level descriptors and the content of each unit standard. Based on the order indicated in figure 5.3, I have analysed the two unit standards for module 1 followed by the module's assessments and I followed the same process for module 2. The decision to analyse the selected assessments in the curriculum (as opposed to modules) is based on the premise that Unit Standards are written statements of desired student outcomes (South African Qualifications Authority, 1995). Thus, comparing assessments to the Unit Standards indicates whether the desired knowledge and skills - articulated in the Unit Standards – can be evidenced or produced in the assessments.

Below, I explain how the language of description enables a dialogue between the theory and the data presented in the analysis. Using LCT Semantics as the analysis instrument, I analyse the texts for inferred meanings and then code them based on their relative strength or weakness of semantic density and semantic gravity. The raw data includes analyses of the modules, but this data did not inform the final analysis: While the modules proved to be aligned to their unit standards, the assessments determine whether the knowledge in the unit standards is supported. The full analysis of the data can be found in Appendix 2.

5.3 Unit Standards: analysing their texts

Different terms for certain sections of text within unit standards are frequently referred to in the analysis and these are explained below.

- *Specific outcomes*: Specific outcomes are specific competencies that a qualifying learner should demonstrate upon achievement of each unit standard. Unit standards usually contain an average of six specific outcomes which, when combined, result in the achievement of the overall unit standard's competence.
- *Assessment criteria*: Many of the old unit standards provide a list of 'associated assessment criteria'; a list of general criteria associated with the specific outcomes, providing a guide for assessment. In more current unit standards, each specific outcome has unique assessment criteria.
- *Essential embedded knowledge*: This is a list of particular concepts considered essential for the achievement of a unit standard. It guides curriculum developers in terms of theories that underpin unit standards. For ease of reference within this study, 'essential embedded knowledge' will be referred to as 'essential knowledge'. This essential knowledge is not necessarily listed in any order of importance; it is more of a 'shopping list' of concepts that should be embedded and not overlooked when designing programmes. It is important to

identify all of the essential knowledge listed in the unit standard to ensure competence. (SAQA, South African Qualifications Authority Act, 1995)

5.4 Methodology: Using LCT Semantic coding for the study

Using LCT Semantics to explore the organising principles of knowledge practices, I have identified meanings in the curricula texts, coding them in terms of their strength or weakness of semantic density and semantic gravity. Maton defines semantic gravity as:

> "The degree to which meaning relates to its context, whether it is social or symbolic; semantic gravity may be relatively stronger (+) or weaker (-) along a continuum of strengths. The stronger the semantic gravity (SG+) the more meaning is dependent on its context; the weaker the semantic gravity (SG-), the less dependent meaning is on its context" (Maton, 2014, p. 129)

To elaborate, when the semantic gravity of a curriculum text phrase is weaker, its meaning moves from the specifics of a *particular* context towards a more generalised meaning that is less dependent on a specific context (Maton, 2014). For the purposes of this study, context refers to *fitness practice* where knowledge is embedded in the practice. I will elaborate with an example of a question from an examination on anatomy: '*Name the main muscles responsible for knee flexion'*. Here, the meanings are *independent* of the context of fitness or its practice because the knowledge inferred in this phrase can be found in other curricula (e.g. medicine). Thus, the semantic gravity in the examination question is weaker (SG-). When semantic gravity is stronger, meanings shift from being generalised to being more context-embedded (Maton, 2014). An example of an examination question where knowledge is embedded in the fitness practice is as follows: '*Provide a range of compound exercises for your middle-aged unfit female client, indicating how you would adapt these exercises for her current weakness in muscular strength and flexibility'*. Here, the meanings are clearly associated with fitness practice. Thus, the semantic gravity is stronger (SG+). While semantic gravity is concerned with the context-dependence of knowledge, semantic density is concerned with the degree to which meanings are condensed within phrases. Semantic density is defined as:

> The degree of condensation of meaning within symbols (terms, concepts, phrases, expressions, gestures, clothing etc.). Semantic density may be relatively stronger (+) or weaker (-) along a continuum of strengths. The stronger the semantic density (SD+) the more meaning is condensed within symbols; the weaker the semantic density (SD-) the less meaning is condensed (Maton, 2014, p. 129)

Calling again on the previous example '*Name the main muscles responsible for knee flexion'*, knowledge is inferred from one discipline, with concepts about anatomical structures and their functions, therefore semantic density is weaker relative to the second example. With the second example '*Provide a range of compound exercises for your middle-aged unfit female client, indicating how you would adapt these exercises for her current weakness in muscular strength and flexibility',* in the context of exercise programming, '*compound exercises'* and *'adapt for current weakness'* indicate stronger SD as concept-complexity increases when more concepts build on and integrate from anatomy, kinesiology and biomechanics.

To enable nuanced differentiation in the analyses of meanings in the texts, phrases with the greatest condensation of meaning are coded as SD++ and those with the least condensation of meaning are coded as SD--. When coded as SD++, there is an increase in concept-complexity which brings about an integration of knowledge from more than one discipline. Phrases inferring basic concepts from one discipline exhibit less condensation of meaning and are coded as SD--. This same coding applies to semantic gravity: When meanings infer knowledge that is most embedded in the context of fitness practice, this is coded as SG++, and when meanings infer knowledge that is not tied to the specifics of fitness practice, this is coded as SG--. Thus, for the analysis of the data, each phrase in the texts is coded SD++/SD+/SD-/SD-- in terms of its relative strength or weakness of semantic density and is coded SG++/SG+/SG-/SG—in terms of its relative strength or weakness of semantic gravity.

5.5 Developing the language of description

If semantic density is measured in terms of the degree to which meanings are condensed within phrases used in the curriculum texts, then it follows that phrases with fewer meanings relate to more basic concepts from one discipline. Phrases that exhibit a greater condensation of meaning bring in more concepts, creating greater conceptual complexity with a number of inter-related disciplines.

In the analysis for this study, when inter-disciplinary relationship increases, concepts increase in complexity. For example, when knowledge from the field of physics is added to knowledge from the field of anatomy, the new field that emerges is kinesiology, or when concepts from the field of mechanical physics integrate with anatomy and kinesiology, biomechanical knowledge emerges. Thus, for the purposes of this study, meanings condense as concepts integrate and concept-complexity increases. Figure 5.4 illustrates how semantic density increases in strength from question 4 at the base of column C where semantic density is weaker relative to question 1 where semantic density is stronger.

Semantic Field: Exercise Science and Fitness Practice			
A	**B**	**C**	**D**
SD+	**Concept complexity increasing**	**Text Examples**	**Explanation**
↑	Greatest concept complexity and number of inter-related disciplines = increased concept integration.	1. Your client wishes to strengthen his/her shoulder abductors. 1.1 Demonstrate a single joint exercise with a long lever arm to work this muscle. 1.2 How would you make this exercise easier by changing the lever? 1.3 Demonstrate a compound exercise that includes this muscle.	Condensation of meanings in terms; e.g. 'single-joint exercise' or 'compound exercise' inferring greater concept-complexity combining more subject knowledge such as anatomy plus physics and biomechanics or exercise physiology plus physiology and anatomy
	Inter-disciplinary relationship increases thus concepts increase in complexity other disciplines are added. E.g. physics is added to anatomy = kinesiology or mechanics is added to anatomy = biomechanics	**2.** Consider the modified push-up. How would you make this exercise more difficult by changing the lever length?	Adding to subject specific knowledge indicated below plus more disciplines added e.g. anatomy + kinesiology + biomechanics + physics
	Concept complexity increases i.e. When X occurs, Y happens. Adding concepts of processes, functions, responses, inter-relationships.	3 a) Which muscle adducts, extends and inwardly rotates the shoulder. 3 b) Indicate the type of joint that this muscle crosses.	Subject specific terminology +definitions, or locations or structures + actions or functions or processes
↓	Basic concepts in one discipline; expressed in the use of correct term or name, basic definition, location, structure	4. Name the origin AND insertion points of the Rectus Abdominis.	Subject specific: e.g. terminology or definitions, or locations or structures
SD-	**Concept complexity decreasing**		

Figure 5.4 External Language of Description (ELD) for Semantic Density

In figure 5.4, column C, with question 4, meanings are least condensed as knowledge relates to an anatomical term *(Rectus abdominis)* conveying an anatomical concept about the location of a structure; this phrase is coded SD--. Relative to this, semantic density strengthens with question 3 in column C, as concepts are added from kinesiology (*adducts, extends, rotates*), so the inter-relationship increases concept complexity. With question 2, biomechanical knowledge is added with 'changing lever length'. Finally, with question 1, semantic density is stronger as concepts build anatomy ('shoulder abductors'), adding kinesiology ('single joint exercise') and increasing concept-complexity with physical mechanics ('long lever arm') thus stronger semantic density in the term 'compound exercise'.

Relative to question 4 (coded SD--), more meanings condense in question 3 which is coded SD-. With question 2, SD strengthens as biomechanical knowledge integrates with mechanical physics, anatomy and kinesiology (*lever length changes which affect difficulty)*, and this phrase is coded SD+. Finally, with Q 1, more meanings are condensed in 'compound exercise' as concepts are integrated from anatomy, kinesiology and biomechanics and this is coded SD++.

According to Maton (2011), a lengthy description condensed into one term signifies SD strengthening, whereas when an "abstract idea is fleshed out with empirical detail", SD weakens (Maton, 2011, p. 66). For example, the term 'Rectus Abdominis' - a Latin term for a specific abdominal muscle in question 4 – condenses meanings by symbolising a particular abdominal muscle but it is graded as SD- in this context because, relative to the term 'compound exercise' in question 1, less concepts are inferred in the term 'Rectus Abdominis'. With 'compound exercise' more meanings are condensed because additional concepts integrate, where kinesiology and physical mechanics build on anatomy thus question 1 is graded as stronger in semantic density relative to question 4.

The aim with this analysis is to establish whether it is possible for vocational curricula to provide for the kind of knowledge-building which Bernstein (1999) was concerned about in different knowledge structures. Bernstein defines vertical discourse as "a coherent, explicit, and systematically principled structure" for knowledge building (1999, p. 157). Maton (2011) adds to this, asserting that 'meanings are related to other meanings' in vertical discourse, integrating knowledge from lower levels (Maton, 2011, p. 70). While meanings relate to other meanings in the texts examples used here, does this mean that there is knowledge-building? Equally, when the same meanings are associated with context, demonstrating a strengthening of semantic gravity does this tie knowledge to its context and reduce epistemic access? I explain more about the relationship between SG and SD in chapter 6.

With semantic gravity, texts that represent knowledge embedded in fitness practice (likely to be applied in authentic, work-based environments) are stronger in semantic gravity and coded SG++. Texts inferring knowledge that is context-*independent* (and likely to be classroom-based) are coded SG--. Using the same examples to illustrate the analysis, semantic gravity is depicted in the table in figure 5.5. In column B, question 1, the meanings are the most context-dependent with the conveyed knowledge being specific to fitness practice whereas with question 4, column B, the meanings can relate to other curricula, thus the semantic gravity is weaker and the phrase is coded SG--.

Semantic Field: Exercise Science and Fitness Practice		
A	**B**	**C**
SG+	**Text Examples**	**Explanation**
	1 Your client wishes to strengthen his/her shoulder abductors. 1.1 Demonstrate a single joint exercise with a long lever arm to work this muscle. 1.2 How would you make this exercise easier by changing the lever? 1.3 Demonstrate a compound exercise that includes this muscle.	Applied knowledge in the context of practice. The environment is closer to practice; in a fitness environment or simulated practice.
	2. Consider the modified push-up. How would you make this exercise more difficult by changing the lever length?	
	3 a) Which muscle adducts, extends and inwardly rotates the shoulder. 3 b) Indicate the type of joint that this muscle crosses.	Knowledge is closer to its discipline and portable to other curricula Environment is classroom-based
	4. Name the origin AND insertion points of the Rectus Abdominis.	
SG-		

Figure 5.5: External Language of Description (ELD) for Semantic Gravity

5.6 Semantic fields of knowledge

Shay (2013) shows how these relations of semantic gravity and semantic density can form a 'field of semantic possibilities' (Shay, 2013, p. 6). With the use of semantic codes, she differentiates types of knowledge as general, theoretical, practical and professional knowledge. Guided by the principles of a Cartesian plane used to depict these 'semantic possibilities' (as opposed mathematical possibilities), I will show how knowledge can be differentiated and what these differences mean to vocational curriculum. In figure 5.6 the vertical plane demonstrates how semantic gravity and semantic density exist on a continuum of strength and weakness. SG+ represents context-embedded practice and SG- represents knowledge that is independent of fitness practice. On the horizontal plane, SD+ represents knowledge with the greatest relative level of concept integration where concept-building occurs from a number of disciplines, whereas SD- represents basic conceptual knowledge from one discipline.

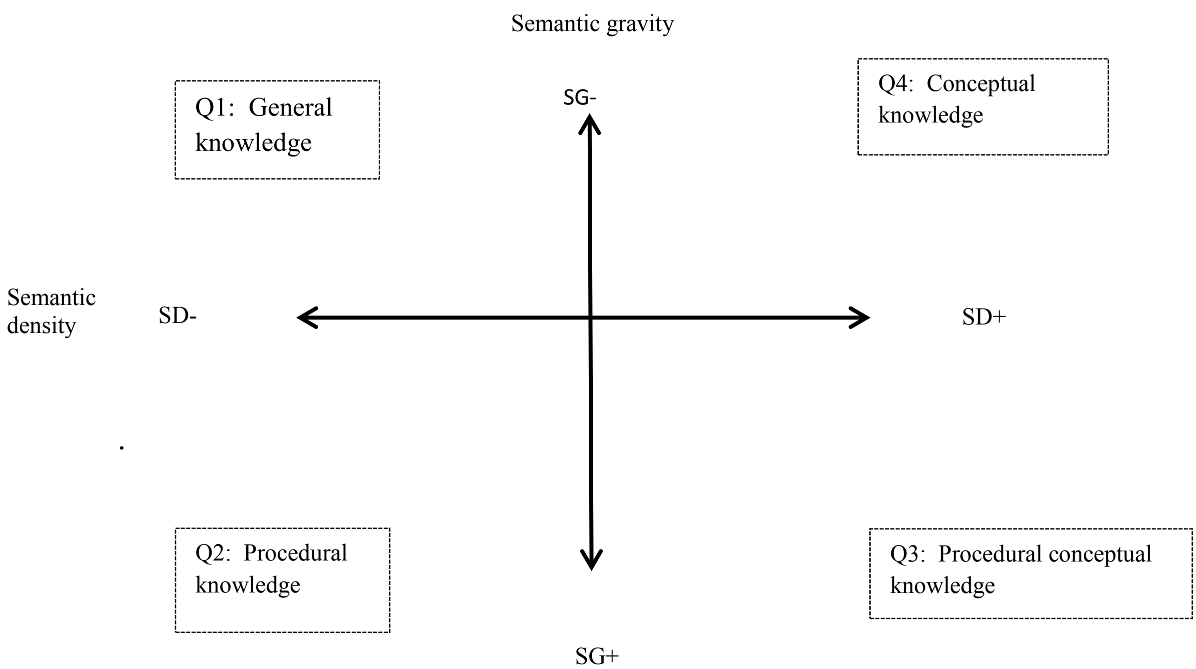

Figure 5.6: Semantic Plane and Types of Knowledge. Source: Shay (2013) figure 2, Maton (2011) figure 4.1

In the semantic plane in figure 5.6 quadrant 1 (Q1) is coded SD-/SG- representing general knowledge (including critical cross field outcomes). Quadrant 4 (Q4) represents theoretical or conceptual knowledge, found in a conceptually coherent curriculum and coded SD+/SG-. Quadrant 2 (Q2), coded SD-/SG+, represents practical or procedural knowledge, and quadrant 3 (Q3) represents procedural conceptual knowledge (coded SD+/SG+) which is achieved in contextually oriented curriculum, where theories underpin the procedures of practice (Shay, Oosthuizen, Paxton, & van der Merwe, 2011, p. 107). Here, the continuum operates by identifying nuanced differences in types of knowledge, for example, differences between practical knowledge, which is purely procedural, on the extreme left of Q2, and procedural conceptual knowledge, on the extreme right of Q3 which would be highly theoretical.

According to Gamble (2004) , practical knowledge can be informed by the principles which make procedures work. Equally, Shay (2013) reminds us that procedural conceptual knowledge is theory-based knowledge applied in practice. This leads us to the following question: Is there a clearly defined point when the knowledge shifts from being purely practical knowledge in Q2, to being procedural conceptual knowledge in Q3 and if so, how is this differentiation demonstrated?

Staying with the semantic plane and its depiction of knowledge differentiation, figure 5.7 shows how questions 1 to 4 (used as examples in the tables in figure 5.4 and 5.5) are differentiated according to the strength of semantic density and semantic gravity in their texts. Given that question 1 is coded SG+/SD+, it is placed in Q3 as procedural conceptual knowledge. Question 4, however, is independent of fitness practice, and conveys basic concepts that are independent of fitness practice. It is coded SD-/SG- as this is discipline-specific knowledge. Thus, expanding the knowledge typology from Gamble (2009) and the curriculum typology proposed by Shay et al (2011) the semantic plane enables even more differentiation of knowledge and its practices.

