An Analysis of Curriculum Knowledge in an Introductory Actuarial Science Course

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COMPULSORY DECLARATION

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

Signature:  Date: 23 November 2015

Acknowledgements and Dedication

Acknowledgements

I would like to acknowledge with gratitude the willingness and enthusiasm of the Course Convenor in participating in this research project. I would also like to thank my supervisor for her wisdom and expertise, her constant encouragement and invaluable feedback.

I would to thank all SAADP students past and present for the privilege of working with them, but in particular Rinaye and Tsakane for their excellent tutoring and perennial support since I embarked on the project.

Dedication

This research study is committed to all those of historic disadvantage who wish to pursue actuarial science in South Africa, as well as all those who are committed to making it happen.

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Abstract

Actuarial Science is a sought after profession in South Africa with high attrition rates at university. The profession is small and dominated by white males. Slow transformation of the profession to reflect a more representative sample of the population is exacerbated by the long route to qualification.

This study is an analysis of the first module of the redesigned course reader for the course 'Introduction to Actuarial Science' at the University Cape Town. It was prompted by the change in student engagement with and sentiment about the course in 2013. Data is concurrently analysed from two interviews with the course convenor exploring (a) the nature and description of the profession as well as what knowledge is valued in the field of practice and the discipline and (b) the reasons for the redesign of the course reader and the process itself. The first module of the course reader is analysed in tandem with the second interview data.

The research aims to reveal the complexity of the knowledge of actuarial science which makes mastery of its content, methods and ways of thinking (summed up in the term *epistemic access*) challenging. Thus careful curriculum design is important in orientating first year students to the discipline and profession. Educational theorists from the school of social realism provide conceptual frameworks through which one can identify knowledge structures and elements thereof in data.

Basil Bernstein's *Pedagogic Device* is used in locating the course reader data in the *field of recontextualisation*, relying on *recontextualising rules* which 'regulate the formation of specific pedagogic discourse' (Bernstein, 2000, p.28) to examine the ways in which access to the discipline is facilitated in the course reader. In addition, Bernstein's pedagogic codes analysed by means of his concepts *classification* and *framing* are employed to analyse (a) the nature and description of the profession and (b) the knowledge valued in the discipline and in the field of practice. Karl Maton's *Legitimation Code Theory* and in particular the identification of *specialisation codes* on the basis of *epistemic* and *social relations* affords the potential of understanding the key principles by which this knowledge form is legitimated. The writings of Young (2008) and Muller (2009 and Young and Muller (2014) assist in delineating a few crucial issues on professional knowledge and the curriculum.

This project seeks to analyse the curriculum knowledge and the pedagogic codes employed in the course reader of a newly designed introductory course to ascertain the nature of actuarial science and to suggest what forms of pedagogy might enable students to access that knowledge. Regarding the nature of actuarial science, the study found that it is a complex region that combines highly specialized techno-theoretical knowledge with specific forms of inferential reasoning and professional judgment required to address knotty problems in the business world. Regarding an effective pedagogy, the analysis of

the course reader provides clues as to what an explicit, visible pedagogic discourse capable of providing access to this complex field to first generation students might entail.

Keywords: actuarial science, profession, curriculum knowledge, epistemic access

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Abbreviations and Acronyms

ASABA	**Association of South African Black Actuaries**
ASSA	**Actuarial Society of South Africa**
CC	**course convenor**
CR	**course Reader**
ID	**instructional discourse**
L1	**internal language of description**
L2	**external language of description**
ORF	**Official Recontextualising Field**
PRF	**Pedagogic Recontextualising Field**
RD	**regulative discourse**
SAADP	**South Afric an Actuaries Development Programme**
UCT	**University of Cape Town**

Chapter One

Introduction to the Research

> "An actuary applies analytical, statistical and mathematical skills to financial and business problems, especially those which involve uncertain future events. This helps individuals and businesses to safeguard their future, confidently and at a fair price, in an everchanging world." [1]

Background

Based on the above definition of the role of actuaries it makes sense that learners with high grades in mathematics are drawn to the degree believing the core mathematical requirement is what will ensure their graduation and lead them swiftly to qualification. However, attrition rates are high and most students transfer to other degree programmes.

In this study I briefly sketch the background as to what has directed my interest in curriculum knowledge in this field and how despite the imperative in post apartheid South Africa for the transformation of higher education, representation of black actuaries in the actuarial profession remains low.

Before moving into the body of the thesis I clarify my interest in the topic and the overarching problematic of transformation in the actuarial section at the University of Cape Town (UCT) in serving both the profession and the student. Central to my understanding of analysis in the sociology of education is that it is always embedded in a social context which requires foregrounding. The first section of the thesis therefore deals with this context, although the more critical aspect will be the data analysis and subsequent findings and conclusion.

In this thesis I explore three data sources: two interviews with the course convenor (CC) and an analysis of the first two chapters (Module 1) of the course reader (CR) for the course *Introduction to Actuarial Science* (2013). These datasets are separated for

[1] Quoted from the Actuarial Society of South Africa in *Introduction to Actuarial Science* course reader, 2013, p.9)

content analysis, but integrated in the findings and discussion, particularly in the CR analysis which draws on the second interview and course objectives. This 'triangulation' of the datasets assists in identifying the foregrounding of the demands of the profession in the CR and brings in the CC's rationale for the redesign of the CR which in turn sheds light on the purpose of a CR as an explicit text that captures the pedagogic discourse for this curriculum. The objectives of the course form a backdrop for understanding the *recontextualising rules*[2]; the course objectives are presented and referred to but are not analysed.