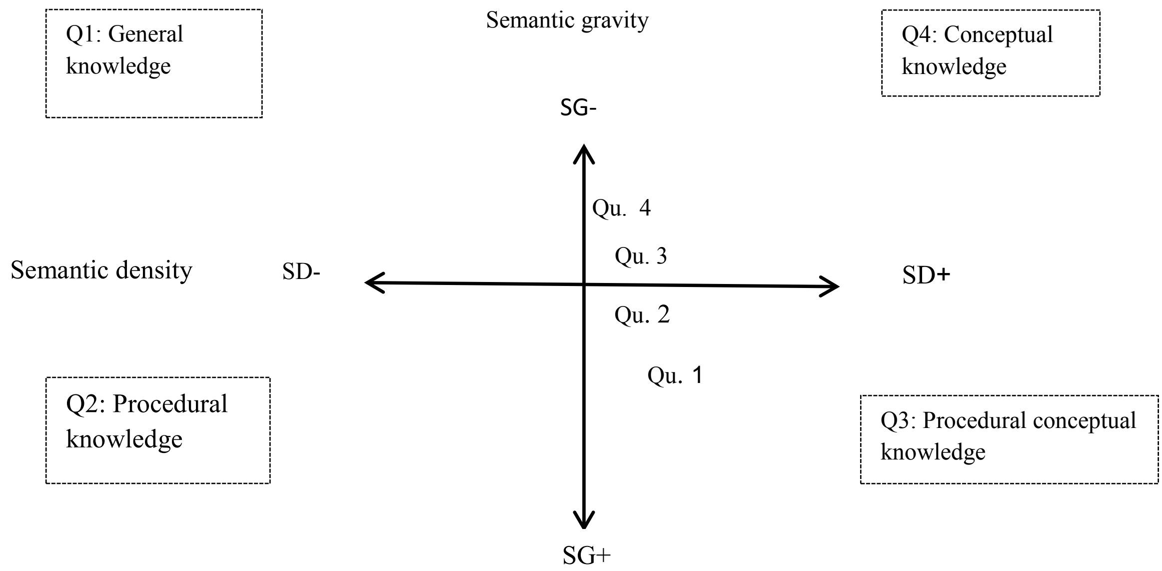

Figure 5.7: Semantic Field of Knowledge. Source: Shay (2013) figure 2, Maton (2011) figure 4.1

Through the use of tables and semantic planes to support the data analysis in chapter 6, I demonstrate shifts in knowledge and in knowledge practices based on the relative strength of semantic density and semantic gravity of the analysed texts.[8]

5.7 Ethical considerations

As mentioned in Chapter 1, my position as director of the college which hosts the study places me inside the empirical field. The study is not ethnographical, no interviews or observations were conducted and therefore written consents from individuals were not required. Nevertheless, ethical considerations remain relevant to ensure that the college that was responsible for the curriculum design is not adversely affected or threatened by the potential outcomes of the study.

My need to assure anonymity and confidentiality regarding those involved in the curriculum was addressed in meetings prior to embarking on the study. Nevertheless, to provide assurance, I asked for written consent from staff directly involved in curriculum. These signed consent forms are provided in appendix 3.

I was also one of twenty five members of the Standards Generating Body (SGB) responsible for designing and developing the qualification analysed in this study. The SGB met quarterly during the qualification's first design phase from 2000 to 2003, and in its revision phase from 2005 to 2008. I attended every meeting of the SGB cycles, over two consecutive three-year periods. This SGB is no longer in existence since the last qualification review period which ended in 2008. The qualifications designed by the SGB have been re-registered on the National Qualifications Framework by SAQA since 2008 and they expire in 2015. Unless there are new qualifications to replace them, they will be re-registered and placed on the Occupational Qualifications Sub-Framework for a further 3-year period. While it is not possible to discuss the study with these SGB ex-members, it has been discussed with the quality assurance manager of the Culture, Arts, Tourism and Sport Education and Training Authority (CATHSSETA) which is the Sector Education and Training Authority that originally funded the SGB. He has expressed support for the study and enthusiasm to see the outcomes.

5.8 Validity

This is a qualitative study. My intent is to ensure descriptive validity through the quality of my account of the study in relation to its conceptual framework. To support the validity, I use Legitimation Code Theory (LCT), specifically LCT Semantics (Maton, 2014) to enable data to be classified according to LCT's definitions. These definitions enable a dialogue between the language of description and LCT's codes. If the research maintains a strong link to the language of description and my rationale is sound, relative to the conceptual framework, then the findings should be relevant and should meet validity criteria and other researchers, using the same approach, are likely to experience similar findings (Maxwell, 2008).

5.9 Limitations

While the aim of this study is to analyse the type of knowledge that emerges from the re-contextualisation process of a qualification's development and its assessment design, this analysis cannot reveal whether that same knowledge is in fact achieved by the students on the programme. Without studying the quality of students' evidence from assessments, it is not possible to evaluate the quality of their learning or the different knowledge they gain through this type of vocational programme. Thus, the study can expand on theories about knowledge, but not to theories about learning. Additionally, I have provided a background to the different types of practice-based knowledge (occupational, vocational and professional) that is supported by South Africa's new qualifications sub-frameworks. However, this study cannot indicate whether the articulation and the knowledge transfer anticipated from these qualifications is in fact possible. More studies are needed to evaluate the articulation possibilities that are claimed by SAQA during the evolution of these qualifications and their sub-frameworks.

Page break

Chapter 6

Analysis

6.1 Analysis part 1

The aim of the data set discussed in this chapter is to uncover the conceptual fabric embedded in vocational curriculum and to explore whether and how this knowledge is revealed in terms of practice. The explanations below factor the curriculum-to-unit standard alignment discussed in chapter 6. Thus, each group of texts (Specific Outcomes, Assessment Criteria and Essential Embedded Knowledge) is analysed as a whole, according to its alignment to the others, and based on the curriculum design of the college. This analysis explains how each phrase or set of phrases increases in strength of semantic density (SD) as the concept integration increases. It also demonstrates how phrases increase in their strength of semantic gravity (SG) as knowledge becomes more context-embedded (Maton, 2014).

6.2 Unit standards: Module 1

Module 1 (Exercise Science) is the first core module of the NC Fitness and in passing this module; students achieve the following two unit standards:

- Apply anatomical and biomechanical principles to physical activity
- Apply principles of sport and exercise physiology

The title of each unit standard flags the overall expected competence, inferring that once qualified, students have the ability to apply the disciplinary knowledge indicated in each unit standard's title.

6.2.1 Unit-standard 1: Apply anatomical and biomechanical principles to physical activity (figure 6.1) Data: Appendix 2.1

This unit standard contains four specific outcomes, six assessment criteria and eleven essential knowledges. Table 6.1 shows how these phrases have been graded according to their relative strengths of semantic density and semantic gravity. At the base of table 6.1, specific outcome 1 (*Describe anatomical structures and systems of the human)* aligns to assessment criterion 2 and essential knowledges 2, 3 and 4. These phrases relate to basic concepts of anatomical structures (muscles, bones, ligaments, tendons) thus, semantic density is weaker relative to the next phrase above, which is specific outcome 3 (*Conduct an anatomical analysis of movement*). With this specific outcome, assessment criterion 1 and essential knowledges 2-4 and 8-11, semantic density is stronger because new concepts are added from kinesiology (*exercise and movement analyses*). The list of essential knowledges that align to specific outcome 3 provides insight into the range of concepts that underpin this competency and almost all of the essential knowledges in the unit standard are needed to achieve specific outcome 3. Knowledge of anatomical processes (*ranges of movements, functions of different muscles in human movement, movement analysis)* scaffolds on to concepts of anatomical structures, and how they contribute to movement builds concept-integration.

Semantic density is even stronger with specific outcome 2 (*Conduct a biomechanical analysis of movement*), assessment criterion 3, and essential knowledges 1-11. With these phrases, knowledge from physics (*modifying forces and levers*) is added to anatomy and kinesiology so that physics' mechanical laws inform knowledge about resistive forces (*modifying forces and levers*). Thus, the anatomical knowledge inferred in specific outcome 1 and 2 is subsumed by new concepts from additional disciplines.

SD+	Specific Outcomes	Assessment Criteria	Essential knowledge	SG+
↑	4. Adapt exercises using biomechanical principles to ensure safety and effective movement. For example; changing range of motion or degree of movement.	**AC 4:** Exercise is modified or progressed to the needs of the participant/s. **AC 5:** Relevant safety precautions are adhered to and implemented.	11. Exercise and movement analysis. 10. Normal range of motion in various anatomical structures. 9. Fundamental movements and function of different muscles in human movement. 8. Human movement terminology. 7. Posture and muscle imbalance. 6. Balance and alignment. 5. Physical laws influencing movement. 4. Systems e.g. circulatory, respiratory, nervous, endocrine. 3. Anatomical terminology. 2. Anatomical structures. 1. Biomechanical principles.	↑
	2. Conduct a biomechanical analysis of movement. For example; modifying forces and levers to change exercise intensity or increase difficulty.	**AC 3:** Choice of exercise is explained in relation to biomechanical principles and anatomical structures.	11. Exercise and movement analysis. 10. Normal range of motion in various anatomical structures. 9. Fundamental movements and function of different muscles in human movement. 8. Human movement terminology. 5. Physical laws influencing movement. 4. Systems e.g. circulatory, respiratory, nervous, endocrine. 3. Anatomical terminology. 2. Anatomical structures. 1. Biomechanical principles.	
	3. Conduct an anatomical analysis of movement. For example; muscles and joints involved in a "push-up".	**AC 1:** Locate an anatomical structure and describes its involvement in movement.	11. Exercise and movement analysis. 10. Normal range of motion in various anatomical structures. 9. Fundamental movements and function of different muscles in human movement. 8. Human movement terminology. 4. Systems e.g. circulatory, respiratory, nervous, endocrine 3. Anatomical terminology. 2. Anatomical structures.	
↓	1. Describe anatomical structures and systems of the human. For example; composition of muscles, bones, ligaments, tendons; structures, locations and functions of anatomical systems.	**AC 2:** Composition of anatomical structures is explained. **AC 6:** Reflect on, measure and evaluate performance in order to improve future practice and learning.	2. Anatomical structures. 3. Anatomical terminology. 4. Systems e.g. circulatory, respiratory, nervous, endocrine.	↓
SD-				**SG-**

Figure 6.1 Unit standard: Apply Anatomical and Biomechanical Principles to Physical Activity

At the top of table 6.1 is specific outcome 4 (*Adapt exercises using biomechanical principles to ensure safety and effective movement*), aligned to assessment criteria 4 and 5 and essential knowledges 1-11. Semantic density is stronger in these phrases as concepts integrate from physics, anatomy, kinesiology and biomechanics, and provide the knowledge needed to adapt exercises. Essential knowledge 6 and 7 add the concepts needed to ensure the safety requirements of specific outcome 4 with knowledge from kinesiology and biomechanics (*posture, muscle imbalances, balance and alignment*). Thus, with specific outcome 4, meanings condense as more concepts are called upon to integrate from more disciplines.

In the same way that these specific outcomes, assessment criteria and essential knowledges show similar strengthening of semantic gravity, so too do the phrases show stronger semantic gravity. Because the knowledge in specific outcome 1 (*Describe anatomical structures and systems of the human)* is not fixed to a specific practice-based context, semantic gravity is weaker, whereas specific outcome 4 (*Adapt exercises using biomechanical principles)* infers fitness-based, context-dependent knowledge (applying the knowledge to exercise). Semantic gravity becomes stronger and can be traced from specific outcome 1 (where semantic gravity is weaker) to specific outcome 4 (where semantic gravity is stronger), through to the main competence inferred in the unit standard title (*Apply anatomical and biomechanical principles to physical activity),* which specifies the type of context-embedded knowledge associated with practice (Shay, 2013).

At the base of the table in figure 6.1 is criterion 6 '*Reflect on, measure and evaluate performance in order to improve future practice and learning*.' Similar text appears in many of the unit standards. Not necessarily at the exclusion of concepts, but having the capacity to reflect on practice is considered an important element of action learning; learning through the mistakes and successes of vocational practice (Shon, 2007). This phrase has been placed at the base of the table in figure 6.1 and graded as weakest in semantic density and semantic gravity because of the generic nature of this knowledge, which could apply in other academic contexts.

Unit standard 2: Apply principles of sport and exercise physiology (figure 6.2), Data: Appendix 2.2

This unit standard contains six specific outcomes, four assessment criteria and six essential knowledges. Table 6.2 shows how the phrases in the unit standard have been aligned and graded according to their relative strengths of semantic density and semantic gravity. At the base of table 6.2 is specific outcome 1 *(Describe the body systems and the physiological factors associated with them)* which aligns to essential knowledge 1, inferring basic concepts about physiological systems and their processes. So semantic density is weaker relative to specific outcome 2 *(Outline and analyse the effects of environmental and physical factors)* where meanings begin to condense as exercise physiology and the effect that the environment has on performance adds to physiology of the energy systems. Semantic gravity is also stronger in this specific outcome, as meanings move closer to the exercise context (*physical factors that may affect performance*). Thus, physiological concepts add to exercise physiology, increasing the strength of the semantic density resulting in the knowledge becoming more context-embedded. Thus, semantic gravity is stronger.

Semantic density is even stronger in specific outcomes 3 to 6, which call for the ability to '*Demonstrate knowledge of the physiological responses to endurance training and various methods of training for improved performance'*. Essential knowledges 3, 4 and 5 underpin this outcome, increasing concept-integration with knowledge from exercise physiology, which add concepts about training principles for different outcomes. Conceptual knowledge increases with physiology (in terms of terminology, definitions and descriptions), and functions of the anatomical and physiological systems and processes between these systems.

<table>
<tr><th>SD+</th><th>Specific Outcomes</th><th>Assessment Criteria</th><th>Essential knowledge</th><th>SG+</th></tr>
<tr><td rowspan="3">↑
↓</td><td>3. Demonstrate knowledge of the physiological responses to endurance training and various methods of endurance training for improved performance.

4. Demonstrate knowledge of the physiological responses to resistance training and various methods of resistance training for improved performance.

5. Demonstrate knowledge of the physiological responses to flexibility training.

6. Demonstrate knowledge of the physiological responses to speed and power training.

For example: Describe the different types of purposes of training; Identify and demonstrate correct technique for a range of training exercises; Analyse the needs of a specific sport and design a general programme of training that is appropriate.</td><td>AC 4: Specific conditionings are adapted according to the fitness status of the participant/s.

AC 3: Training methods are adjusted according to changing environmental and physical conditions.

AC 2: Conditioning programmes are implemented that provide for improvement in endurance, flexibility, strength, speed, power, agility, balance and co-ordination.</td><td>5. Physiological basis of endurance, strength, speed, power, agility, balance, flexibility and co-ordination.
4. Fitness requirements for sport and fitness.
3. The principles of training and the design of fitness programmes.
2. Physiological mechanisms that underlie adaptations to training.
1. Anatomy and physiology of the energy systems of the body.</td><td rowspan="3">↑
↓</td></tr>
<tr><td>2. Outline and analyse the effects of environmental and physical factors.
For example: outline and discuss environmental and physical factors that may affect performance in a specific sport or exercise; Describe and analyse the possible physiological effect of these factors.</td><td rowspan="2">AC 1: Effective recovery activities are included in training programme.</td><td rowspan="2">2. Physiological mechanisms that underlie adaptations to training.

1. Anatomy and physiology of the energy systems of the body.</td></tr>
<tr><td>1. Describe the body systems and the physiological factors associated with them.
For example: analyse the appropriate energy systems that underpin a specific exercise or sport; Outline the three energy systems and describe when each is used and the interrelationship of each; Analyse the contribution of each energy system to a specific exercise or sport and compare the recovery times of each system; Identify different types of recovery programmes and outline the importance of including recovery techniques in a training programme.</td></tr>
<tr><td>SD-</td><td colspan="3"></td><td>SG-</td></tr>
</table>

Figure 6.2 Unit standard: Apply Principles of Sport and Exercise Physiology

Kinesiology and biomechanics inform exercise technique (*Describe the different types of endurance training; Identify and demonstrate correct technique for a range of endurance training exercises).* Equally, assessment criteria 2, 3 and 4 all infer the same knowledge-building (*Specific conditionings are adapted according to the fitness status of the* *participant/s).* Semantic gravity is also stronger in these phrases with its context-embedded knowledge.

Semantic gravity is weaker in specific outcome 1 *(Describe the body systems and the physiological factors associated with them)* and its associated essential knowledge 1 because the meanings are not necessarily related to the context of fitness practice compared to specific outcomes 3 to 6 (*Demonstrate knowledge of the physiological responses to training and various methods of training for improved performance)* and their associated assessment criteria and essential knowledge, which include applied knowledge in the context of fitness practice . However, the examples associated to specific outcome 1 do infer being able to use the physiological knowledge to analyse particular exercises or sports and their effect on the physiology. With specific outcomes 3 to 6, semantic gravity is stronger because these phrases all require the demonstration of knowledge (*various methods of training for improved performance).*

The knowledge inferred in four of the six specific outcomes and five of the six assessment criteria in this unit standard infer context-embedded knowledge relating to fitness and sport e.g. assessment criterion 2 (*Conditioning programmes are implemented that provide for improvement in endurance, flexibility, strength, speed, power, agility, balance and co-ordination).* Finally, the knowledge inferences in the title of the unit standard (*Apply principles of sport and exercise physiology)* and which articulates the main competence of this unit standard, infers strong semantic density and semantic gravity, inferring context-embedded knowledge, which combines the anatomical biomechanical concepts discussed in this analysis. The knowledge inferred in four of the six specific outcomes and five of the six assessment criteria in this unit standard show strong context-embedded knowledge relating to exercise and fitness practice.

6.3 Semantic fields: knowledge in the unit-standards (module 1)

The semantic plane in figure 6.3 shows the different types of knowledge this analysis reveals, while the text reference in the plane refers to each specific outcome. By implication, this includes their assessment criteria and essential knowledge analysed as a whole.