The research aims to shed light on the nature of the knowledge that is valued in actuarial science and how these values are reflected in the CR. The research excludes the analysis of assessment in the course. This was a conscious delimitation due to1) space constraints 2) the decision to privilege *selection*, *sequencing* and *pacing* as the primary features of *pedagogic disourse* and 3) keeping within the bounds of researcher's expertise. It is hoped that the findings will provoke discussion around best practice for the formation of effective pedagogic discourse for the complex knowledge which underpins a coveted profession.

Declaring an Interest: South African Actuaries Development Programme.

I am the programme manager of the South African Actuaries Development Programme (SAADP) at UCT - an externally funded programme which has resided within the Actuarial Science Section of the Commerce Faculty since 2003. SAADP was founded specifically to address the dearth of South African, black African actuaries in the profession which at its inception stood at one. SAADP's mission is to avail resources[3] to mathematically talented students of historic disadvantage[4] who wish to pursue actuarial

[2] '…recontextualising rules regulate the formation of specific pedagogic discourse.' (Bernstein, 2000, p.28)
[3] These resources include socio –psycho, academic and financial support, although not all are funded.
[4] This includes all historically disadvantaged students and in exceptional instances needy white females. The targeted demographics of funded students: 85% Black and 15% Coloured, Indian and Asian.

science. This support is given in the hope of fulfilling SAADP's vision to change the demographic composition of the fraternity, such that it better reflects the population and allows for greater participation in the economy from the black community, wherever the specialised skills of the actuary may be required.

Sponsored first year SAADP students at UCT are drawn largely from a pool of highly mathematically talented historically disadvantaged students from low socio - economic backgrounds. In my day to day engagement with students on the programme I aim to take a holistic approach by considering their social, cultural, economic, historical, political and educational backgrounds as they grapple with learning and related issues within the university context. Naively, when I joined SAADP at UCT in 2006, I was convinced that all students needed to succeed were funding and the psycho-social and academic support the programme provided. At first I focused on student learning; convinced that this was the key to their academic success. Then I realised that proficiency in English academic discourse was a barrier to success and at the same time witnessed the socio-cultural challenges they were facing and how this impacted on their confidence to acquire new knowledge and skills. In short, acquiring a *Secondary discourse* which is far removed from students' *Primary Discourse* (Gee, 1996) is very challenging. Gee maintains that we are born into our *Primary Discourse* and it will always be present no matter how many other discourses we acquire. In my experience I witnessed that the further students' *Primary Discourse* was from the discourse of actuarial science, the longer they took to acquire it. All of these factors and others besides play their part in students' struggles to get through this arduous degree.

Finally my focus moved to the knowledge itself, because notwithstanding student potential and the provision of support, throughput was not improving. On the actuarial science degree attrition is worst from first to second year, although success is not a given

thereafter. Moreover, this given that actuarial science is not my discipline, I needed to understand the nature of the knowledge that students must acquire in order to provide effective support.

The distinctive role of the researcher in this project.

Inspired by my own studies in Higher Education and the sociology of education, I was drawn to inspect the knowledge of actuarial science to understand what support would be most effective in ensuring success in the degree. This brings me to my current area of interest which is: understanding the nature of the profession and what is valued as knowledge in the *field of practice* and similarly understanding what constitutes knowledge in the discipline[5].

My role in this study is that of researcher; distancing myself from the anecdotal to gain proximity to the knowledge as an ontological object in its own right. In trying to pin point knowledge in the curriculum using the theoretical tools at my disposal, I take a social realist stance which I hope will allow for a more objective approach to a theme in which I have a vested interest. Maton, Moore and contributors (2010) provide insight into social realism as a credible theory to underpin educational research and I hope by the end of the project to have answered some of the questions that this approach raises and are hinted at below.

> Social realism puts *knowledge as an object* centre-stage in thinking about education. This is not to fetishize or view knowledge as the *only* object but rather to recover and reclaim this crucial yet missing dimension of education. Doing so raises questions of the characteristics that enable knowledge to be created and developed over time, the modes of this creation and development, the forms this knowledge takes, and their effects for policies and practices. (Maton and Moore, 2010, p.2)

[5] Defining the terms *knowledge in the discipline of actuarial science* and *knowledge in the actuarial profession* and distinctions between them will be revisited in the first interview.

The Problem

In South Africa, access to university has grown significantly in the past two decades particularly by historically disadvantaged population groups. The National Student Financial Aid Scheme (NSFAS) has enabled hundreds of thousands of impoverished young South Africans to attend university during this period[6], but the debt incurred through dropping out is a sobering reminder that success is not only about gaining entry to university. Wally Morrow, who first used the term *epistemological access* in 1992 (Muller, 20014, p. 256) cautioned the SA education community that 'if we were serious about 'opening the doors to learning' as the then fashionable slogan had it, *formal access*[7] was one thing, *epistemological access* another: indeed, they were in 'direct conflict with each other' [(Morrow, 2007, p. 19) as quoted by Muller, 2014, p. 256]. This debate continues and the proposal for an extended degree (Scott, 2013) addresses the gap between these forms of access which has direct bearing on graduate throughput and attendant costs. The term *epistemic access* (Young, 2010, p.4) is now widely understood "to signal intent to move beyond physical or formal access to meaningful access to the 'goods' of the university." (Muller, 2014, p. 255) This study uses the latter meaning of *epistemic access.*

Transformation in the actuarial profession appears slow.

I am drawn to explore knowledge in the actuarial curriculum, because despite efforts to extend access to tertiary education across all population groups, the increase in black actuaries in South Africa has been sluggish. There are many contributing factors as to why the change in the demographic make-up of the actuarial fraternity is lethargic;

[6] The 2014 NSFAS report reveals that 194,923 students were assisted at 23 Universities for the period March 2013 to March 2014.

[7] Formal access is synonymous with admission to university.

suggested by some that it may be constrained by structural barriers and cultural lags and by others that there may be 'gate –keeping'[8] in the profession.

In post-apartheid South Africa it has become common for politicians to accuse professions of 'gate-keeping' as their membership is largely dominated by white males. 'One factor which we must also confront is a continuation of racist attitudes and outlook of some teaching staff, particularly when it comes to scarce skills professions such as engineering, business studies, accounting and the actuarial profession' (Blade Nzimande, 29 September, 2009). The accusation appears warranted on a macro-scale as change in the demographic representation has been marginal; it stands in stark contrast to the potential that exists among the historically disadvantaged who now have access to higher education and are eager to join the ranks of the professionals.

Every profession by virtue of its definition will guard its realm of practice and jurisdiction carefully to uphold its integrity and unique contribution to society (Abbott, 1988). Alternatively, this could be a means to 'defend' prestige, income and a way of life resulting in 'monopolistic closure of access' (Larson, 1977, p.155) or both? Slattery balances the 'privileges' of a profession with its 'responsibilities' (2004, p.4). Notwithstanding an overriding challenge in actuarial science, regardless of socio-historical hindrances has always been the long route to qualification.

Transformation in the Actuarial Section at UCT is onerous.

Space does not permit giving an historical account of the causes of an inequitable educational state (Kros, 2010) and the subsequent policies of redress deployed to bring it into balance from 1994; but we need to acknowledge that systemic oppression cultivates deep mistrust and has left a 'treacherous legacy' of authoritarian teaching which

[8] 'gate–keeping' used in this context has a political connotation. The demographic makeup of the profession is 85% white and 84% white male (2013). To the uninformed, it may appear that the profession is the preserve of the historically advantaged.

continues to encourage 'rote learning' stunting the growth of 'critical evaluation' and 'argued response' (Kros, 2010). We need to recall that not only was education separate, it was unequal (Kros, 2010, p.114) and disproportionately financed (The Bantu Education Act, 1953). The burden of financing fell on black parents and besides overcrowding and the issues of language of instruction, it was not permissible for black learners to study the natural sciences and mathematics; according to Verwoerd they had neither the ability nor need (Kros, 2010, p.155).

Qualifying as an actuary involves more than graduating in actuarial science, although the degree forms the foundation for the qualification and affords entry into the workplace. The actuarial science division faces outwards towards the actuarial profession as well as inwards towards the discipline. However, being cognisant of transformation implies a third angle – facing the student.

This study attempts to reveal the complexity of the knowledge of actuarial science which may make epistemic access challenging –highlighting the importance of careful curriculum design for orientating the first year student to the discipline.[9]

The link between the profession and the discipline.

It has not always been the case that educating students for the actuarial profession rested with the university; on the contrary within the context of the last century, UCT was among the first few in the British Empire to offer actuarial science courses (UCT Science Faculty Handbook, 1963). This recognition depended on the relationship between the profession and the discipline. ASSA which had been formed in 1948, when the Nationalist Party inauspiciously came into power, was probably critical in paving the way for this recognition since it did not have its own education arm. The relationship was

[9] From this point forward, unless otherwise stated, the use of 'discipline' refers to the discipline of actuarial science within the university and the use of 'the profession' refers to the actuarial profession.

both formative and strategic for UCT in maintaining accreditation with ASSA and two UK professional bodies: The *Institute of Actuaries* (London) and the *Faculty of Actuaries* (Edinburgh). Additionally providing 'exemption'[10] courses was a major draw card for potential actuaries to UCT, but it also meant that standards had to be maintained for professional recognition to be honoured. Initially this process emphasized exceptionally high academic standards[11], but over time the university gained the trust of the profession and reached an agreement that students achieving 60% in any actuarial university exam would be awarded an exemption for that course on graduating. Accreditation remains an ongoing requirement and the actuarial section is regularly evaluated by ASSA as a consequence.

South Africa broke away from the British Commonwealth in 1966 and the many changes in the curriculum over the subsequent twenty years is indicative of serving the needs of the profession and business by preparing white graduates for the field with no apparent recognition of the disenfranchised. The raging discontent with the medium of instruction policy in African, Coloured and Indian high schools culminating in the riots of June 16th, 1976 had not penetrated to the level of the university curriculum.

Only with the formation of the ASSA *Diversity Committee and Mentorship Scheme* in 2000 (See Appendix A) and *Actuaries on the Move* in 2002, did it appear that the potential residing in the historically marginalised majority population would be recognised as a critical recruitment pool for the internal 'transformation' of the profession. Critically a tiny pool of existing black actuaries[12] and actuarial professionals

[10] An 'exemption course' is a course that is offered at the university which if passed well enough contributes towards the actuarial qualification. The passing student would then be *exempt* from writing that exam whilst in the workplace. UCT offers ten exemptions in the Business Science degree and fifteen are required to qualify.

[11] The first exemption agreement required students to pass with 70% (1973) the second 65% (1988).

[12] Some of whom were Zimbabwean with permanent residence in SA.

created their own voice in forming the *Association of South African Black Actuarial Professionals* (ASABA) in 2003 and in the same year, SAADP came into being.

Being a small profession '(one of the smallest...with only 35,000 members worldwide)' (Denett, 2004, p.*vi)*) also makes it less well known and seemingly more élite; characteristics which reinforce the notion of 'gate-keeping'. In addition, the relationship between ASSA and its parent bodies from the UK as well as the struggle for a South African identity within the profession has played a significant role in perpetuating the elitist paradigm.

In 2009 the Actuarial Science Section changed the second semester course *Introduction to Actuarial Science* into a half year course delivered over the full year[13]. This was followed in 2010 by accommodating actuarial science students in an extended degree programme in the Education Development Unit (EDU). These both signify a change in curriculum as a result of focussing on the student and a commitment to transformation.