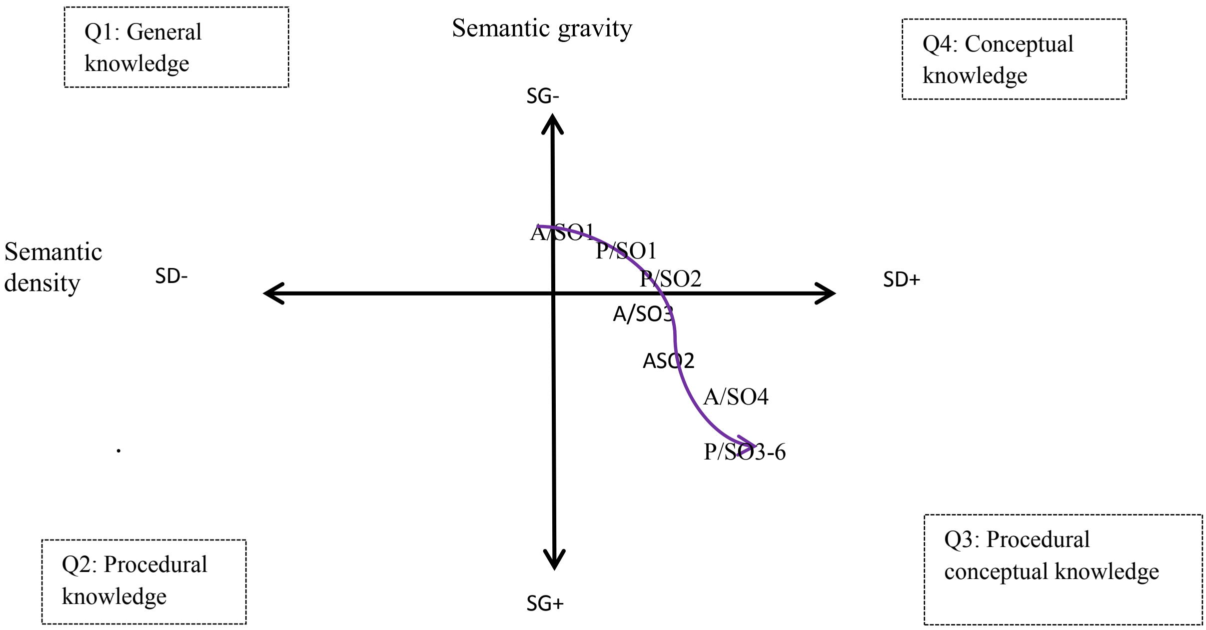

Figure 6.3 Types of knowledge in unit standards' specific outcomes

Except for specific outcomes 1 in the anatomy and physiology unit standard, the other specific outcomes are placed in quadrant 3 according to their relative strength of semantic density and semantic gravity. For reference purposes, Unit Standard 1 = A (anatomy) and Unit Standard 2 = P (Physiology). Each specific outcome in quadrant 3 requires application of knowledge, categorised as 'procedural conceptual knowledge'. The dominant logic of the curriculum is 'contextual coherence': recontextualised knowledge serving the external purposes of practice (Shay et al, 2011, p. 107). Quadrant 4 is conceptual knowledge and, because specific outcomes 1 and 2 (A/SO1, P/SO1 and P/SO2) are theoretical and independent of fitness, these are placed in the base of quadrant 4, whereas Physiology's specific outcomes 3-6 (P/SO3-SO6) are stronger in semantic density and semantic gravity, and therefore are placed in quadrant 3.

This first section of the analysis has concentrated on two core unit standards, which emphasise the application of theory. The analysis of the assessment follows, representing achievement of the knowledge inferred in the two unit standards.

6.4 Assessment: Module 1 (Exercise Science)

Assessment for module 1 consists of five tasks, beginning with two question papers. Task 2A (anatomy) then task 2B (physiology) are each worth 7%. Both papers include a multiple-choice section (part 1) and long answers (part 2). Task 2C (Kinesiology) is an oral exam including practical demonstrations and contributes 11%. Task 2D is a case-based paper worth 11%. Task 2E is a practical demonstration assessing knowledge relating to all of the subjects in the module, and is worth 14%. With this weighting, the three question papers represent 25% and the practical demonstrations 25% of the overall score, giving equal weighting to theory and applied knowledge.

6.4.1 Task 2A: Anatomy question paper (figure 6.4) Data: Appendix 2.3

Task 2A, Part 1 consists of 50 multiple-choice questions. Of the 50 multiple choice questions, 36 are coded as weaker in semantic density with fewer meanings condensed in their phrases. This is because the type of knowledge inferred in the questions relates to basic concepts, such as simple anatomical definitions, locations or functions. For example, a simple definition in question 5; '*Synergists are muscles that*….'; an example of anatomical location is question 4: '*Which muscles crosses both the hip and the knee*', and an example of anatomical actions is question 9; '*The action of the Rhomboids is*…'. These questions call for basic theoretical concepts; such knowledge requires little or no application of the knowledge, thus, semantic gravity is also weak. At the base of the table in figure 6.4 is question 7, which provides an example of weak semantic density. This relates to basic anatomical terminology of the musculo-skeletal system ('*Hamstring group'*) and knowledge of specific muscles in the hamstring group.

From the group of eleven questions representing slightly stronger semantic density is question 21. This question exemplifies stronger semantic density in the phrase relative to the more basic concepts exemplified in question 7. Question 21 adds knowledge, with anatomical terminology of musculo-skeletal structures (*Brachialis muscle relative to the Humerus bone*) and their anatomical position (*posterior, inferior*). Two other questions in figure 6.4 demonstrate stronger semantic density, for example, question 17 uses anatomical terminology of muscles in the musculo-skeletal system *(Biceps femoris, Semitendinosus, Semimembranosus)* then adds actions (*flex the knee*) and locations (*posterior group*).

At the top of the table in figure 6.4 with stronger semantic density is question 2 (part 1 MCQ) and question 1, part 2 (long questions). Question 2 includes knowledge of muscle actions (*extends and laterally rotates the hip*), and then adds locations (i*nserts on the greater trochanter*) and functions (*is best isolated with knee extension*). Question 1 also includes knowledge of anatomical terminology (*Name the three muscles*), locations (*State the* *insertion of the muscle*) and actions relative to position *(two joint actions that the muscles crosses)*.

Semantic density	Task 2A: Anatomy
SD +	**Question Paper Part 1 and Part 2**
↑	**Part 2 (long questions) (***this type of question repeats for Q 1, 2 and 3 but with different pictures)* **Q 1.** Consider the 3 pictures above; A. Name the three muscles. Write down the figure number & the corresponding name of the muscle next to it. B. State the insertion of the muscle in figure 1. C. State the origin of the muscle in figure 2. D. Name two joint actions that the muscle in figure 2 can bring about. **Part 1 (MCQ)** **Q2:** The Gluteus maximus I inserts on the greater trochanter II extends and laterally rotates the hip III is involved with running and hopping IV is best isolated with knee extension A I, II B I, II, III C II, III, IV D II, III
	Part 1 (MCQ) **Q 17**: The muscles that flex the knee (the posterior group) are the A. Biceps femoris, Semitendinosus, Semimembranosus. B. Semitendinosus, Sartorius, Gracilis. C. Rectus femoris, Vastus lateralis and medialis. D. Adductor magnus, longus and brevis.
↓	**Part 1 (MCQ)** 21 The Brachialis muscle is ________ to the Humerus. A. Posterior B. Inferior C. Anterior D. Superior
	Q 7: All the muscles below form part of the Hamstring group except A. Biceps femoris B. Rectus femoris C. Semitendinosus D. Semimembranosus
SD -	

Figure 6.4 Task 2A: Levels of semantic density

One question in this task hints at the exercise context, namely question 41 (*When performing a sit-up, one lies face upwards, downwards, in a prone position or supine)*. This question is not included in the table in figure 6.4 because, while it is an example of stronger semantic gravity with an inference to exercise in the commonly used term '*sit-up'*, semantic density is weak. This question simply calls for knowledge of the anatomical terminology in relation to body position (*prone, supine*) and the best position to recruit the muscles involved in the sit-up. Figure 6.4 provides examples of changes in strength of semantic density because there were no questions in this task that represented a strengthening of semantic gravity *and* semantic density.

Before moving on to the analysis of the next assessments, it is important to clarify why phrases in figure 6.1 are graded as SD- whereas similar phrases are graded as SD + in figure 6.4. Figure 6.1 compares specific outcomes, which are statements of *achieved* knowledge and skills (competencies). Thus, a competence such as specific outcome 1 '*Describe anatomical structures and systems of the human body'* is weaker in semantic density relative to specific outcome 4 '*Adapt exercises using biomechanical principles to ensure safety and effective movement'* because specific outcome 4, infers more concepts; scaffolding biomechanics on to kinesiology and anatomy. On the other hand, the analysis in figure 6.4 compares exam questions in the theory paper (task 2A). This task contains questions which test the anatomical concepts needed to achieve specific outcome 1 in figure 6.1. Therefore although Q1 (part 2 long question) is graded SD+ in figure 6.4, because semantic density is stronger relative to other questions in the paper, a phrase containing similar text in specific outcome 1 in figure 6.1 is graded SD- relative to the other specific outcomes because less meanings condense in specific outcome 1 relative to specific outcome 4.

Task 2B: Physiology question paper (figure 6.5); data: Appendix 2.4

Task 2B, part 1, is a 40-question multiple-choice paper. Unlike task 2A, this paper includes more questions with greater concept integration. These are all listed in appendix 2.4 but examples are explained below and provided in figure 6.5.

Question 3 and 17 infer basic physiological concepts about processes (heart circulation or protein being broken down into amino acids) with no relationship to practice, thus, semantic density and semantic gravity are weak. At each layer of the table in figure 6.5, more concepts are added e.g. in question 3 and question 6, exercise physiology is added to physiology with reference to 'exercise intensity' in question 3 and energy systems without oxygen in question 6. Exercise context comes in with question 8, with stronger semantic density, as physiology (*oxygen consumption*) adds responses with exercise physiology '*variables … increase during aerobic exercise'*. Question 28 is one of four, which exhibit stronger semantic density as concept integration increases: Exercise physiology (*aerobics*) is added to physiological responses (*cardiac output, blood pressure, oxygen consumption)* indicating how physiological systems are affected by different demands (e.g. *aerobic exercise*). Finally question 27 demonstrates stronger semantic density. While inferring context-embedded knowledge (*how the body adapts to exercise)*, question 27 also adds exercise physiology (*adaptations and training effects*) to the pre-existing concepts from physiology (*lung fusion capacity, cardiac output*).

Semantic density	Task 2B: Physiology	Semantic gravity
SD+	**Question Paper Part 1 and Part 2**	SG+
↑	**Part 1** **Q 27** Which of the following physiological adaptations are seen when doing aerobic endurance training? I. Increased lung fusion capacity II. Decreased cardiac output III. Increased mobilisation of free fatty acids IV. Increased capillarisation in the muscle bed a) I, II b) I, III, IV c) III, IV d) I, IV	↑
	Part 2 **Q8**. Which energy system(s) are predominantly utilised with the following activities? a) Short sprint (100m) 10 seconds in duration b) Sustained sprint (400m) 40-60 seconds in duration **Part 1** **Q 28**. Which of the following physiological variables do not normally increase during aerobic exercise? a) Cardiac output b) Oxygen consumption c) Systolic blood pressure d) Diastolic blood pressure e) Stroke volume	
	Part 2 **Q6**. Name the two energy or power systems in the body that provide energy without the use of oxygen. **Part 1** Q3: During which intensity exercise are free fatty acids the supplier of energy? A. High intensity, short duration B. Moderate intensity, short duration C. Low intensity, long duration D. Low intensity, short duration	
↓	**Part 1** **Q 17.** Protein can be broken down into amino acids, which can be utilised as an energy form a) True b) False **Part 2** **Q3**. Describe heart circulation i.e. the cycle of blood through the heart, naming all the relevant heart chambers, veins and arteries.	↓
SD-		SG-

Figure 6.5 Task 2B: Levels of semantic density and semantic gravity

Many of the questions in part 2 of the paper provide examples of stronger semantic density as concept integration increases as well as stronger semantic gravity as practice-based knowledge increases. There are questions in part 2 of Task 2B which are not shown in figure 6.5 because semantic gravity is weaker yet semantic density is stronger, e.g. question 7; *Fully describe both oxygen dependent energy systems referring to their names, fuel sources, by-*

products and energy production. This infers a range of conceptual knowledge including terminology, functions and responses, which are also context-independent. The data for task 2B can be seen in appendix 2.4.

6.4.3 Task 2C: Kinesiology oral-demonstration (figure 6.6); Data: Appendix 2.5

Task 2C is a time-managed oral and practical exam, consisting of a number of assessment stations. Students have completed Task 2A. Task 2C includes the following sections:

1. Kinesiology Section A – Basic recognition and joint actions
2. Kinesiology Section B – Levers, adaptation and pelvis
3. Kinesiology Section C – Functional Training
4. Kinesiology Section D – Movement Analysis(lower body)
5. Kinesiology Section E – Movement Analysis (upper body

Students are given different fictional scenarios where they answer questions orally or provide demonstrations. Although a practical demonstration may imply context, this is not necessarily always the case. In some instances, the questions simply require the student to name a muscle involved in a movement; in other instances the student is required to know more in relation to exercise names, or how to analyse an exercise, thus, semantic gravity is stronger. Figure 6.6 provides relevant examples that show questions ranging from weaker to stronger semantic density and semantic gravity, but additional examples are expanded on below.

Section A, question 1 '*your client wishes to strengthen his or her hip extensors. Name the main muscle responsible for this movement'*. Here, semantic density is stronger as anatomical terminology (*the name of the muscle*) is linked to the function of the muscle (*hip extension*). This is then associated to the client's goal (*to strengthen the muscle*), thus, semantic gravity is stronger, as knowledge is applied in practice. This question elicits knowledge of basic concepts but the inference of the 'client' adds another layer of meaning; it puts the student 'in the shoes' of a fitness practitioner and shifts the knowledge closer to its applied context.

With Kinesiology Section B, question 7 (*Consider the modified push-up: how would you make this exercise more difficult by changing the lever length?),* knowledge is context-embedded; concepts integrate with terms, functions and processes, and the inter-disciplinary relationship between physics and anatomy enables progression of the push-up movement (*more difficult by changing lever length*).

Finally, in Section B of the paper, the cluster of questions 2 to 6 below shows the strongest relation to fitness practice, as well as a compounding of knowledge from anatomy, physics and biomechanics, requiring the ability to synthesise this knowledge:

> Q 2: Your client wishes to strengthen his/her shoulder abductors. What is the main muscle responsible for this movement?
> Q 3: Demonstrate a single joint exercise with a long lever arm to work this muscle.
> Q 4: How would you make this exercise easier by changing the lever?
> Q 5: Demonstrate a compound exercise that includes this muscle.
> Q 6: Name all the joints that are moving in this multi-joint exercise

At the base of figure 6.6 with weaker semantic gravity is kinesiology section B, question 1. Conceptual knowledge relates to terminology (*muscle names*), actions or functions (*extends, adducts*). Semantic density is stronger in question 9, bringing terminology relating to location of the muscle (*anterior, posterior*) with knowledge of skeletal structures and locations, as well as actions of the muscles. Building on to the concepts of question 9, question 8 brings in positional terminology (*supine)* with physics of lever systems and their effects on exercise difficulty, which add to the knowledge about abdominal exercises and how to modify them with lever length changes. Hence, knowledge from anatomy, kinesiology and physics add to the application of the knowledge in the context of an abdominal exercise. Finally, with question 1 (section C), meanings condense in the terms used (*closed chain, open chain)*. These semantic terms assume knowledge from anatomy (joints and muscles involved), kinesiology (what type of movement closed and open chain means) and physical laws (one implying a closed lever system and the other an open lever system).

Semantic density	**Task 2C: Kinesiology**	**Semantic gravity**
SD+	**Oral and practical exam**	SG+
↑	Kinesiology Section B – Levers, adaptation and pelvis **Q8**. Consider the lying supine crunch / curl-up with the hands behind the head. How would you make this exercise easier by changing the lever length? Kinesiology Section C – Functional Training **Q1**. Demonstrate 1 closed chain and 1 open chain exercise. Kinesiology Section B – Levers, adaptation and pelvis **Q9**. Demonstrate a pelvic anterior tilt and a posterior tilt. Kinesiology Section B – Levers, adaptation and pelvis **Q1**. Name the muscle that adducts, extends and inwardly rotates the shoulder	↑
↓		↓
SD-		SG-

Figure 6.6 Task 2C: **Levels of semantic density and semantic gravity**

6.4.4 Task 2D: Long-question paper (training principles) (figure 6.7); data: Appendix 2.6

This fourth task consists of case-based questions relating to training principles and methods. Students have completed task 2B prior to task 2D. There is no ambiguity about the exercise-based context in which the questions are placed and the only variable is levels of concept complexity thus only changes in strength of semantic density are shown in Figure 6.7.

As can be seen in the example with case study 1 in figure 6.6, the question relates to an imagined client who has a certain resting heart rate, assuming a level of knowledge relating to the cardio-vascular system and the implications of a particular physiological system (*heart rate*) plus physiological responses (*training heart and how to calculate*).

Case Study 1 – Cardiovascular focus
Consider the following case study and answer the questions related to this case study.

Yasmin is a 45-year-old working mother with three children. She would like to engage in a general and regular fitness and wellness programme. She has been cleared by the doctor for exercise. Her resting Heart Rate is 70bpm.

SD+	**Task 2D: Training Principles and Methods**
↑	**Q4**. Calculate the training heart rate range (in BPM) if she trains at 50-60% of her maximum heart rate. Use the Karvonen formula. **Q6**. List three cardiovascular (CV) training exercises that would be suitable for her to do in her first week of training. (3) **Q7.** Draw up a cardio training FITT principle for Yasmin's first month of her training programme.
↓	**Q5.** Which cardiovascular training mode would be more suited to her on the commencement of her training programme?
	Q8. List two short-term responses that Yasmin will experience during her cardiovascular training.
SD-	

Figure 6.7 Task 2D: **Levels of semantic density and semantic gravity**

Gender is an additional factor because male and female heart responses differ, thus, this knowledge is assumed. Question 8 includes exercise physiology *(physiological responses to cardiovascular training*). Question 5 adds concepts from exercise physiology relating to training principles and different effects on the physiological systems. Question 7 adds greater complexity (*FITT' principle*). This is a semantic term that embeds knowledge about physiological responses, exercise intensity, frequency and duration. Finally, question 4 assumes a level of applied knowledge of physiological responses to training and the ability to calculate formulae for this training using the Karvonen formula. Heart rate informs training intensity, indicating knowledge of the inter-relationship of physiology, exercise physiology and heart rate response. Thus, semantic density and semantic gravity are stronger.