This forms the background from which the drive to transform the profession has grown and agitating for effective epistemic access has taken root. This next section illustrates how the research question emerged and follows directly from my interest in guiding students from 'formal' towards *epistemic access*.

[13] Pre 2009, students had to qualify for entry into this second semester course by obtaining 60% for Maths, Economics and Accounting in the first semester of their first year.

Chapter Two

Research Questions and Methodology; Incorporating a Literature Review

In this chapter I will recount how my interest in the topic emerged in the year 2013 and how the research questions were formulated. I will explain the methodology supporting the research and how a review of the literature led me to choose specific theoretical perspectives above others. Detail on the chosen theoretical perspectives will be explored in Chapter Three.

Three Dimensions Converge to Focus on Forms of Knowledge in the Curriculum

From my observations of the course as it unfolded in 2013 there was a strong sense of cohesion. Previously this was a course students would drop to lighten their load in order to obtain the high grades required to get through to the first official year of actuarial science[14]. In 2013 however, this was not the trend. At this stage my observations were anecdotal, but a possible research topic was emerging with respect to analysing the form of knowledge in the curriculum and how the students came to value it. It appeared that three domains of the problem were coming together. These were firstly: *forms of the knowledge in the profession* and secondly the *curriculum*. I regard these two as internal to the problem because they are closely tied to our understanding of the *discipline*. They have a necessary relationship with each other and are relatively more enduring than the third domain which is dynamic, socio-historically determined and an external relation - the *student body.*

I am proposing that all three domains were recognised in the project to improve the course under enquiry. As the analysis of the first module of the course reader (CR)

[14] At UCT a student must obtain 70% for first year pure Maths and first year Mathematical Statistics, plus 60% for first year Accounting and Economics, in order to proceed to Financial Mathematics; the first actuarial course of the degree.

sharpens they can be redefined as; 1) *knowledge in the field of practice* **and** *in the discipline*, 2) *the imagined learner*, yielding at their intersection 3) *knowledge* ***in*** *the curriculum* (Figure 1.). This research project was designed to capture data that would illuminate the relationships between these three dimensions of the research problem.

The goal of the research project is to enquire as to what might count as best practice for an entry level course CR in actuarial science that facilitates *epistemic access* by signalling the way into the disciplinary knowledge and thereby making entry into the profession possible. I assume that one goal of the actuarial science degree is to orientate the student to the discipline and in the first instance to the *field of actuarial practice* as well. The scope of the project does not extend to interrogating student performance on the course, as on its own it will not show *how* epistemic access is afforded.

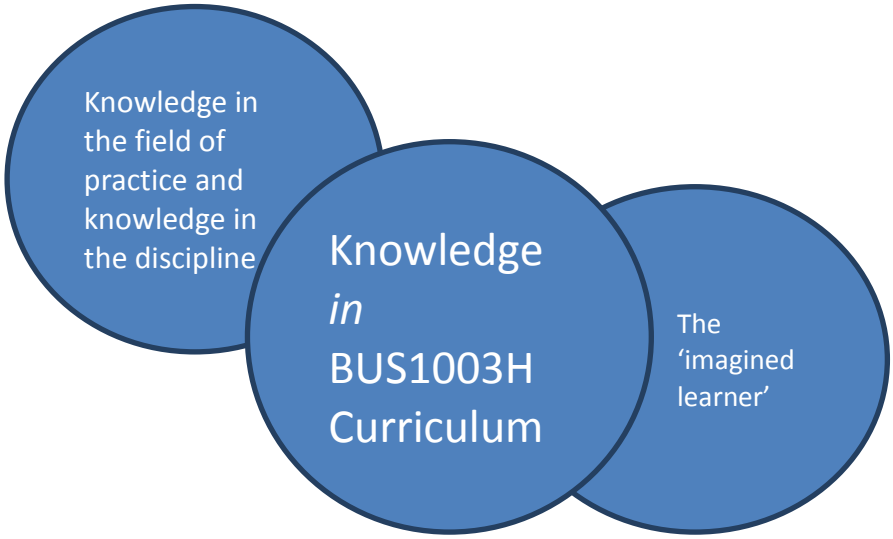

Figure 1. Three Dimensions Converge.

It is propitious for the purposes of this research, that in 2013 when data was being gathered, the course *Introduction to Actuarial Science* was being redesigned and simultaneously being delivered in a new course format with a new CR at its centre. The data will disclose the rationale for its redesign and what factors motivated the redesign

process. The research project aims to trace the curriculum knowledge in the CR back to the forms of knowledge valued in practice. In doing so, I recognise that curriculum knowledge has been *recontextualised* [15] and *pedagogised* [16] in order to create the pedagogic discourse that is found in the CR.

Would the CR in its new format allow for epistemic access to the actuarial science discipline and to actuarial practice? This leads me to the research questions for this study:

1. What is the nature of the knowledge valued by the actuarial profession in the *field of practice*?
2. What type of knowledge is valued in the discipline of actuarial science?
3. To what extent is epistemic access to this knowledge made explicit through the *pedagogic discourse* of the course reader *Introduction to Actuarial Science*?

Two further sub questions will be addressed:

- Why was it necessary to redesign the course reader to allow for improved epistemic access?
- What factors were pivotal in effecting these changes?

A qualitative case study with knowledge as the object of enquiry.

[15] Referred to by Bernstein as *recontextualising rules* (2000, p. 31).
[16] In other words I am respecting the *discursive gap* between pedagogic fields.