6.4.5 Task 2E: Practical demonstration (training methods), (figure 6.8); Data: Appendix 2.7

Task 2E is a practical demonstration intended to evidence students' ability to instruct; to communicate clearly and to teach exercise, using safe and effective exercise technique and execution principles, with and without the use of equipment or machines. The task involves a role-play and occurs in a fitness facility. The student simulates the role of a personal trainer while working with another student, who acts as the client. The demonstration is observed by the assessor. Figure 6.8 shows an example of the type of question asked and demonstrating the context-embedded nature of the knowledge in the task.

On the face of it, the scenarios that are posed to the students during this assessment are procedural and it seems difficult to determine how the assessor would know whether underpinning concepts inform the procedures. The knowledge is context-dependent; the task occurs in a fitness facility and the questions require students to demonstrate safe and effective exercise preparation, technique, execution and modification. It may be possible for a student to learn the procedures of exercise equipment by observing another. However, the assessment seems designed to elicit knowledge in such a way that, without underpinning theory; for example, it would be difficult for a student to know alternatives to a particular exercise or machine. Knowledge of anatomy, kinesiology, biomechanics and exercise physiology informs the ability to modify training according to anatomical and physiological responses, and knowledge of training methods informs exercise or machine choices. Knowledge of physics is added to enable a student to adapt a given exercise. Therefore, this task calls for a level of reflexive knowledge to be able to adapt and modify exercises based on different scenarios or clients' responses. The text example in figure 6.8 is from section 1 of Task 2E; the student is required to use the correct machine to demonstrate cardio-vascular exercise and then provide a body-weight alternative.

A competent personal trainer needs a relevant level of conceptual knowledge, which informs practice. While point (a) seems procedural, a term such as '*modification'* assumes knowledge of current fitness level, physiological responses to training as well as each client's fitness goals. Additional elements include exercise modifications or machine settings to elicit the required outcome, based on observable anatomical and physiological responses.

Practical Demonstration

Cardiovascular [5 points] Criteria:

The student has to demonstrate at least 2 cardiovascular exercises; one exercise needs to make use of a 'machine' and the other body weight.

a) Machine set up correctly for client and modification noted if client could not properly use the machine after explanation offered
b) Client was warmed-up sufficiently for the exercise (e.g. joint mobilisation before cardio, or a slow start)
c) Tell-show-do of what is expected from the client with correct technique (clear and easy to understand)
d) Posture explained and corrected where necessary
e) Purpose of exercise explained

Figure 6.8 Task 2E: Practical Demonstration Instructions

Point (b) infers knowledge of exercise physiology and what constitutes a safe and effective '*warm-up'*. '*Mobilisation'* is a term that infers concepts from anatomy and kinesiology (bones, joints and muscles that enable mobilisation), and knowledge from physics and biomechanics for correct body position relative to gravitational or other resistive forces.

Point (c) 'tell-show-do' requires the instructor to explain clearly (tell), demonstrate and execute the exercise with the correct technique (show), then ensure that the client executes the exercise properly according to the instruction and demonstration (do). Point (d) and (e) in the task are incorporated in point (c) which requires the student to ensure their own correct posture and technique as well as that of the client. Thus, the student, with the underpinning conceptual knowledge, explains the benefits or purpose of particular exercises and then ensures that the explanation and demonstration is followed properly. Finally, in point (d), 'posture' assumes understanding of the anatomical and biomechanical functions, which ensure good posture. Thus, terms such as 'modification', 'mobilisation', or 'posture' infer concept-integration from the singulars that exercise science draws from.

6.5 Semantic fields: Knowledge in the assessments (module 1)

Figure 6.9, shows how each task is positioned on the semantic plane according to its strength of semantic density and semantic gravity. Concept-integration with context-embedded knowledge increases most with task 2E. Thus, this task is placed lowest in question 3.

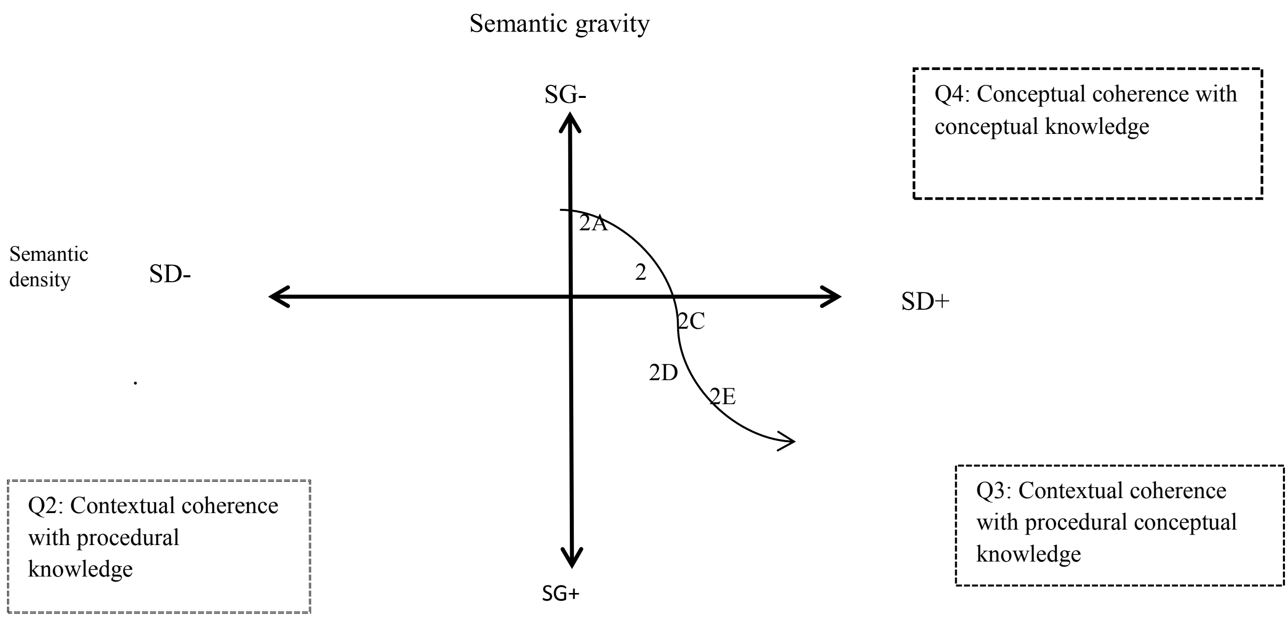

Figure 6.9 Semantic plane: Knowledge and curriculum coherence

Except for tasks 2A and 2B, which are more conceptual in terms of their knowledge requirements (implying conceptual coherence to the curriculum), the rest of the tasks imply contextually coherent curriculum, because the demands of the exercise environment and fitness practice influence the curricula logic of module 1. This is mainly procedural conceptual knowledge because, while these tasks express a conceptual demand, they also fulfil their vocational mandate (Shay, Oosthuizen, Paxton, & van der Merwe, 2011, p. 107).

It is beyond the scope of this paper to analyse the cognitive demands of these tasks but this is an analysis of a level-five qualification. Hence, the assessments should be pitched at SAQA's level five descriptor while meeting the quality assurance criteria for unit standard alignment.

6.6 Summary: Module 1

This first section of the analysis has interrogated knowledge in two unit standards for module 1: *Apply anatomical and biomechanical principles to physical activity'* and '*Apply principles of sport and exercise physiology'*. The titles of these two unit standards announce the applied knowledge that a qualifying learner achieves. It also proves a range of conceptual knowledge for application to exercise. The five different tasks for module 1 are designed to elicit the quality and quantity of theoretical and practical evidence, assuring knowledge of the module and achievement of the unit standards.

Meeting Biggs (2002) curriculum alignment model, the theoretical and applied knowledge inferred in each unit standard is provided in the module and assessed with a range of tasks. This range of assessments also fulfils two of the three SETA assessment requirements of knowledge (theory) and process (observable practical knowledge) (CATHSSETA, 2003).

The analysis uncovers the type of conceptual knowledge inferred in both the unit standards and their assessments, and to what extent that knowledge is dependent on the exercise environment. Using the semantic plane (figure 6.9) to depict the changes in strength of semantic density and semantic gravity, this demonstrates how knowledge changes in terms of its level of theoretical complexity and its context. This results in more clarity about knowledge differentiation and knowledge practices. The second section of the analysis follows, with the unit standards and their assessments for the second module.

6.7 Unit Standards: Module 2 (Screening, Assessment and Programme Design)

This second section of the analysis addresses the following four US:

- Conduct a screening procedure
- Test and evaluate health-related fitness components
- Motivate and encourage participation in physical activity
- Design exercise programmes

These unit standards are achieved with module 2; *Screening, Assessment and Programme Design* which contains four subjects; (1) Screening, (2) Assessment and Testing, (3) Motivation and Communication and; (4) Programme Design.

6.7.1 Unit standard 3: Conduct a Screening Procedure (figure 6.10); Data: Appendix 2.8

This unit standard consists of four specific outcomes, five associated assessment criteria (additional to the usual general assessment criteria), fifteen assessment criteria plus fourteen essential knowledges. The specific outcomes in this unit standard seem to relate mostly to the procedures of gathering and storing data or to the psychosocial skills needed to communicate with a participant. There are few inferences relating to the conceptual knowledge that underpins the ability to conduct a screening procedure in order to recommend physical activity or to clear participants for participation in activity (as indicated in the unit standard's purpose). However, there is more about conceptual knowledge in the essential knowledges that comprise physiology (in terms of pathology, medical risks and the role of preventative healthcare) as well as anatomy, physiology and exercise physiology, which inform the ability to determine exercise readiness along with the risks and benefits of exercise.

At the base of the table in figure 6.10, specific outcomes 4, assessment criteria 1 to 4 and essential knowledge 10 relate to procedural knowledge (*Manage data).* These texts contain no inferences to knowledge from the disciplines that make up exercise science. Therefore, as basic procedural knowledge with little relationship to fitnessc, these phrases are weaker in semantic density and semantic gravity. Specific Outcomes 1 and Assessment Criteria 10 and 11 introduce psychosocial skills *('client sensitive manner' and 'advise, motivate and support a participant'*). In comparison to the epistemic emphasis so far, these phrases stress 'knower' qualities, where empathy, sensitivity and client-care are emphasised. Essential knowledges 4, 8 and 12 call for concepts from sociology with cultural sensitivity, communication and motivation skills that bring knowledge closer to fitness practice.

Similar psycho-social skills are inferred in specific outcomes 3 (*Assist the participant in making informed decisions in setting goals*) but meanings begin to condense as knowledge from exercise physiology is added with the inferences in assessment criteria 12 and 13 (*setting goals appropriate to physical activity readiness*) and associated assessment criterion 1 (*exercise/sport readiness),* implying the knowledge needed to provide such advice. A range of knowledge from anatomy, exercise physiology, biomechanics, nutrition and training principles is indicated in essential knowledges 1, 2, 3, 5 and 6. Relatively, semantic density is stronger and more concepts integrate in specific outcome 2 (*Interpret data in order to make decisions for participation or for physical activity readiness and provide relevant feedback*) and in particular, assessment criterion 7 (*Screening protocol is understood together with the issues and implications that make up the screening tool)* implying knowledge from health sciences and risks associated with chronic diseases integrating with concepts from exercise physiology (*benefits of physical activity*).

Interpreting data for physical activity readiness and identifying medical risks and lifestyle factors to provide advice on exercise and lifestyle changes imply the type of knowledge indicated in essential knowledges 1, 2, 3, 5, 6 and 7. In terms of relative strength of semantic gravity, specific outcome 2 (*Interpret data in order to make decisions for physical activity readiness)* shows stronger semantic gravity with its relation to fitness practice. On the other hand, specific outcome 4 and its emphasis on data management could apply in many contexts that call for this skill.

At the base of the table in figure 6.9 are assessment criteria 14 and 15, with essential knowledge 11; these phrases require the knower to be able to reflect on own practice to improve performance. As with similar texts discussed previously, these phrases in table 6.8 are also graded SD-/SG- because, as opposed to epistemic, the emphasis is social, which calls for knower capabilities and this capability is relevant to other contexts.

SD+	Specific Outcomes	Assessment Criteria	Embedded knowledge	SG+
	2: Interpret data in order to make decisions for participation or for physical activity readiness and provide relevant feedback. *For example, identify the outcomes and provide feedback on the information, clarify goals and establish whether they are realistic.*	AC 7: Screening protocol is understood together with the issues and implications that make up the screening tool (e.g. smoking, elevated cholesterol). AC 8: Results are accurately communicated to the fitness participant and/or referring practitioner. AC 6: Data is accurately interpreted according to accepted protocol for the particular screening tool. AAC 2: Appropriate referrals are made where necessary.	14: Professional and Legal Issues - professional, legal and ethical issues around screening. 9: Referral - the role of health-care professionals and related industries and how to refer to them. 7: Health Conditions and Risk Factors - identification of health conditions and risk factors that may necessitate referral or place fitness participant at risk when participating in certain activities. 6: Training Principles - as they relate to physical activity. 5: Nutrition - nutrition principles as they relate to general health and physical activity. 3: Biomechanics and Applied Kinesiology - the physical structure of the component parts (bone/ joints) and how the physical laws of motion govern that structure. 2: Exercise Physiology - how the body functions at rest and understand how the body responds and adapts to many different types of physical activity. 1: Functional Anatomy and functional physiology - the major systems - cardiovascular, respiratory, muscular, skeletal, endocrine, nervous.	
	3: Assist the participant in making informed decisions in setting goals. *For example, give information regarding lack of fitness and help participant decide on* choice of exercise or training.	AC 13: Participant is guided towards goals appropriate to physical activity readiness. AC 12: Participant is consulted with in reaching conclusions, which relate to physical activity readiness. AC 5: Explains purpose and function of questionnaire. AAC 3: Goals/objectives are set relative to the needs and aims of participant. AAC 1: Appropriate decisions are made about exercise/sport readiness for the participant.	13: Environmental Considerations - impact of natural and built in environments as they relate to physical activity. 6: Training Principles - as they relate to physical activity. 4: Psychology of health behaviour - psychology of health behaviour as it relates to motivation and adherence to exercise.	
	1: Collect data in a client-sensitive manner. *For example, use accepted questionnaires and ask questions in an empathetic manner.*	AC 11: Creates conducive environment for the screening process. AC 10: Displays listening skills, non-judgmental, culturally sensitive and supportive behaviour. AC 9: Protocol/s are explained to the participant. AAC 4: 4. Reflect on screening procedure and modifies protocol if necessary AAC 5: 5. Modifies delivery of the screening procedure in a culturally sensitive manner.	12: Sociology - knowledge of sociological factors as they relate to participating in physical activity. 8: Communication - understand the fitness participant / practitioner relationship at this stage.	
	4: Manage data in order to provide continuity of support to the participant. *For example, keep records in chronological order; record recommendations and information given that there is base line information and updates can be made.*	AC 1: Data is accurately recorded. AC 2: Data is stored systematically. AC 3: Necessary data sheets, questionnaires, forms, logbooks are sourced for the screening procedure. AC 4: Confidentiality and integrity of data is maintained.	10: Manage Data - techniques and methods used to record, manage, maintain process and store confidential data.	
		AC 14: Areas of performance that are evaluated are open to improvement. AC 15: Keeps track of own learning and performance and evaluates it against this unit standard and own expectation.	11: Self-evaluation - knowledge of self-learned styles and modification of performance.	
SD-				SG-

Figure 6.10 Unit standard: Conduct a Screening Procedure

6.7.2 Unit standard 4: Test Health Related Fitness (Figure 6.11); Data: Appendix 2.9

There are eight specific outcomes, ten assessment criteria and eleven essential knowledges. Like the previous unit standard, the phrases in this unit standard also seem to be procedural. For example: specific outcomes 1 (*Take measurements, using a variety of measuring methods)* and specific outcome 7 (*Assess body composition).* But, assessment criterion 6 (*Explain the issues and implications that make up the testing tool)* hints at the scientific knowledge required in order to understand the processes and implications of testing validity, repeatability and accuracy. Thus, relative to specific outcome 1, in specific outcomes 2 (*Test cardio-respiratory endurance)* and 3 *(test muscular fitness and flexibility, using accepted protocols),* semantic density is stronger because the ability to conduct these tests assumes knowledge from physiology, anatomy and kinesiology, as well as exercise physiology, which informs fitness testing. However, the procedure of taking measurements – as in specific outcome 1 - might *not* imply conceptual knowledge, anthropometry and the ability to select from its range of body measurement techniques based on the scientific principles of testing. Thus, semantic density is stronger relative to specific outcome 8.

Specific outcome 8 (*Prepare participant and organize the testing session*) with assessment criteria 1, 2, 8 and 9 indicate little about conceptual knowledge other than knower qualities of communication skills and the ability to advise the participant. Specific outcome 5 (*Explain this protocol and the information related to the outcomes of the test)* supports the results of specific outcomes 2, 3, 4 and 6, demonstrating stronger semantic density (*Integrate and evaluate the gathered*) and (*Explain this protocol and the information related to the outcomes).* These imply the kind of knowledge indicated in assessment criteria 3, 4, 5 and 6.

<table>
<tr><th>SD+</th><th>Specific Outcomes</th><th>Assessment Criteria</th><th>Embedded Knowledge</th><th>SG+</th></tr>
<tr><td rowspan="7">↑
↓</td><td>4: Integrate and evaluate the gathered data.

5: Explain this protocol and the information related to the outcomes of the test to the fitness participant.</td><td>AC 4: Data is accurately interpreted according to accepted protocol for the particular testing tool.

AC 5: Understands the testing protocol.

AC 10: Participant is consulted with in reaching conclusions, which relate to physical activity readiness.</td><td rowspan="7">7: The scientific criteria underlying fitness testing (I.e. accuracy, validity, reliability, relevance, specificity, objectivity, variables).

3 The testing procedure and the impact of this data on the chosen method of fitness testing.

2: Applied kinesiology and biomechanics.

1: Exercise physiology.

11: Injuries and risk factors and how these may impact on the testing method.

10: Emergency management procedures, first aid and CPR

6: The role of other health care practitioners and the appropriateness of referrals, when necessary.

9: Safety precautions and preparation requirements for fitness testing.

8: Informed consent and the various fitness tests and their protocols, as well as an understanding of when they are appropriate to use.

5: The issues surrounding respect for personal space and appropriate physical contact within the testing environment.

4: Appropriate verbal and non-verbal communication skills within the context of data gathering and fitness testing.</td><td rowspan="7">↑
↓</td></tr>
<tr><td>3: Test muscular fitness and flexibility, using accepted protocols, for example, muscular strength, muscular endurance, agility, range of motion.</td><td rowspan="4">AC 6: Explains the issues and implications that make up the testing tool (e.g. validity, repeatability, accuracy).

AC 7: Accurately communicates results to the fitness participant.

AC 3: Explains purpose, function and protocols of fitness test.</td></tr>
<tr><td>2: Test cardio-respiratory endurance, using accepted sub-maximal protocols, for example; Field-testing, ergo meter, treadmill, step test.</td></tr>
<tr><td>6: Evaluate posture and body alignment and lower back health.</td></tr>
<tr><td>7: Assess body composition.</td></tr>
<tr><td>1: Take measurements by using a variety of measuring methods, using accepted protocols, for example; Height, weight, circumference, skin folds, body mass index.</td><td rowspan="2">AC 8: Displays non-judgmental, culturally sensitive and supportive behaviour.
AC 9: Creates conducive environment for the testing process.
AC 2: Confidentiality and integrity of information is maintained.
AC 1: information is accurately recorded and stored systematically.</td></tr>
<tr><td>8: Prepare participant and organise the testing session.</td></tr>
<tr><td>SD-</td><td colspan="3"></td><td>SG-</td></tr>
</table>

Figure 6.11 Unit standard: Test Health Related Fitness

Essential knowledges 1 to 5 and 7 to 9 are more explicit about the knowledge required (*The testing procedure and the impact of this data).* Stronger semantic density is in specific outcomes 2, 3 and 4 because these call for greater concept-complexity and knowledge building from the subjects in exercise science and indicated in essential knowledge 1 (*exercise physiology)* and 2 (*applied kinesiology and biomechanics)* as well as 7 (*scientific criteria underlying fitness testing).* Specific outcome 1 – the ability to take body measurements – relates to skills that could apply in other contexts e.g. dress-making. However, specific outcomes 2, 3, 6 and 7 are associated with fitness practice because their concepts clearly relate to testing for a range of fitness applications.

As with the specific outcomes and assessment criteria , the list of essential knowledge indicates the knowledge required to fitness test with essential knowledges 4 and 5, relating to personal space and appropriate communication implying the same knowledge indicated in specific outcome 8 (*Prepare participant and organise the testing session)***.** Equally, with legal concepts indicated in essential knowledge 8 and professional scope of practice in essential knowledge 6, semantic density and semantic gravity are weaker because these are basic concepts and because the knowledge is relevant to other contexts. Because informed consent is a requirement prior to the test, the participant should be familiarised with the testing protocol and be warned about the potential risk of injury. Thus, safety knowledge results in stronger semantic gravity in essential knowledge 9 and participant preparation indicated in specific outcome 5 and 8.

Essential knowledges 10 and 11 seem outliers in this unit standard because none of the competencies or criteria infers knowledge about emergencies or injury management. When the SGB designed the unit standard, they may have felt it necessary to include this essential knowledge. However, the curriculum designers of the college decided to address this knowledge in a separate module, possibly for operational reasons. But, this is an example of how knowledge is recontextualised for pedagogic purposes depending on prevailing factors at the time (Bernstein, The Pedagogic Device, 2000).

The knowledge in these two unit standards builds on concepts in module 1 (Exercise Science), assuming knowledge from anatomy, biomechanics and physiology, which underpin screening and testing. To determine medical risks in a screening process and decide on whether a participant is at risk or will benefit from exercise requires knowledge from exercise physiology, but specifically the area of pathology, which underpins principles of health management and disease prevention. Equally, cardio respiratory, strength or flexibility tests presupposes knowledge from exercise physiology and biomechanics, which underpin fitness testing.

The list of essential knowledge in both unit standards flags this conceptual knowledge, ensuring that it is not overlooked in the curriculum design and ensuring that knowledge scaffolds as learning is sequenced. In the same way, the next two unit standards imply a building of knowledge from previously achieved unit standards, enabling the ability to '*Motivate and encourage participation in physical activity*' and '*Design exercise programmes*'.

6.7.3 Unit standard 5: Motivate and Encourage Participation in Physical Activity (figure 6.12); Data: Appendix 2.10

This unit standard contains five specific outcomes, six associated assessment criteria and thirteen essential knowledges. The basic and procedural knowledge inferred in specific outcome 5 (*Monitor progress against set goals)* indicates weaker semantic density and semantic gravity, with procedural knowledge of record keeping and monitoring that can apply in other contexts. However, with specific outcome 4 (*Implement strategies for long and* *short term goal setting)* and assessment criteria 5, semantic gravity strengthens due to the relationship of this psychological knowledge to fitness practice. Therefore, semantic density strengthens with knowledge from health psychology in essential knowledge 11 (*Health behaviour psychology)* and 4 (*The role of intrinsic and extrinsic motivation).*

SD+	Specific Outcomes	Assessment Criteria	Essential knowledge	SG+
↕	**3:** Utilise health psychology principles to encourage adherence to physical activity. **4**: Implement strategies for long and short-term goal setting. **2**: Apply appropriate methods of motivation and develop strategies for exercise adherence. **1**. Identify factors that enhance or inhibit exercise adherence. **5:** Monitor progress against set goals.	**AC 6**: Identifies psychological or emotional factors that may require specialist attention and refers participant/s to relevant practitioner/s. **AC 2:** Motivational techniques are explained and demonstrated/implemented. **AC 1.** Factors that encourage exercise adherence are listed and described. **AC 5:** Strategies for promoting commitment to lifelong fitness and health are demonstrated. **AC 3.** Goals are set which are realistic, achievable and measurable. **AC 4.** Records are kept of goals set and achieved.	**7:** Cognitive methods and behavioural approaches for enhancing and maintaining motivation to participate in and adhere to fitness activities. **9:** Guidelines to identify psychological and/or emotional factors that would require referral to a relevant professional. **2:** Psychosocial factors that influence fitness participation and health-related lifestyle decisions. **12:** The psychological benefits of exercise. **11:** Health behaviour psychology. **3:** The concept of motivation. **1:** Definition of exercise adherence and the factors that influence it. **4**: The role of intrinsic and extrinsic motivation in fitness participation. **8:** Methods for creating an environment conducive to fitness participation and adherence. **13:** Methods and guidelines for effective goal setting in the fitness context. **10:** Counselling and consulting skills (in the context of helping and advising with health & fitness). **5:** Leadership qualities required to motivate others. **6**: The role of verbal and non-verbal communication in motivating fitness participants.	↕
SD-				**SG-**

Figure 6.12 Unit standard: Motivate and Encourage Participation in Physical Activity

Specific outcomes 1, 2, 4 and 5 with assessment criteria 1, 2, 3 and 5 plus essential knowledges 1, 3, 4, 8 and 13 all call for concepts from behaviour psychology, which underpins the ability to motivate exercise adherence. Psychological concepts of motivation integrate with health behaviour psychology in specific outcome 3 (*Utilise health psychology principles to encourage adherence to physical activity),* where relatively stronger semantic density and semantic gravity with assessment criteria 6, essential knowledge 2, and 7 which add knowledge from sociology, plus psychology's cognitive methods, enabling different psycho-social approaches to encourage adherence to physical activity. Finally, essential knowledge 9 calls for concepts from psychology to enable identification of emotional or psychological factors that may require professional referral, indicating stronger semantic density and semantic gravity.

This unit standard takes a departure from the core knowledge of exercise science, especially with the essential knowledges that emphasise psychosocial factors of leadership, empathy and effective communication. These qualities were also indicated in some essential knowledge and assessment criteria in the screening and fitness-testing unit standard. Thus, in terms of this 'knowledge' and 'knower' equation, social relations emphasise knower qualities and attributes. It is this 'knower code' that emerges in this unit standard (Maton K. , 2000). However, the specific outcomes also make inferences to knowledge from psychology, health psychology and sociology, while calling for knower qualities of leadership, communication and the ability to show empathy.

The analysis of this unit standard reveals a different emphasis in terms of the type of knowledge identified in the other unit standards as well as the knower qualities emphasised in this unit standard. Meanings shift from an epistemic emphasis on exercise science to a knower emphasis, which calls for the psychosocial capabilities needed to communicate, support and monitor clients' progress. Nevertheless, in terms of this study, which explores conceptual and contextual knowledge differentiation, the unit standard still calls for a level of relevant conceptual knowledge, which is applied in practice - albeit in a different method and for a different purpose.

6.7.4 Unit standard 6: Design Exercise Programmes (Figure 6.13); Data: Appendix 2.11

This unit standard consists of five specific outcomes, twelve associated assessment criteria and a list of thirteen essential knowledges. The procedural nature of assessment criterion 1 (*Programme design is organised, concise and user-friendly)* indicates weaker semantic density. However, this is only one criterion for specific outcomes 1, 2, 3 and 4, all of which indicate stronger semantic gravity and semantic density. These outcomes (*Design a safe and effective cardio-respiratory exercise programme in a scientific and flexible manner, while meeting the individual needs, abilities and goals of the fitness participant/s)* imply a range of knowledge from physiology (different physiological systems for various exercise forms), exercise physiology (how systems respond to different exercise programmes) as well as the principles of training, which inform programme design and enable effective exercise (FITT principle). The knowledge needed for exercise programme design, monitoring and modification requires concepts to be built from all of the disciplines of exercise science in module 1.

Psychosocial factors such as assessment criteria 9, 10 and 11 (*communication, and listening skills, being culturally sensitive)* increase strength of semantic gravity as knowledge becomes more related to fitness practice e.g. assessment criterion 9 *(Effectively communicates design of exercise programme)*. Weakest in semantic gravity - because the knowledge applies in other environments – is assessment criterion 1 (*Design is organised, concise and user-friendly)* and assessment criterion 11 (*Displays non-judgmental, culturally sensitive and supportive behaviour).*

SD+	Specific Outcomes	Assessment Criteria	Essential knowledge	SG+
↑ ↓	**5** Monitor and modify exercise programmes in accordance with the responses and adaptations observed. **1** Design a safe and effective cardio-respiratory exercise programme in a scientific and flexible manner, while meeting the individual needs, abilities and goals of the fitness participant/s. **2** Design a safe and effective resistance training programme in a scientific and flexible manner, while meeting the individual needs, abilities and goals of the fitness participant/s. **3** Design a safe and effective flexibility training programme in scientific and flexible manner, while meeting the individual needs, abilities and goals of the fitness participant/s. **4** Design a safe and effective weight management and body composition programme.	**AC 8**, Modifies selected exercise/s and equipment choices to meet same goals. **AC 2**, Adheres to scientific principles of exercise and current guidelines when designing exercise programme/s, e.g. duration, frequency, specificity, intensity, progression, variation, muscular balance, ROM. **AC 4**, Explains the relevant body type/s, mode/s and method/s of exercise used in the programme design. **AC 6,** Makes informed exercise selections and equipment choices, while avoiding contra-indicated exercises and movements. **AC 5**, Explains the fitness requirements and abilities of the participant/s and designs exercise programme/s to meet these needs, goals and expectations. **AC 3**, Includes safe and effective pre-exercise (warm-up), recovery and post-exercise (cool-down) components in programme/s design. **AC 7**, Anatomy, physiology, biomechanics and muscle application in human movement is applied when designing exercise programme/s. **AC 9**, Effectively communicates design of exercise programme to the participant. **AC 10**, Displays listening skills. **AC 11**, Displays non-judgmental, culturally sensitive and supportive behaviour. **AC 1**, Programme design is organised, concise and user-friendly.	**3**, The scientific criteria underlying exercise programming and exercise training. **4**, Training principles for cardio vascular conditioning, strength training, flexibility. **5**, Methods of training for endurance, strength, mobility, flexibility, core conditioning. **7**, The concept of total fitness and the requirements of holistic exercise design. **9**, Exercise and movement selection, equipment choice and correct use of fitness equipment. **13**, The differences and similarities in programme design for individuals, as opposed to programme design for groups. **8**, Principles and components of exercise programme design and guidelines for creating programme layouts. **6**, Safety precautions and preparation requirements for exercise. **10**, Common exercise injuries, injury management and prevention. **1**, Functional anatomy and exercise physiology. **2**, Applied kinesiology and biomechanics. **12**, Legal and professional responsibilities and scope of practice of the fitness practitioner in programme design and prescription. **11**, Participant motivation and promoting adherence to exercise programmes through effective programme design.	↑ ↓
SD-				SG-

Figure 6.13 Unit-standard: Design Exercise Programmes

Semantic gravity is stronger with assessment criterion 3 (*Includes safe and effective pre-exercise warm up).* More so in essential knowledge 3 (*scientific criteria underlying exercise programming)* with concomitantly stronger semantic density, as knowledge shifts from being procedural in assessment criterion 1 (*Programme design is concise and user friendly),* adding concepts of safety and injury prevention, as in essential knowledge 10, and even greater strengthening of semantic density in assessment criterion 2 (*Adheres to scientific principles of exercise and current guidelines).* Here, meanings condense with knowledge from exercise physiology (*scientific principles of exercise),* adding training principles (*specificity, intensity, progression, variation)* and anatomy and kinesiology (*muscular balance and ROM* - Range Of Movement). At the same time, semantic gravity is stronger as knowledge moves closer to fitness practice.

Relative to the knowledge in the unit standards in module 1 (Exercise Science), semantic density and semantic gravity are stronger with *Design Exercise Programmes***.** This is because more meanings condense in the unit standard *Design Exercise Programmes,* relative to those in *Apply Anatomical and Biomechanical Principles to Physical Activity* and *Apply principles of sport and exercise physiology.* For example, with assessment criterion 7 in *Design Exercise Programmes*, knowledge compounds from anatomy, physiology, biomechanics and kinesiology in the application to movement. Equally, with assessment criterion 2, semantic density and semantic gravity strengthen more as the knowledge from module 1 is subsumed with assessment criterion 2 (*Adheres to scientific principles of exercise and current guidelines when designing exercise programme/s, e.g. duration, frequency, specificity, intensity, progression, variation, muscular balance, ROM).* Additionally, with specific outcomes 1 to 5, knowledge from anatomy, kinesiology, biomechanics and physiology underpins these capabilities, which condenses their meanings as more concepts integrate, adding exercise physiology's principles of training (*duration, frequency, specificity, intensity, progression, variation, muscular balance, ROM).*

Additionally, in specific outcome 1, knowledge from anatomy, kinesiology, biomechanics and exercise physiology is added, with the ability to '*design safe and effective* *cardio-respiratory exercise programmes in a scientific and flexible manner'* and its associated assessment criterion 2; *'Adheres to scientific principles of exercise and current guidelines when designing exercise programme/s',* which condenses meanings as this knowledge compounds further, adding to exercise physiology's principles of training *e.g. 'duration, frequency, specificity, intensity, progression, variation, muscular balance, ROM'.*

6.8 Semantic fields: Knowledge in the unit standards (module 2)

Before positioning the specific outcomes from the four unit standards below in relation to their semantic field, each specific outcome has been listed in figure 6.14 according to its relative strength of semantic density and semantic gravity. This shows how each specific outcome in each unit standard has been graded relative to its unique strength of semantic density and semantic gravity as well as according to the particular differentiated knowledge inferred in each one.

Each column in figure 6.13 has a heading indicating the unit standard it represents and each specific outcome is listed underneath its column heading in order of its relative strength of semantic density and semantic gravity, with SD+/SG+ at the top and SD-/SG- at the bottom of the table.

- Conduct a screening procedure = S
- Test and evaluate health-related fitness components = T
- Motivate and encourage participation in physical activity = M
- Design exercise programmes = D

SD+/ SG+	S	Quadrant	T	Quadrant	M	Quadrant	D	Quadrant	SD+/ SG+
	S/SO2	Q3							
↑							D/SO5	Q3	↑
							D/SO1/2/3/4	Q3	
			T/SO4	Q3					
			T/SO3	Q3					
			T/SO2	Q3					
			T/SO6	Q3					
			T/SO7	Q3					
	S/SO3	Q3	T/SO5	Q3	M/SO3	Q3			
					M/SO4	Q3			
					M/SO2	Q3			
					M/SO1	Q3			
					M/SO5	Q2			
			T/SO1	Q2					
↓			T/SO8	Q2					↓
	S/SO1	Q2							
	S/SO4	Q2							
SD-/ SG-									**SD-/ SG-**

Figure 6.14 Specific outcomes from unit standards 3 to 6

Each specific outcome is now positioned on the semantic plane in figure 6.15 according to its relative strength of semantic density and semantic gravity (as indicated in the table in figure 6.14). As with the unit standards for module 1 - although the specific outcomes are referenced in the semantic plane—their assessment criteria and essential knowledges are included in this diagram. The unit standards and their specific outcomes are depicted in figure 6.14 as follows:

- Conduct a screening procedure = S with Specific Outcomes = S1/ S2/ S3/ S4)
- Test and evaluate health-related fitness components = T with Specific Outcomes = T1/ T2/ T3/ T4/ T5/ T6/ T7/ T8
- Motivate and encourage participation in physical activity = M5 with Specific Outcomes = M1/ M2/ M3/ M4/ M5
- Design exercise programmes = D with Specific Outcomes = D1/ D2/ D3/ D4/ D5

This depiction of the different knowledge inferred in each specific outcome (according to relative strength of semantic density and semantic gravity) results in a spread between Q2 and Q3 on the semantic plane in figure 6.15, implying a range of knowledge from procedural to procedural conceptual knowledge. I discuss the implications in chapter 7. Nevertheless, it is apparent that when competencies are expressed in the form of unit standards, a range of competencies would, in all likelihood include basic practical outcomes e.g. ‘Manage data and record in order to provide support’ but this outcome may well be associated with another more complex one, such as ‘Design, monitor and adapt a range of exercise programmes to meet the needs of a client’ – each outcome is relevant for the needs of the whole unit standard.