This research falls within the category of a case study. The key participant is the course convenor (CC) who for the purposes of this study represents the actuarial profession and the actuarial science division in two separate interviews. This is both a limitation and a positive characteristic of the study; a very limited sample of the actuarial fraternity, but positive in providing insight into the redesign of the course and the CR. As a case study 'one of its perceived weaknesses concerns the issue of generalisability' (Balfour, Davey and Rule, 2011, p.302). However, the 'multiple methods of data collection' have balanced this weakness 'in order to gain deep understanding of the phenomenon under investigation' (Balfour, Davey and Rule, 2011, p.302).

The interview data assist in uncovering the objectives for the redesigning of the course and more particularly for the CR, and their analyses serve to substantiate or refute the findings. The three data sources form a hybrid set, conforming somewhat to Mouton's 'hybrid mixed data' (Mouton, 2001, p 145). In this case study the research methods are qualitative, consisting of 'content analysis' (Bernstein, 2000, p.133) followed by discourse analysis[17] as a means of selecting, organising and interpreting the textual data.

The data is filtered through a conceptual framework that permits description of the inferences at work in recontextualising knowledge. The focus is on a rich description that allows for retroduction of the underlying principles or causal mechanisms. The meta-theory that frames this micro study is social realism 'a school of thought that takes knowledge seriously as an object of study' (Maton, 2014, p 3). Social realism draws on Bhaskar's philosophy of critical realism (Bhaskar, 1979) which 'focuses attention on a theory's explanatory rather than predictive power' (Mingers, 2006, p.25). In addition; critical realism holds together ontology and epistemology as analytically distinct. This

[17] Not critical discourse analysis.

permits description of ontologically real phenomena, while conceding that such a description is epistemically fallible because it is mediated subjectively by our 'time period and culture' (Mingers, 2006, p.19). Social realism thus accepts the sociality of the researcher or knower.

Hopefully high levels of self- awareness will guard against my own enthusiasm for the success of the redesign of the course's curriculum leading me to 'construct' rather than 'discover' what is reflected in the data. As Maxwell reminds us 'it is always possible for there to be different, equally valid accounts from different perspectives' and then again referring to data specifically, he quotes from Hammersley and Atkinson '...data in themselves cannot be valid or invalid; what is at issue are the inferences drawn from them' (Maxwell, 1992, p.283). A commitment to a social realist approach allows for the unexpected to come to the fore.

I have found it appropriate to use Basil Bernstein's (2000) *Pedagogic Device* to locate the CR in the *field of recontextualisation*. In addition, I use Bernstein's concepts *classification* (C) and *framing* (F) to describe the codes of the knowledge valued by the profession in a) the *field of practice* and b) in the discipline. Furthermore, I rely heavily on Bernstein's concept, *recontextualising rules* which 'regulate the formation of specific pedagogic discourse' (Bernstein, 2000, p.28) to examine the ways in which epistemic access is facilitated in the CR.

The proliferation of articles on professional knowledge by Michael Young and Johan Muller and a co edited book on *Knowledge, Expertise and the Professions* (2014) have provided greater depth in understanding the complexity of *fields of professional practice*. A pupil of Bernstein's, Karl Maton has extended the model of the *Pedagogic Device* into an *Epistemic- Pedagogic Device* with capacity to operationalise the 'organising principles' (2014) of the knowledge in focus. Maton's *Legitimation Code*

Theory (LCT) and in particular the *specialisation codes* based on *epistemic relations* (ER) and *social relations* (SR) with their attendant modalities[18], have added positively to the picture of the nature and description of the profession and what knowledge is valued in the field of practice and the discipline.

The actuarial profession as *field of practice*.

The route to qualifying as an actuary has moved in part from the workplace to the university and currently there is dual ownership of knowledge production between the profession and the university, incorporating both academics who are actuaries and those who are not.

The degree is a form of institutionalised knowledge; students may graduate and never qualify or enter a work environment that employs actuaries. The degree is also foundational in that it provides scope for the student to acquire many of the 'exemptions' that makes the route to qualification that much shorter, once in the workplace. Despite the fact that one could bypass the degree route altogether (not discussed here) there is a strong relationship between the professional body and the universities as well as a fair amount of tension as to the contribution of research to deepening and improving the knowledge in the profession. These two aspects make it difficult to locate where knowledge is produced; in the workplace or in the discipline because the production of new knowledge works with real world examples to substantiate its findings. In this respect Bernstein's description of the *field of production* appropriates it to *singulars* (in proverbial disciplines), which does not adequately capture the production of new knowledge in actuarial science. However, Bernstein observed that in the latter half of the twentieth century the 'very strong classification of singulars has undergone a change and

[18] *Knowledge codes* (ER+, SR-), *knower codes* (ER-, SR+), *élite codes* (ER+, SR+) and *relativist codes* (ER-, SR-) (Maton,2014, pp.30,31)

what we now have, I may suggest, is a *regionalistion of knowledge*' (Bernstein, 2000, p.9). He clarifies this further by claiming that a *region* is 'created by a recontextualising of singulars' (Bernstein, 2000, p.9). In contrast 'Singulars address only themselves. Singulars are intrinsic to the production of knowledge in the intellectual field. Regions are the interface between the field of the production of knowledge and any field of practice' (Bernstein, 2000, p.9).

Theoretical perspectives; knowledge in professions, knowledge in disciplines

For these reasons I find the work of Muller and Young insightful in locating actuarial science within the range of typologies that have been offered in social realism literature in the past few decades. I am referring to Biglan (1973), Becher (1989, 1994), Merton (1973) and others who have helped create a macro description of knowledge in the professions and the disciplines. According to Muller (2009), Biglan (1973) set the ball rolling publishing 'a set of disciplinary distinctions that have been remarkably enduring' (Muller, 2009, p.210), the 'hard/soft' distinction having held as much as the 'pure' and 'applied' even though the first has been given more 'conceptual underpinning' (Muller, 2009, p.210). Muller goes on to illustrate other contemporary analyses of the disciplines moving from Biglan's 'quartenary' to Becher's (1989, 1984) 'tribes' to a discussion of 'other implications for the production and distribution of the disciplines' made transparent by Merton (Muller 2009, p. 212). Merton brings Bernstein in using *classification* to explain his (Merton's) term 'codification' which underlines his use of 'paradigmicity' and 'hardness'.