This concludes the analysis of the unit standards achieved with module 2. I now finalise this analysis with the assessments for module 2.

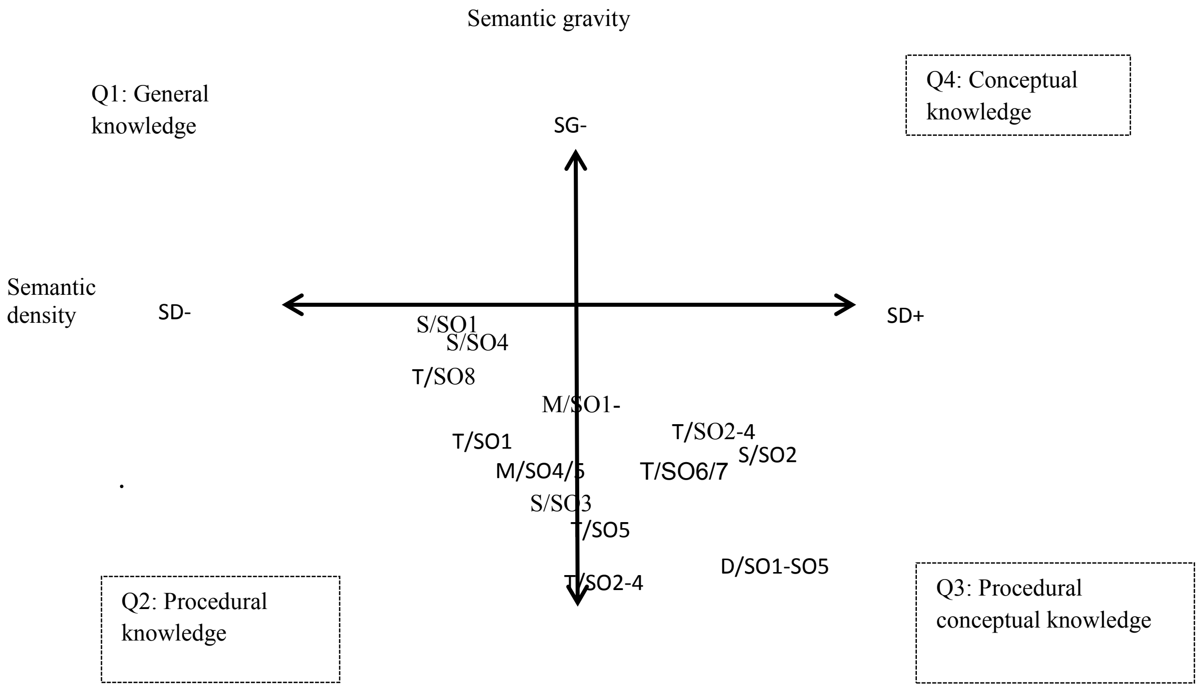

Figure 6.15 Types of knowledge in unit standard’s 3 to 6 and their specific outcomes

6.9 Assessment: Module 2 (Screening, Assessment and Programme Design)

The weighting for the tasks in module 2 is 15% for task 2A (question paper), 15% for task 2B (demonstration) and 20% for task 4C (practical project). Thus the conceptual knowledge in the question paper and the practical knowledge in the demonstration are each given equal weighting and the procedural conceptual knowledge of task 4C has a greater weighting.

6.9.1 Task 4A: Question paper screening (figure 6.16), Data: Appendix 2.12

Task 4A is a one-hour question paper containing 7 long answer questions (Q) about screening. At the base of the table in figure 6.16, question 4 denotes weaker semantic gravity relative to the questions above. While confidentiality relates to clients' records, this is a transferable skill that is not dependent on the environment of fitness practice. Moving up the table in figure 6.16, question 1 infers more in conceptual knowledge relating to risk screening (*benefits of screening prior to exercise*) and question 2 adds knowledge from pathology, enabling the ability to identify contraindications for exercise and determine risk prior to exercise. The other three points in question 2 include knowledge from exercise physiology plus pathology. This includes precautions relating to exercise and chronic diseases such as asthma, coronary artery disease or high blood pressure.

The other four questions in task 4A (questions 3, 5, 6 and 7) are case-based scenarios which call for the application of conceptual knowledge to determine and stratify risks. To understand *why* coronary artery disease or high blood pressure are risk factors for exercise requires knowledge from physiology, anatomy and exercise physiology in order to comprehend how the body functions at rest and during activity. Knowledge from pathology is added, enabling the ability to determine risks relative to age, blood pressure (BP) and heart rate, and then make decisions about exercise readiness, to advise on lifestyle changes or indicate reasons for medical referral. These questions all indicate semantic density strengthening when disciplinary knowledge is added to increase concept complexity.

Semantic density	Screening	Semantic gravity
SD+	**Task 4A: Question Paper**	**SG+**
↑	**Q 7**. Henry, a 40-year-old male, has a high-stress job as CEO of Engen. His brother died from a heart attack at age 37 and Henry has noticed lately that he struggles with unusual fatigue and shortness of breath with usual movements. Please answer the following questions based on the above case study. a) What is the risk stratification (level) of this client? b) What exercise would you prescribe for Henry and explain your answer.	↑
	Q 6. Glenda, a 23-year-old female, has not been participating in any sport since age 8, but she walks her dog four times a week for 30 minutes. She quit smoking two weeks ago and her cholesterol levels are elevated (5.9mmol/L). She is considering commencing a regular training programme with you. Please answer the following questions based on the above case study. a) What is the risk stratification (level) of this client and explain your answer by making reference to CAD risk factors b) What will your first steps be with this client?	
	Q 5. Claire, a 33-year-old female, participated in several sporting codes at school and since then has been jogging on an ad hoc basis. She has been smoking since 20 years of age. After attending a wellness talk, she decided to commence a regular training programme with you. You have not yet met her, but her physician has cleared her for exercise in the meantime. Please answer the following questions based on the above case study. a) What is the risk stratification (level) of this client and explain your answer by making reference to CAD risk factors b) What will your first steps be with this client?	
	Q3. John, a 50-year-old male, suffers from Hypertension stage 1 and is currently on medication. He has a stressful job and has been advised by his friend to seek you, the trainer, to assist him to commence a training programme. There are no other risk factors present. Please answer the following questions based on the above case study. a) What is the risk stratification (level) of this client and explain your answer by making reference to CAD risk factors. b) What will your next step be with this client?	
↓	**Q2**. Define the following: a) Contraindication (2) b) Risk stratification (1) c) Asthma (1) d) Coronary Artery Disease (1) e) Blood pressure (1)	↓
	Q1. List five benefits and points of importance of screening.	
	Q4. List five guidelines you can follow to maintain confidentiality of your client's records once you have obtained all the data from screening your client.	
SG-		SG-

Figure 6.16 Task 4A: Strength of semantic density and semantic gravity

Except for question 4, most of the questions in this task relate to the environment of exercise, thus, semantic gravity strengthens, particularly with questions 3, 5, 6 and 7. But question 4 and question 1 weaken in semantic gravity because this knowledge can apply in other scenarios. For example, a doctor, dentist or psychologist would screen their patient. Semantic gravity is stronger with question 2 but the context may not entirely relate to fitness; this knowledge could also apply in medical practice. However, point (a) in question 2 relates to contraindications for exercise and point (b) relates to stratifying risks for exercise participation. Thus, semantic gravity strengthens as well. Finally, because questions 3, 5, 6 and 7 - risk screening for the exercise environment – relate to knowledge that is closest to fitness practice relative to the questions 1, 2 and 4, semantic gravity strengthens most.

6.9.2 Task 4B: Demonstration (Assessment and Fitness Testing); Data: Appendix 2.13

This practical demonstration and oral assessment requires students to evidence their ability to carry out anthropometry measurements as well as various fitness tests. The assessment requires practical demonstrations but includes oral questions on testing methodologies and protocols. Demonstrations include taking blood pressure, body composition measurements (skin-folds and girth measurements), as well as fitness tests for endurance, strength endurance and flexibility. The full data for this task can be found in Appendix 2; Part 2.13, but the list below indicating the components of the oral and demonstration, shows that three of the five elements relate to knowledge dependent on the context of fitness practice:

1. Blood pressure or how to take blood pressure
2. Body composition measurements and anthropometry (skin-folds and girth measurements)
3. Fitness testing of aerobic fitness a) step testing, b) oral on different endurance tests
4. Tests for strength endurance
5. Tests for flexibility

Point 1 relates to practical knowledge, which can apply in other contexts e.g. medical practice. Taking body measurements in point 2 is a skill that also applies in other practices, even dress making, although the rest of the text in point 2 requires the ability to take skin-fold measurement and determine ratio of fat mass to lean body mass. This is an assessment used in the context of fitness or sport performance, which is relevant because the ratio of lean body mass to fat mass is a measure of physical performance. Points 3, 4 and 5 are demonstrations of health-related fitness tests, the knowledge of which informs current fitness levels, providing information about the relevant exercises for participants' needs, based on current fitness levels.

The five components of this task (points 1 to 5 above) and their memo indicate weak semantic density. With the first task in the demonstration - how to take blood pressure - points 1 and 2 below (from the memo) are clearly procedural. Point 3 asks for *understanding of the systolic reading*, but the memo points to 'hearing the beat' and 'seeing the needle flicker' - both sensory factors but not necessarily cognitive. Point 4 shows the same, thus, task 1 in this assessment expresses weak semantic density and weak semantic gravity relative to the other components in the demonstration.

Student shows ability to take blood pressure; these points should be evident:

1. Apply cuff correctly.
2. Show control when releasing the air out.
3. Understands how to read the systolic reading (on first audible heart beat / needle flicker).
4. Understands how to read the diastolic reading (as the consistent heart beat pattern softens or fades).

The rest of the data reveals a similar emphasis on procedure but adds the psychosocial skills of client care; for example, task 2, point 1 (*Student shows client sensitivity in their approach when taking measurements).* Thus, this practical demonstration emphasises procedural knowledge that may not necessarily be informed by conceptual knowledge. Thus, semantic density is weak throughout the task but strong in semantic gravity with its relatedness to fitness practice.

Student asked to take a skin-fold and girth measurement:

1. Student shows client sensitivity in their approach when taking measurements.
2. Site of taking the skin-fold is determined correctly.
3. Student uses the calliper correctly i.e. not at an angle with tricep site, but parallel to the floor.
4. Site of girth measurement and tape tightness is correct.

6.9.3 Task 4C: Practical project (Screening, Assessment and Programme Design) (Figure 6.17); Data: Appendix 2.14

This practical project requires students to train a client over a period of at least 6-weeks. The task's evidence demonstrates the knowledge and skills required to design and implement an exercise programme for a client. Students are required to interview the client, conduct risk screening and health assessment, and to complete the relevant testing and legal forms provided, using these tools to gather the relevant data and then write a report on the outcomes. The project includes an assessment for posture and body composition, plus fitness tests for endurance, strength and flexibility, followed by goal setting. After 6-weeks, there will be a follow-up screening and assessment process. The exercise programme must be linked to the outcomes of the screening, assessment and fitness test.

Assessors are informed in the memo that if students overlook any of the following points in the initial screening of a client, the project must be returned as '*not achieving* *criteria'*. These points below are strong indicators as to what knowledge is legitimated in this task:

1. Risks must be noted to ensure good understanding of this risk screening process and why referral is important in the event of risk.
2. Referral must be given in the event of risks; if this is not done, the student's evidence indicates poor understanding of risk screening.
3. Waivers and indemnities are important; forms must be completed and signed by the client
4. Tests must be appropriate for the level of fitness of the client and their fitness goal e.g. if the client is very unfit, a walk or step test is more appropriate than a run test.
5. Planning and goal setting are essential elements of both motivating and designing programmes; therefore this must be included.

The requirements are under each task sub-heading in the table in figure 6.17 but these points mean little without the memo, where more meanings are inferred. Appendix 2, part 2.14 provides the full data with the task requirements and the memo but examples are provided in the analysis that follows.

At the base of the table in figure 6.17, under the first heading for *Motivation and Communication*, Point 4 (*managed data)* and point 5 (*self-reflection)* each show weaker semantic gravity, as data management applies in different contexts, as does the ability to self-reflect. Semantic density is weaker with basic concepts in the ability to manage data. Self-reflection is a relevant skill for self-improvement but does not require the conceptual knowledge depicted in phrases under the heading *Exercise Programme Design* (at the top of table 6.13), Point 1 - *Overall exercise design* - infers knowledge from anatomy, kinesiology, biomechanics and exercise physiology, with an inter-relationship of concepts from these disciplines, which enable this skill, and 2 *'Write out the detailed exercise programme for each modality following the plan you've designed'.* Semantic density becomes stronger in these phrases, with meanings compounding knowledge from the range of disciplines from exercise science.

Under the second heading in the table in figure 6.17 for *Motivation and Communication* (points 1, 2 and 3), semantic density is stronger, with the psycho-social skills of communication and goal setting as well as knowledge from psychology and sociology informing these capabilities. Semantic gravity weakens, however, because this knowledge can apply in other scenarios ranging from counselling to customer care in service-based industries. Semantic gravity strengthens as knowledge moves closer to the fitness context, under the second heading for *Assessment and Testing*, points 3 (*Body composition),* point 2 (*Assessment for posture and body alignment),* point 4 (*Cardio respiratory endurance tests)*, point 5 (*Muscular strength tests*) and point 6 *(Flexibility tests)*.

The memo checks for the ability to conduct the assessment, to evidence records of the data in the relevant form, to report on the findings and to suggest recommendations. With the body composition and postural assessment, evidence calls for conceptual knowledge from anatomy and kinesiology and procedural knowledge of the assessment protocols, enabling the ability to report on the findings and to make suggestions for remediation or improvement.

Semantic density becomes stronger - under the heading *Risk Screening*, point 3 (*determined their risk)* and point 4 *(provided referrals and referred - or said why referral was not necessary)* where knowledge from the exercise science module underpins the knowledge needed for *Risk Screening* (first subject in the second module, *Screening, Assessment and Programme Design)* so that relevant referral can be made if risks are too high. Point 1 (*overall exercise plan design*) and 2 (*detailed exercise programme for each* *modality following the plan you've designed*) also call for knowledge of anatomy, physics and physiology to inform the ability to design an exercise programme incorporating knowledge from exercise physiology, enabling relevant training methods and techniques to be included in the plan.

Semantic density	Screening	Semantic gravity
SD+	**Task 4 C: Practical Project**	**SG+**
	Exercise Programme Design **1.** Overall exercise-plan design. **2.** Write out the detailed exercise programme for each modality following the plan you've designed. a) Warm up b) b) Cool down c) Part A – Right level of exercise selection for right level of client (1 point each modality = 3), beginners. Part B – Sets, reps and weights for client level (intensity) (1 point each modality = 3). **3.** Programme meets needs and goals of client. **4.** 12 logged sessions.	
	Risk Screening **3.** Determine their risk. **4**. Provided referrals and referred (or said why referral was not necessary). **Assessment and Testing** **3**. Body composition (health component). **2**. Assessment for posture and body alignment. **4**. Cardio respiratory endurance tests. **5**. Muscular strength tests. **6.** Flexibility tests.	
	Motivation and Communication **3**. Communication and listening skills. **1**. Plans and Goal setting. **2**. Evaluated progress. **Risk Screening** **2**. Included signed waivers and indemnities. **1**. Completed Screening forms with data. **Assessment and Testing** **1**. Consent Form signed. **7**. Include information on your record keeping and data management. Note how the information is stored for confidentiality of records and how you systemised your storage. **Motivation and Communication** **4**. Managed data. **5.** Self-reflection.	
SG-		**SG-**

Figure 6.17 Task 4C: Strength of semantic density and semantic gravity

6.10 Semantic fields: Knowledge in the assessments (module 2)

The semantic plane in figure 6.18 demonstrates the type of knowledge and curriculum logic for tasks 4A, 4B and 4C, which are placed in their respective quadrants. Showing the greatest relative strength in semantic density and semantic gravity is task 4C - the long-term practical project. The level of concept-integration is higher in this task, as is the level of context-embedded knowledge associated with vocational practice.