Muller's article (2009) on the movement in history towards an appreciation of the professions and preparing and qualifying students for a profession via university mirrors, to a certain extent, what has happened with actuarial science. ASSA created its own education arm (2010 launch) whereas previously it relied almost completely on the UK

bodies for the exams and granting of exemptions. This means that transformation within the fraternity now rests squarely on ASSA's shoulders. Another force of influence is an imperative from government to universities to transform through widening access and improving throughput. Bernstein is cynical of universities conforming to outside pressures; he terms this 'marketisation' which has the effect of watering down knowledge. I will use Bernstein's *Singular*, *Region* and *Generic mode* well illustrated by Young (2008) and then again by Muller and Young (2014) to help describe the nature of the profession and the knowledge valued in the *'Fields of practice'* (Muller and Young, 2014, p.14). This later work provides even greater insight as to how the intricacies of calling on appropriate knowledge in the discipline to solve a problem in the workplace is a form of knowledge, moving out of the bold distinction of normative and theoretical/technical skills into more nuanced forms of reasoning accessible to experts in the field. In this regard work by Winch and Guille, (Muller and Young, 2014, chapters 4, 6) is useful for identifying the presence of something other than the normative or theoretical/technical at work in such reasoning.

More than Ryle's 'knowing that' and 'knowing how'.

The philosopher Gilbert Ryle (1946) as described by Muller and Young, moved the debate on the nature of expert knowledge forward using 'Cartesian rationalism' (2014, p.6) to make the distinction between 'knowing that' and 'knowing how' for which he is renowned. However, as Muller and Young point out, this had the effect of 'complicating the distinction between knowledge and practice' (2014, p.6) something which the philosopher Christopher Winch (2010) has addressed by suggesting there are two kinds of 'know how' knowledge. 1) 'Knowledge of the *inferential relations* between propositions' which he claims is 'facility with *existing knowledge;*' and 2) 'Knowledge of

the *procedures* in assessing, testing and acquiring new knowledge' which is 'facility with *new knowledge.*' (Muller and Young, 2014, p.6)

'Continuous recontextualisation' (Guile, 2010).

Guile offers one yet another perspective (social practice perspective) on 'recontextualising' knowledge for professional practice which is far more fluid and encompassing than that of Bernstein's *recontextualising rules* which are strictly applicable in the *field of recontextualisation*. Guile provides a study (Muller and Young, 2014, chap. 6) which draws attention to 'the implications of the concept of recontextualisation for the future design and delivery of programmes of professional formation'. He also notes how his use of the term 'recontextualisation' differs from Bernstein's. As I am an outsider to the profession, Guile does bring into focus how 'an inferential approach to learning and teaching presuppose supporting aspiring professionals to grasp the relationship between the forms of knowledge and professional practice, rather than to assimilate those forms of knowledge purely in their disciplinary terms' (Guile in Muller and Young, 2014, p.85). However, although this is mentioned by the CC as one of the challenges for the junior actuarial analyst, this is not the focus of my study. Thus Bernsteins's conceptual framework is better suited for my analysis than Guile's.

Andrew Abbott advanced the discussion of the 'professions' and what it means to be called a professional in the late 80's in *The System of Professions: An Essay on the Division of Expert Labour*. Although his work is not directly related to actuarial science, it sheds light on how professions come to claim jurisdiction in certain areas and how important legitimation of the knowledge that is specific to a profession is, in making those claims. I will draw on his research in the sociology of the professions to inform assumptions about knowledge claims in the application of actuarial skills to widening

fields and how this may impact Bernstein's *classification* and *framing* of the profession as reflected in the data.

The curriculum.

In Muller's article (2009) there is clearly a tension between knowledge in the professions and knowledge in the respective disciplines. He also names a tension between 'Disciplines and the curriculum' and disagrees with Bernstein's claim that there is no link between the knowledge in the *field of production* and knowledge in the *field of recontextualisation*.

> Bernstein went so far as to deny that the logic of the curriculum could be derived from the logic of the discipline. If this is taken to mean that recontextualisation (or 'pedagogisation') wipes out any link back to the parent discourse, then this is surely too strong." (Muller, 2009, p.215)

I thoroughly agree with Muller on this point and I find his article *Forms of knowledge and curriculum coherence* (2009) pertinent to my study. It provides a history on the split between the disciplines Trivium and Quadrivium [first discussed by Durkheim (1938, 1977) Maton, 2014, p. 126] and the modern day pressure on universities to produce professionals who can contribute to the economy. Muller's work is additionally relevant for a South African audience when 'distinguishing between curricula which have *conceptual coherence* and those which have *contextual coherence*' (Muller, 2009, p.216). The analysis of the CR will reveal the use of both, which once again puts actuarial science outside of any ready- made typology.

Bernstein maintains that the line between Durkheim's two classes of knowledge (*mundane* and *esoteric*) is 'relative to any given period' (Bernstein, 2000, p. 29). 'There is the knowledge of how it is (the knowledge of the possible) [mundane], as against the possibility of the impossible'[esoteric] (Bernstein, 2000, p.29). Is transformation and the

imperative to transform in the new South Africa pushing the esoteric towards the mundane? In actuarial science it is both the *field of practice* and the *field of production* which hold the key to creating a relationship between abstract meaning and the material base. In making forms of knowledge explicit in *pedagogic discourse*, the discursive gap between fields narrows, it links abstract meaning to a material base 'creating an alternative power relation' (Bernstein, 2000, p.30). There is this potential for the new curriculum as the knowledge moves from the *field of production* into the *field of recontextualisation* '….to its new positioning as pedagogic discourse, a transformation takes place' (Bernstein, 2000, p. 32). It is my purpose in this research to reveal the links and to see whether deployment of the *recontextualising rules* makes forms of knowledge visible in this *pedagogic discourse* which in turn might facilitate access to curriculum knowledge; a factor in precipitating change sought in the profession.