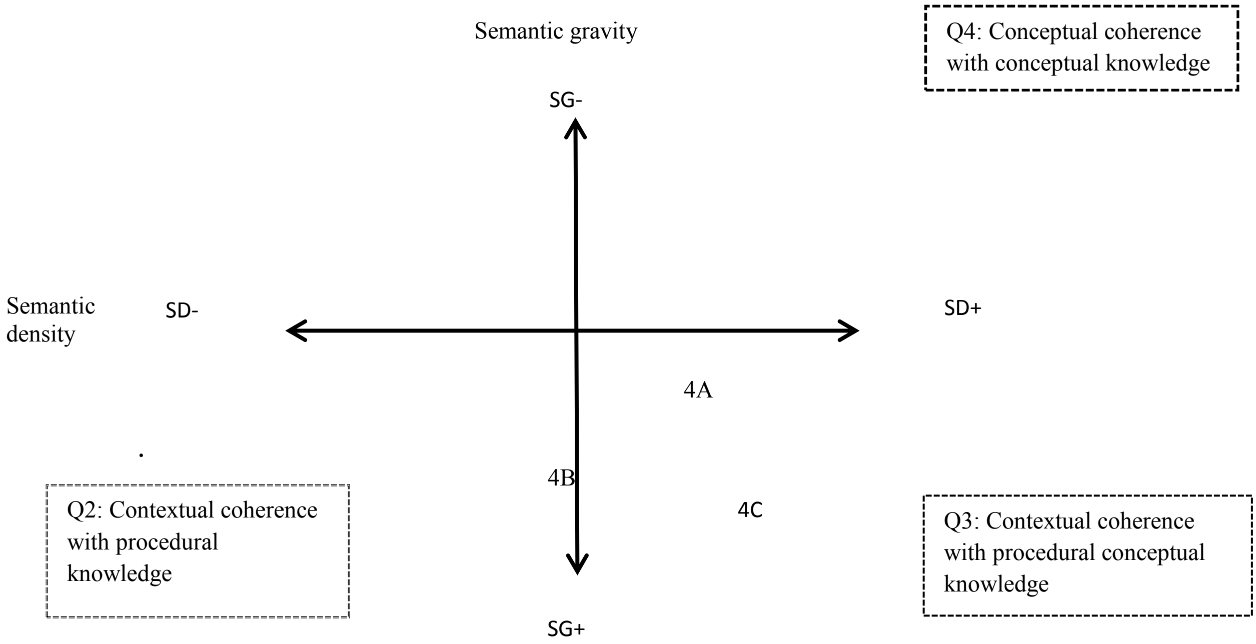

Figure 6.18 Types of knowledge and curriculum coherence in the tasks for module 2

Task 4B, however, assesses procedural knowledge, and as such is placed in quadrant 2. This is procedural knowledge which is informed by its organising principles. Thus, the task is placed between the extreme right of quadrant 2 and extreme left of quadrant 3, implying a relative level of theory, which informs the assessment procedure (Gamble J. , 2004). Task 4A, however, calls for the conceptual knowledge required for risk screening and determining exercise readiness, thus, knowledge is both conceptual and context-embedded. It is less applied than 4C, thus, it is placed higher in quadrant 3, closer to quadrant 4.

6.11 Summary: Module 2

This analysis of the assessment tasks for module 2 reveals differentiated knowledge, ranging from procedural knowledge to procedural conceptual knowledge that is embedded in vocational practice. It also shows a strong level of conceptual knowledge from the variety of disciplines that inform practice. These are disciplines that form the academic region of exercise science. It is the knowledge from this region that informs and underpins fitness practice. I explore the implications of this in the chapter 7.

Chapter 7

Findings

7.1 The qualification and the curriculum

This analysis began with an examination of six core unit standards which achieve seven of the nine exit level outcomes in the fitness qualification. These unit standards represent competence and articulate the knowledge and skills essential to vocational practice. The analysis went on to examine knowledge in the curriculum because it is the curriculum texts – specifically the assessments – which evaluate the knowledge that is required for the qualification's achievement.

The findings for each unit standard are described below in the same order of the preceding analysis for modules 1 and 2. Each unit standard is positioned within a quadrant of the semantic plane. They are represented in terms of their relative strength of semantic density (interpreted as a level of concept integration) and their relative strength of semantic gravity (interpreted as context-embedded knowledge). This is illustrated in Figure 7.1. To identify unit standards on the semantic plane, each unit standard is allocated a code based on the first letter of the subject in each title and a number representing its order in the analysis. Their codes are as follows:

1. Apply anatomical and biomechanical principles to physical activity = A1
2. Apply principles of sport and exercise physiology = P2
3. Conduct a screening procedure = S3
4. Test and evaluate health related fitness components = T4
5. Motivate and encourage participation in physical activity = M5
6. Design exercise programmes = D6

7.2 The unit standards

- With unit standard A1 (*Apply anatomical and biomechanical principles to physical activity)*, specific outcome 1 (*Describe anatomical structures and systems of the human*) is one of the four specific outcomes which infers weaker semantic density and semantic gravity. It conveys basic conceptual knowledge that is independent of exercise-based context. The remaining three specific outcomes all relate to the application of knowledge, thereby demonstrating stronger semantic gravity, but also conveying greater concept integration along with this context–based knowledge. However, while the knowledge in A1 applies to exercise, it has not yet been applied to practice.
  - With unit standard P2 (*Apply principles of sport and exercise physiology)*, fewer concepts are integrated from exercise science as compared to unit standards A1, S3, T4 and D6. Therefore, the semantic density is weaker than the other unit standards. Like A1, the knowledge is less context-embedded when the concepts are basic. However, as the knowledge becomes more applied, concept-integration increases. Two of the six specific outcomes reveal weaker semantic density and semantic gravity. They are specific outcome 1: *Describe the body systems and the physiological factors associated with them* and specific outcome 2: *Outline and analyse the effects of environmental and physical factors*. However, with the other four outcomes, semantic density and semantic gravity are stronger because more concepts from exercise science are applied. Relative to A1, S2, T4 and D6, semantic density is weaker in P2 because there is less concept integration in this unit standard.
  - Although the title of unit standard S3 (*Conduct a screening procedure)* implies the procedural knowledge evidenced in three of its four specific

outcomes, there is still greater concept integration with one specific outcome in S3. This is specific outcome 2: *Interpret data in order to make decisions for participation or for physical activity readiness and provide relevant feedback.* Therefore, semantic density is stronger than A1, P2, T4 and M5. Semantic gravity is stronger in S3 than in A1, P2, T4 and M5 because the knowledge is more embedded in fitness practice.

- With unit standard T4 (*Test and evaluate health related fitness components)*, semantic density is stronger than in A1 and P2 because concepts are better integrated from exercise science to enable fitness testing. Equally, semantic gravity is stronger because T4 infers context-embedded knowledge as applied in practice. Specific outcome 8: *Prepare participant and organize the testing session* and specific outcome 1: *Take measurements by using a variety of measuring methods, using accepted protocols)* are examples of procedural knowledge. The remaining specific outcomes relate to procedural conceptual knowledge, enabling the application of exercise science concepts within fitness testing.
- Unit standard M5 (*Motivate and encourage participation in physical activity)* emphasises the psycho-social knowledge needed to motivate clients. Three of the five specific outcomes represent context-embedded knowledge and two relate to skills that could apply in other contexts. With relatively weaker semantic density due to weaker concept integration, M5 is not as conceptually strong as the other five unit standards. The semantic gravity, however, is stronger than A1 and P2.
- Given the increased concept integration from module 1 (Exercise Science) and module 2 (Screening, Assessment and programme Design) as well as the

context-embedded knowledge in all of the specific outcomes (e.g. *Design a safe and effective cardio-respiratory exercise programme in a scientific and flexible manner, while meeting the individual needs, abilities and goals of the fitness participant/s*), D6 indicates relatively stronger semantic density and semantic gravity than all of the other five unit standards in the analysis.

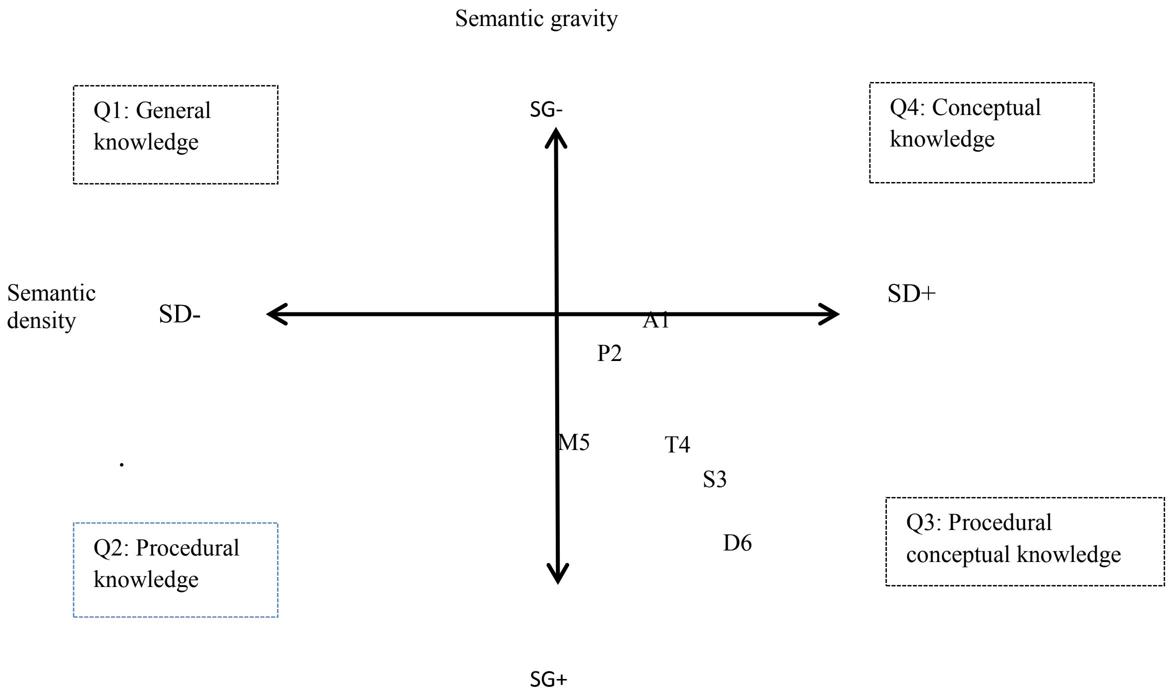

Figure 7.1 Unit standards and types of knowledge

The spread of the unit standards as illustrated in Figure 7.1 shows the range of procedural conceptual knowledge evidenced in these six unit standards. I turn now to the second phase of this study which analysed the curricula knowledge in the assessments for the two modules.

7.3 The assessments

The semantic plane in figure 7.2 demonstrates the range of different knowledge forms evidenced in the assessments for modules 1 and 2. The findings for each task are described below in the order of the analysis.

- Task 2A relates to basic concepts from one subject in exercise science and this theoretical knowledge that can apply in other contexts. Semantic density and semantic gravity are weaker in 2A relative to the other tasks.
- Task 2B integrates more concepts from exercise science than Task 2A. Therefore, it has stronger semantic density. Compared to 2A, semantic gravity in 2B is stronger due to its increased applied knowledge relating to exercise, although the applied knowledges does not necessarily relate to practice.
- Through increasing concept integration, Task 2C builds on the knowledge assessed in Task 2A, resulting in stronger semantic density. Knowledge also shifts closer to the exercise context, although not necessarily to practice. Task 2C is stronger in semantic density and semantic gravity than Task 2A and 2B.
- Task 2D builds on the concepts that are assessed in Task 2B and the knowledge conveyed by the task is applied in exercise-based contexts using the device of an imagined client. Given the stronger concept integration of Task 2D, compared to Task 2B, semantic density is stronger. Semantic gravity is also stronger because the knowledge conveyed relates explicitly to practice. Tasks 2D and 4A show a similar strength of semantic density and semantic gravity.
- Task 2E is the final assessment in module 1. It integrates concepts demonstrated in all of the tasks in module 1, resulting in stronger semantic density. Because Task

2E calls for applied knowledge, the semantic gravity is stronger. Task 2E shows the greatest relative strength of semantic density and semantic gravity for module.

- Task 4A from the second module conveys additional conceptual knowledge which is applied in problem-based scenarios, but is not directly applied to professional practice as is the case in Task 4C. The problem-based questions of 4A assume theoretical knowledge from module 1 thus additional concepts integrate to strengthen semantic density. Task 4A indicates stronger semantic density than 2E because of the greater range of concepts in its task. Compared to Tasks 2A, 2B, 2C, and 2D, semantic gravity is stronger in Task 4A. Task 4A is similar to task 2E in its strength of semantic gravity because of the context-embedded knowledge.
- Task 4B is weaker in semantic density than all of the other tasks because the task is clearly a demonstration of practical procedures of testing e.g. putting on the blood pressure cuff properly or positioning the skinfold calliper at the correct body site. The design and duration of the demonstration elicits little in the way of conceptual knowledge therefore it is difficult to determine if conceptual knowledge underpins the capabilities evaluated in the task. This task is a practical demonstration using role-play, and as a result, the semantic gravity is stronger than in the other tasks.
- Task 4C represents professional practice in its design and demonstrates relatively strong semantic density and semantic gravity because it integrates all of the exercise science concepts from modules one and two, by applying them in fitness practice.

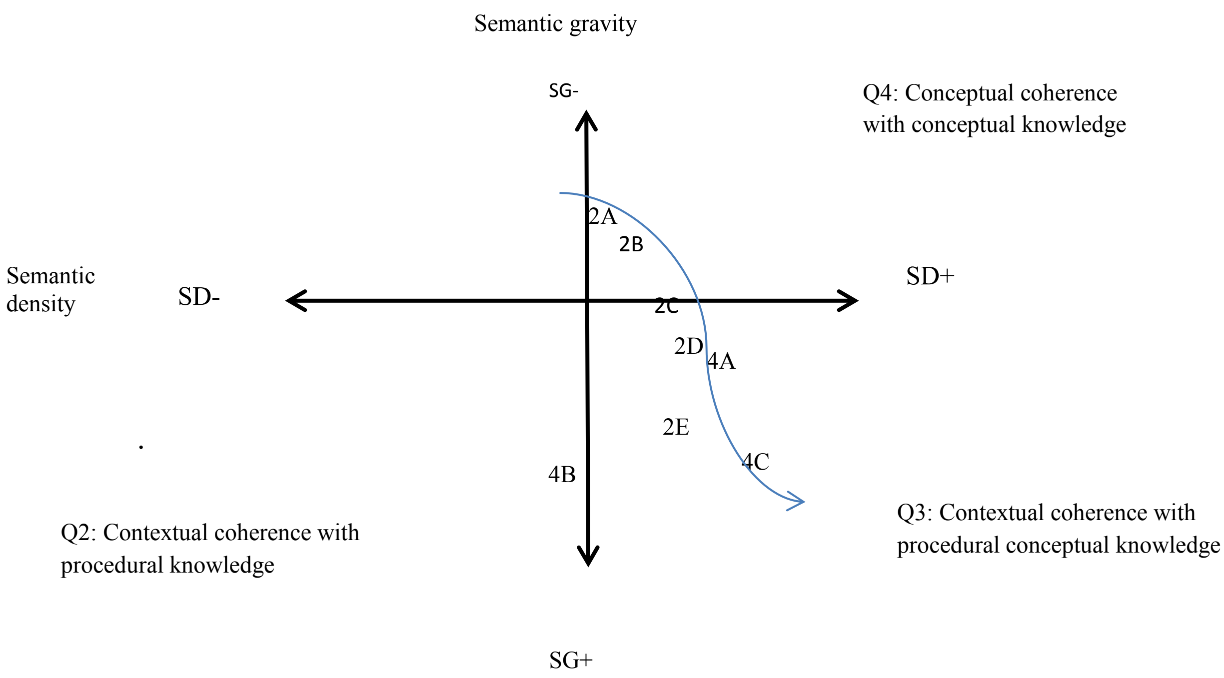

Figure 7.2 Assessments: Types of knowledge and curriculums coherence

7.4 Implications for knowledge and curriculum coherence

In my examination of the two unit standards achieved from module 1, it is clear that three of the seven specific outcomes represent conceptual knowledge and the remaining seven specific outcomes represent a range of procedural conceptual knowledge. Of the four unit standards in module 2, six specific outcomes represent a range of practical and principled procedural knowledge, depending on the simplicity of their procedures and the level of theory-informing procedures. Sixteen specific outcomes demonstrate a range of conceptual procedural knowledge for context-embedded practice (the semantic plane in Figure 6.3, Chapter 6 illustrates this).

Unit standards are defined as desired education and training outcomes and these standards are therefore concerned with competence-based education (South African Qualifications Authority, 1995). This study was stimulated by the perceived lack of conceptual knowledge within competence-based education that leads to unit-standards-based qualifications. To allay the concerns of educational sociologists, a curriculum for vocational education needs to provide the conceptual knowledge to inform vocational practice and assure concept-based competence. When comparing the unit standards to the assessments, we see that there are some specific outcomes in each unit standard which infer conceptual knowledge, while others are clearly indicative of procedural knowledge. However, most specific outcomes demonstrate a range of procedural conceptual knowledge. Conceptually informed practice is demonstrated in the strength of semantic density in the unit standards, explained as concept integration. The strength of semantic gravity is demonstrated as context-embedded knowledge.

Similar to unit-standards, this contextually coherent curriculum indicates that the assessments mostly contain procedural conceptual knowledge. However, compared to the segmental nature of unit standards, the tasks evidence a sequential range of knowledge forms, from basic theoretical knowledge to complex procedural conceptual knowledge. There is evidence of concept-building in the curriculum, from Task 2A in module 1 (which calls for basic conceptual knowledge of one subject) to Task 4C in module 2 (which is an example of procedural conceptual knowledge which integrates a range of concepts applied to practice). However, one practical task in module 2 (4B) demonstrates weaker semantic density. However, the skill of the fitness testing should ideally be practical knowledge that is informed by exercise science. Consistent and repeatable principles inform testing procedures and ensure the validity of such tests. In addition, these principles should be informed by theories which enable the practitioner to form judgements about the outcomes of such tests. Thus, while task 4B may be procedural knowledge, and the skill is assessed through observation, the conceptual knowledge that underpins this task is also assessed in task 4C where conceptual knowledge that underpins fitness testing enables the practitioner to provide advice on the testing outcomes.

The qualification represents competence; the achievement of the desired knowledge and skills for practice, and this analysis revealed the knowledge and skills that constitute the qualification's required competencies. It also revealed a range of differentiated knowledge in the qualification, including conceptual knowledge, procedural knowledge and mostly procedural conceptual knowledge where theories of exercise science inform fitness practice. A similar range of differentiated knowledge is shown in the curriculum, where knowledge-building can be seen in the design of the assessment tasks. Concepts build and integrate as the tasks progress from simple and theoretical to more complex concepts that are applied to fitness practice.