Research on actuarial science in an educational context.

As far as I am aware, there has been no formal research within the sociology of education on what constitutes knowledge in actuarial science and/or how this knowledge might be recontextualised. I look to other fields where there is a combination of applied theoretical knowledge and although they are useful, they are not always entirely transferable. Nowadays the actuarial science degree at UCT is housed in the Commerce Faculty, although the mathematics and statistics courses are taught from within the Science Faculty.

I am not going to focus on the transmission of knowledge (*field of reproduction),* but what Morais (2001) has to say is worthy of mention here because she uses Bernstein's distinction between *horizontal* and *vertical structures of knowledge* to illustrate why science teaching often does not change and students continue to struggle to acquire the knowledge.

> Experimental sciences are vertical structures of knowledge. Theories of instruction are horizontal structures of knowledge. That is to say *the what* to be taught in science classes is quite distinct in its structure from *the how* to be taught.
>
> Science educators have been primarily socialised within specific vertical structures of knowledge and they have always found some difficulty in accepting knowledges characterised by parallel languages. (Morais, 2001, p.2)

Moving between *singulars* (vertical structures of knowledge) and responding to problems in the real world (horizontal structures of knowledge) may be a clue as to why actuarial knowledge is not explicitly transmitted within pedagogic discourse as is possible for the experimental sciences cited above. Morais (2002) reminds us that Bernstein constantly maintained that 'successful learning depends to a great extent on the weak framing of pacing - that is, on conditions where children have some control over the time of their acquisition.' But she also maintains that 'time without explicit criteria may be useless' (Morais, 2002, p. 560). In the analysis of the CR I will return to Morais' insight on how questioning, repetition, cross referencing and setting up relationships between new and old concepts inadvertently weaken the *framing* of pacing and build explicit pedagogic discourse which gives students more time to grapple with concepts.

Summary.

I set out to organise the literature review along the lines of the two domains **internal** to the problem: *forms of the knowledge in the profession* and *the curriculum*, both of which are interwoven in the *discipline*. Actuarial knowledge does not conform to a clear cut combination of normative and technical/theoretical skills, but includes the space of reasoning – which draws on the expert's specialised knowledge of the field. Bernstein's concepts of *Singular, Region* and *Generic mode* will be key in analysing the

forms of the knowledge in the profession, aided thereafter by Maton's *Legitimation Code Theory*.

As an integral part of *the curriculum* and as the theoretical under labourer of the study, the CR is located in Bernstein's *field of recontextualisation* within his concept of the *Pedagogic Device*. I will use the device to capture the move through the 'discursive gap' from the *field of production* (discipline) and the *field of practice* (profession) into *the curriculum* via the *recontextualising rules* as they manifest in the CR.

Chapter Three

Theoretical Perspectives –Exposing Knowledge as an Object

In this chapter I unpack the theoretical concepts that form the conceptual framework for the data analysis. I begin with Bernstein and briefly explore his knowledge structures which have bearing on actuarial science as a *region*. I then move onto his *pedagogic device* which is pertinent for the course reader (CR) analysis and lean on Muller for identifying the resemblances in knowledge across fields in the *pedagogic device*. Thereafter I foreground Bernstein's *internal* and *external languages of description* leading into Maton's *Legitimation Code Theory*.

Bernstein's Knowledge Structures

My starting point is Basil Bernstein as he provides us with a theoretical framework on knowledge (discourses) and knowledge structures (Bernstein, 2000, chap.9). According to Maton and Muller (2007) this framework began to take form with the distinction between '*horizontal discourse* and *vertical discourse'* (Maton and Muller, 2007, p.23) where the former refers to the knowledge we use in everyday life and according to Bernstein 'entails a set of strategies which are local, segmentally organized, context –specific and dependent' (1999a, p.159) and the latter 'takes the form of a coherent, explicit and systematically principled structure' (1999a, p.159). At the risk of oversimplifying this theory but in the interests of space, Bernstein continues to expand the theory on *vertical discourse* into different knowledge structures; namely *horizontal* and *hierarchical knowledge structures* assigning the symbol of a triangle to *hierarchical knowledge structures* exhibited in the natural sciences, where there is more consensus within fields and a base which subsumes more and more phenomena by progressing towards the apex through subsuming earlier theories, concepts and principles en route. In contrast *horizontal knowledge structures* - typical of the humanities and social sciences -

expand by adding new ideas segmentally; 'characterised by short-term obsolescence, only to reappear in the future in a new guise' (Maton and Muller, 2007, p.24). Bernstein's 'conceptualisation aims to *make visible* knowledge as an object, one with its own properties and powers that are emergent from, but irreducible to, social practices and which, indeed, help to shape those practices' (Maton and Muller, 2007, p. 24 original emphases).

Bernstein's *pedagogic device*.