According to Muller (2009) contextually coherent curricula are "segmentally connected, where each segment is adequate to a context, sufficient to a purpose" (Muller, 2009, p. 216). Certainly this analysis supports this claim because each unit standard is constituted by its selection and its relevance for the qualification. Muller also asserts that the more segmental the curriculum, the less sequencing matters (Muller, 2009). However, in the fitness curriculum there is a logical sequence to learning and assessment, despite the apparent segmental nature of the modules. While unit standards are arbitrarily listed in a qualification it is up to curriculum designers to ensure coherence in the way they select and cluster them into modules. It would appear that this curriculum shows logical sequencing, because insight into anatomy and physiology precede screening, assessment and programme design. It's also important to note that complex and applied assessments are preceded by basic theoretical assessments.

Exercise Science is an inter-disciplinary region which is hierarchical in its knowledge structure. Therefore, it is likely that its hierarchical nature underpins this curriculum and possibly influences the logic of its sequencing even though disciplinary logic is not necessarily reflected in curriculum (Bernstein, 1999). Another possibility could be that the principles of curriculum alignment influence its logic because quality assurance requires that curricula align to unit standards and their qualifications' outcomes. It is equally important to consider that a competent practitioner needs the conceptual knowledge that underpins fitness practice. It is therefore logical to build conceptual knowledge before applying it to vocational practice.

This analysis explores a range of concepts from exercise science that can be integrated into vocational fitness-based practice. It has also discussed the logic that underpins the curriculum, confirming Muller's (2009) assertion about curriculum coherence. However, with Legitimation Code Theory (Semantics), there is an opportunity to expand on Muller's theory. Figure 7.2, Quadrant 2 shows how basic procedural knowledge is served by a contextually coherent curriculum. This same curriculum logic serves theoretically-based procedural conceptual knowledge in Quadrant 3. However, with Legitimation Code Theory (Semantics), it is possible to differentiate the knowledge between the two ends of the continuum even further.

Chapter 8

Conclusion

While acknowledging that there are particular socio-epistemic factors of vocational education, this study focused on epistemic questions; the main concern being epistemic access and the claims that competency-based, vocational education limits such access to knowledge. The problem relating to the perceived dearth of knowledge in vocational qualifications motivated this exploration of knowledge and how it is differentiated in vocational curricula.

A factor that is said to contribute to epistemic access is concept-building and the capacity for cumulative learning that it engenders (Maton, 2014, Muller, 2009, Young, 2008, Wheelahan, 2007). But competence-based education, with its emphasis on outcomes is said to restrict cumulative learning because it ties learners to their vocational context. However, this analysis shows that it is possible for vocational programmes to provide the concept-building needed for epistemic access. It also shows that with a contextually-coherent curriculum, informed by professional requirements, cumulative knowledge-building is possible, despite the segmental nature of the qualification it serves.

To advance Bernstein's (1999) theories which define knowledge discourses and their distinctly different knowledge structures, this study elaborates on knowledge within vocational curriculum structures. Calling on Bernstein's (2000) pedagogic device which defines the differences between the fields of knowledge production, recontextualisation and pedagogic practice, this study explored knowledge in the field of recontextualisation of the pedagogic device (Bernstein, 2000). The analysis reveals that within this field of recontextualisation, knowledge can be finely differentiated along a nuanced continuum as opposed to a distinct binary. And, while inspired by Muller's (2009) concerns about weak conceptual knowledge in curriculum for fourth generation professions this study shows that certain vocational qualifications are able to provide for conceptually informed curriculum. This study also supports Muller's (2009) curriculum coherence model and its potential for a range of curricula logic by showing that contextual coherence is best depicted on a continuum between practical curricula and conceptually-based curricula.

According to Shay et al (2011) it may be useful to differentiate between vocational, professional and general-formative programmes. I posit that it would also be useful to differentiate between occupational, vocational and professional programmes to refine our understanding of the unique knowledge differentiation within each type of programme. Unless we can identify the unique knowledge within each of these curricula, it will be difficult to determine whether epistemic access is possible within or across the educational sub-frameworks.

While the outcomes of this study indicate that concept-building in vocational education is possible, it does not necessarily imply that all curricula are designed with the same concern for knowledge. Even though programme accreditation regulates that knowledge and skills in a qualification must be included in a curriculum, it remains up to curriculum designers to interpret qualifications accurately and to ensure that the knowledge is re-contextualised in such a way that intended knowledge is achieved. Equally, when teaching such curriculum, concept-building is the hands of educators who could choose to focus on the practical demonstration of competence instead of ensuring that practice is informed by the under-pinning concepts which bring about knowledge-building.

Finally, most of the previous studies on vocational curricula have focussed on analysing competence-based education and training in the workplace. This study, however interrogated a vocational curriculum within a traditional higher education structure. LCT was the instrument of analysis which enabled a process that provided greater insight into the nuanced type of knowledge that vocational curricula can deliver. Thus, I encourage more empirical studies to use LCT as an analysis instrument because it enables educational sociology to examine its own field using the kind of empirical tool that Bernstein claimed his disciplinary field lacked (2000).

If post-school learners are to be assisted along the epistemic path said to give them social mobility, there is much more to be discovered about knowledge. Educational sociology is the field of study that produces knowledge about its own discipline, thus our own studies with their unique empirical instruments should help to provide insights into knowledge and how it is that powerful knowledge can be achieved.

Notes

[1] A small example of the Acts, Regulations and Communiques and to provide an indication of the range and scope of the change: DHET, South African Qualifications Authority Act, 1995, DHET, Higher Education Act, 1997, DoL, 1998, DHET, Education Change and Transformation in South Africa: A Review 1994-2001, 2001, DHET, The Higher Educations Qualifications Framework, Higher Education Act 101 of 1997, 2007, DHET, Joint communiqué on the implementation of the Higher Education Qualifications, 2008.

[2] Unit-standards-based qualifications are a legacy of the Department of Labour's National Skills Act. Unlike CHE accredited qualifications designed by public universities or accredited colleges and registered to their university or college, unit-standards-based qualifications are designed by a Standards Generating Body (SGB). These qualifications and their programmes are quality assured by their SETA (mandated by the Quality Council for Trade and Occupations). Any accredited institution can apply to a SETA for programme approval to offer a unit-standards-based qualification. The National Certificate and National Diploma in Fitness are now defined as occupational qualifications (as opposed to higher education qualifications). They were originally registered on the NQF as higher education qualifications.

Over the next three-years all SETA accredited qualifications will migrate to the Occupational Qualifications Sub-Framework (OQSF). Providers who wish to retain their CHE accreditation now have to align their old Certificates to Higher Certificates. If they meet the CHE programme criteria for these vocational Higher Certificates, they will be accredited. The old National Certificates at level 5 are being de-registered from the HEQSF and being re-registered on the OQSF. Vocationally based diplomas under the CHE are now 360-credit diplomas, registered at level six.

---

[3] Standards Generating Bodies (SGBs) were substructures of SAQA. Originally SGBs were an assembly of stakeholder representatives deemed to have the requisite expertise to develop national qualifications. In terms of the new NQF Act the responsibility for the generation of qualifications will be the responsibility of each Quality Council who will decide how best to utilise the knowledge and experience of various experts. According to SAQA, the new landscape will be characterised by Communities of Expert Practitioners (CEPs), enabling new communities of practice to be convened for the different sectors (South African Qualifications Authority, 2013)

[4] Curriculum autonomy is likely to be reduced with the introduction of the OQSF where its quality council, the QCTO will determine the nature of training programmes and their content (QCTO workshop, October 2013).

[5] The SAQA handbook, 'The NQF Implementation Framework 2011-2015' provides an account of the intended changes in the NQF and the role players responsible for the changes, namely: the Department of Higher Education and Training (DHET), the South African Qualifications Authority (SAQA) and the three Quality Councils (QCs) namely, the Council on Higher Education (CHE), the Council for Quality Assurance in General and Further Education and Training (Umalusi) and the Quality Council for Trades and Occupations (QCTO).

[6] The curriculum for the NC Fitness is now being re-designed in anticipation of the changing demands of the HEQSF. New programmes under the CHE must be re-aligned to the HEQSF by providers and the old National Certificates are re-named Higher Certificates. Old qualifications registered to SETAS will be de-registered from the HEQSF and may be re-registered to the OQSF. New occupational certificates (OC) will be designed by Communities of Expert Practitioners (CEPs), replacing the old SGBs.

[7] Examples of Institutions serving the fitness profession include; the American College of Sports Medicine whose norms and standards inform most risk screening and fitness testing practice (pre-participation requirements for exercise), the National Strength and Conditioning Association (NSCA), the YMCA who have also developed norms and standards for exercise science and exercise testing from their research, the American Council on Exercise (ACE) - an examination and certification body in the USA, the Australian Institute of Sport, the Sports Science Institute of South Africa.

[8] Representing differentiated knowledge, each phrase is positioned on the semantic plane in terms of its strength or weakness of SD or SG *relative to each other* as opposed to relative to a base line or a normative measure (Maton, 2000). Therefore, based on relative strength or weakness of SD or SG, knowledge shifts along a continuum, thus each phrase is positioned accordingly on the semantic plane. According to Maton (2011), it is movements "up and down semantic continua' that contribute to knowledge-building (Maton, 2011, p. 66).

REFERENCES

American College of Sports Medicine. (2012, May 12). *About ACSM: who we are*. Retrieved from American College of Sports Medicine: http://www.acsm.org/

Barnett, M. (2006). Vocational Knowledge and vocational pedagogy. In M. Young, & Gamble, J., *Knowledge, curriculum and qualifications for South African further education* (pp. 143-157). Pretoria: Human Resources Research Council Press.

Beck, J. (2013). Powerful knowledge, esoteric knowledge, curriculum knowledge. *Cambridge Journal of Education, Vol. 43, No. 2.*, 177-193.

Bernstein, B. (1999). Vertical and horizontal discourse. *British Journal of Sociology of Education*, 157-173.

Bernstein, B. (2000). Research and Languages of Description. In B. Bernstein, *Pedagogy, Symbolic Control and Identity: Theory, Research, Critique (Revised ed.)* (pp. 62-84). Lanham: Rowman & Littlefield Publishers, Inc.

Bernstein, B. (2000). The Pedagogic Device. In B. Bernstein, *Pedagogy, Symbolic control and Identity: Theory, Research, Critique (Revised ed.)* (pp. 25-39). Lanham: Rowman & Littlefield Publishers, Inc.

Biggs, J. (2002). Aligning the curriculum to promote good learning. *Learning & Teaching Support Network*, 1-7.

Cooper, K. (1968). *Aerobics.* New York: Bantam.

Council on Hgher Education. (2011). *Work Integrated Learning: Good Practice Guide.* Pretoria: Council on Hgher Education.

Culture, Arts, Tourism, Hospitality, Sports SETA. (2003). *Programme Evaluation Report.* Johannesburg: Culture, Arts, Tourism, Hospitality & Sports Education & Training Authority.

Department of Higher Education & Training. (1997, August). Higher Education Act: Minimum Admission Requirements. *Government Gazette*. Pretoria, Gauteng, South Africa: Department of Higher Education & Training.

Department of Higher Education & Training. (2007). *The Higher Educations Qualifications Framework, Higher Education Act 101 of 1997.* Pretoria: Department of Higher Education & Training.

Department of Higher Education & Training. (2013). *White Paper for Post-School Education and Training.* Pretoria: Department of Higher Education & Training.

Department of Higher Education and Training. (2007, October 5). The Higher Education Qualifications Framework. *HIGHER EDUCATION ACT, 1997 (Act No. 101 of 1997)*. Pretoria, Gauteng, South Africa: Department of Higher Education and Training.

Exercise Science and Sports Medicine. (2012, May 12). *Home page: About ESSM*. Retrieved from Exercise Science and Sports Medicine: http://www.essm.uct.ac.za/about_essm.htm

Fonda, J. (2005). *My life so far.* New York: Ebury Press.

Gamble, J. (2004). Retrieving the general from the particular: The structure of craft knowldge. In J. Muller, B. Davies, & A. M. (Eds), *Reading Bernstein: Researching Bernstein* (pp. 189-203). London: Routledge and Farmer.

Gamble, J. (2009). *The relation between knowledge and practice.* Cape Town: University of Cape Town.

Grubb, W. N. (2006). Vocationalism and the differentiation of tertiary eduction: lessons from US community colleges. *Journal of Further and Higher Education, Vol. 30, No. 1*, 27-42.

Hordern, J. (2014). How is vocational knowledge recontextualised? *Journal of Vocational Education and Traininig*, 22-38.

Lloyd, C. (2008). Recruiting for Fitness: qualifications and the challenges of an employer-led system. *Journal of Education and Work, Vol. 21, No. 3.*, 173-195.

Maguire, J. S. (2001). Fit and Flexible: The Fitness Industry, Personal Trainers and Emotional Service Labour. *Sociology of Sport Journal, Vol. 18*, 379 - 402.

Maton, K. (2000). Languages of Legitimation: the structuring significance for intellectual fields of strategic knowledge claims. *British Journal of Sociology of Education, Vol. 21, No. 2*, 147-167.

Maton, K. (2009). Cumulative and segmented learning: exploring the role of curriculum structures in knowledge-building. *British Journal of Sociology of Education, 30(1)*, 43-57.

Maton, K. (2011). Theories and things: the semantics of disciplinarity. In F. Christie, & K. Maton, *Disciplinarity: Functional linguistic and sociological perspectives* (pp. 62-84). London: Continuum Intl. Pub. Group.

Maton, K. (2014). Semantic density: How to build cumulative knowledge in social science. In K. Maton, *Knowledge and knowers: towards a realist sociloogy of education* (pp. 125-147). Abingdon, Oxon: Routledge.

Maton, K. (2014). Semantic Gravity: cumulative learning in professional learning and school English. In K. Maton, *Knowledge and knowers: towards a realist sociology of education* (pp. 106-124). London: Routledge.

Maton, K., & Moore, R. (2010). Coalitions of the Mind. In K. Maton, & R. Moore, *Social Realism, Knowledge and the Sociology of Education* (pp. 1-13). London: Continuum Intl. Pub. Group.

Maxwell, J. (2008). Designing a Qualitative Study. In L. Brickman, & D. J. Rog, *The Sage handbook of applied social research methods* (pp. 214-253). London: Sage.

Morris, J. N., Heady, J. A., Raffle, M. D., Roberts, C. J., & Parks, J. W. (1953). Coronary heart-disease and physical activity of work. *The Lancet*, 1053-1057.

Muller, J. (2008). *In search of coherance: A conceptual guide to curriculum planning for comprehensive universities. Report for the Santed Project.* Parktown: Centre for Education Policy Development.

Muller, J. (2009). Forms of knowledge and curriculum coherence. *Journal of Education and Work 22(3)*, 205-226.

Muller, J., & Young, M. (2013). Discipline, skills and the university. *Higher Education*, 127-140.

Noakes, T. (2003). *Lore of Running, 4th ed.* Oxford: Oxford University Press.

Paffenbarger, R. N., Blair, S. N., & Lee, I. M. (2001). A history of physical activity, cardiovascular health, and longevity: the scientific contributions of Jeremy N. Morris, DSc, DPH, FRCP. *International Journal of Epidemiology, Vol.30*, 1198-206.

Paffenbarger, R. S., Hyde, R. T., Wing, A. L., & Hsieh, C. (1986). Physical activity, all-cause mortality, and longevity of college alumni. *New England Journal of Medicine*, 314-605.

Quality Council for Trade and Occupations. (2013). *Occupational Qualifications Sub-Framework (OQSF) Policy.* Pretoria: Quality Council for Trade and Occupations.

Shay, S. (2013). Conceptualizing curriculum differentiation in higher education: a sociology point of view. *British Journal of Sociology of Education*, 1-20.

Shay, S., Oosthuizen, M., Paxton, P., & Van der Merwe, R. (2011). Towards a Principled Basis for Curriculum Differentiation: Lessons from a comprehensive university. In E. M. Bitzer, & M. E. Botha, *Curriculum inquiry in South African higher education - some scholarly affirmations and challenges* (pp. 101-119). Stellenbosch: SunMEDIA.

Shon, D. A. (2007). *Educating the Reflective practitioner: Toward a New Design for Teaching and learning in th Professions.* San Francisco: Jossey-Bass Inc.

South African Qualifications Authority. (1995, October 4). South African Qualifications Authority Act. *South African Qualifications Authority Act*. Pretoria, Gauteng, South Africa: Department of Education and Training.

South African Qualifications Authority. (1995, October 4). South African Qualifications Authority Act. *South African Qualifications Authority Act*. Pretoria, South Africa: Department of Education and Training.

South African Qualifications Authority. (2007). *SAQA Refined Level Descriptors.* Pretoria: South African Qualifications Authority.

South African Qualifications Authority. (2010). *The NQF Implementation Framework 2011-2015.* Pretoria: South African Qualifications Authority.

South African Qualifications Authority. (2013, April 14). *Frequently Asked Questions*. Retrieved from www.saqa.org.za: http://www.saqa.org.za/show.asp?id=909#landscape

Travis, J. (1975). *Wellness Inventory.* San Francisco: Wellness Association.

Travis, J., & Ryan, R. (2004). *Wellness Workbook: How to Achieve enduring Health and Vitality.* San Francisco: Ten Speed Press.

van Oers, B. (1998). The Fallacy of Decontextualisation. *Mind, culture and Activity, Vol 5, (2)*, 135-142.

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)*, 637-651.

Young, M. (2008). From constructivism to realism in the sociology of the curriculum. *Review of Research in Education*, 1-28.

Young, M., & Gamble, J. (2006). Introduction: Setting a context for debates about the senior secondary curriculum. In M. Young, *Knowledge, Curriculum and Qualifications for South African Further Education* (pp. 1-15). Cape Town: HSRC.