Bernstein has left us with a conceptual framework for locating knowledge in his *pedagogic device* (Bernstein, 2000a) which preceded his ground breaking work on the structuring of knowledge above. In the *pedagogic device* as illustrated in Figure 2, Bernstein explored the forms of discourse knowledge takes in three fields; the *field of production* where knowledge is created and protected by *distributive rules*, the *field of recontexualisation* where knowledge is transformed into a curriculum and governed by *recontextualising rules* and finally, the *field of reproduction* wherein the *evaluative rules* dominate the discourse. I locate my data in the *field of recontextualisation* because I analyse knowledge in the CR which forms a major part of the curriculum. I conduct two separate interviews with the course convenor (CC) as the major agent in the *field of recontextualisation* who serves three roles simultaneously; 1) actuary, 2) course convenor and main author of the CR and 3) course lecturer. Importantly data from the first interview text will bring to light knowledge valued in the *field of practice* which is not part of the *pedagogic device,* but forms part of the discussion of the nature of the knowledge valued by the actuarial profession in the *field of practice* and in the discipline (research questions 1 and 2) and how that can be transformed into pedagogic discourse in the *field of recontextualisation* (research question 3).

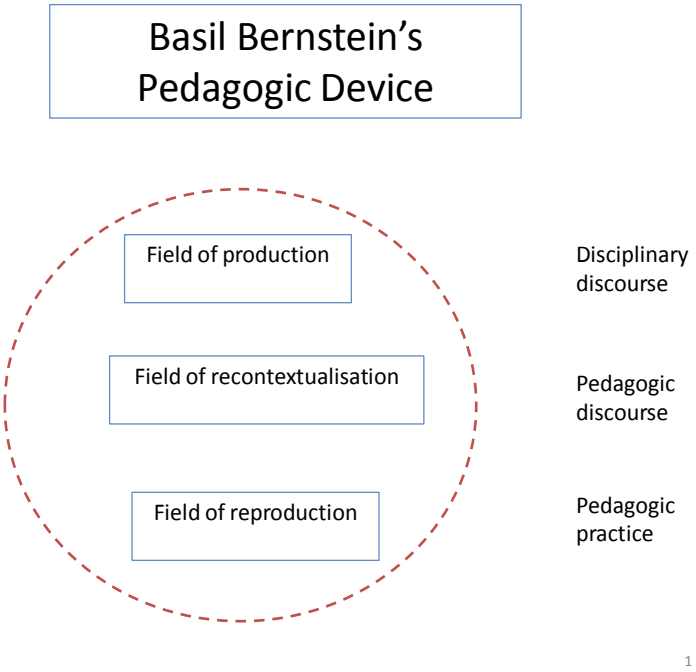

Figure 2. Bernstein's Pedagogic Device

Unlocking the potential of the poor.

Bernstein's work resonates deeper than simply providing a convenient location within a conceptual framework; he was passionate about unlocking the potential for knowledge acquisition by the working class. The quest to transform the demography of the actuarial fraternity relates strongly to that drive. In attempting to answer the question of whether access to this knowledge is made explicit through the *pedagogic discourse* of the CR, I confine myself to the *field of recontextualisation*. However, there will be slippage between fields as I examine the sub-questions which will disclose the interpersonal relations with the 'imagined learner' and its impact on curriculum design as well as *knowledge in the discipline* which is informed by knowledge in the *field of practice*.

When I refer to *knowledge in the discipline* I am referring to the knowledge that is privileged within the *pedagogic device* that allows the learner to progress towards

knowledge in the field of production. It is not the same knowledge as in the *field of production* although it needs to be recognisable as it moves towards that field for any progress to occur. Muller comes to mind once again with his insistence that there must be some resemblance to *knowledge in the field of production* in the other fields (Muller, 2009).

I see *knowledge in the discipline* sitting in a hierarchical relation to **curriculum knowledge** and **pedagogic discourse**. For the purposes of analysis of CR data, I will steer clear of *knowledge in the field of production* and work primarily within the *field of recontextualisation*, mindful of the 'discursive gaps' between fields.

Internal (L1) and external (L2) languages of description.

Maton lifts out the essence of the meaning of Bernstein's internal (L1) and external (L2) languages of description as part of what he describes as *Bernstein's typology*:

> L1 'refers to the syntax whereby a conceptual language is created' or how constituent concepts of a theory are interrelated; and L2 'refers to the syntax whereby the internal language can describe something other than itself' (Bernstein, 2000, p.132) or how a theory's concepts are related to referents. (Maton, 2014, p. 127)

At the risk of oversimplifying the theory informing this study, the L1 is a combination of Bernstein's *pedagogic codes* determined through the values of *classification* (C+/-) and *framing* (F+/-) and Maton's *specialisation codes*, determined through the relative values of *epistemic relations* (ER+/-) and *social relations* (SR+/-) each with their own *classification* and *framing* values. The strength of the framework is that Maton's work is derived from Bernstein's and both theories allow for a weakening (-↓) or strengthening (+ ↑) of modalities that exist within the codes. The L2 will arise from

relating these concepts to the data and be reflected both in tables as a synthesis of the analyses and as a range on Maton's topology of *specialisation codes* (Figure 3).

Classification (C+/-) and Framing (F+/-).

Bernstein created the 'concept of *classification* to examine relations between categories, whether these categories are between agencies, between discourses, between practices' (Bernstein, 2000, p.6). If an entity is well insulated from others and it has a 'unique voice' (p. 7) it can be said to be strongly *classified*. 'In the case of weak classification, we have less specialised discourses, less specialised identities, less specialised voices' (Bernstein, 2000, p.7). Bernstein's *framing* on the other hand 'provides us with the form of the realisation of that discourse; that is framing regulates the realisation rules for the production of the discourse' (Bernstein, 2000, 12).

Pedagogic discourse is the vehicle for recontextualising knowledge.

Bernstein gives the example of carpentry and woodwork to illustrate the principle of recontextualising knowledge for the 'acquirer'. '...*outside* pedagogy there was carpentry, but *inside* pedagogy there was woodwork. In other words, here was a transformation of a real discourse called carpentry into an imaginary discourse called woodwork' (Bernstein, 2000, p.33, original emphases).

The CC's task was to recontexualise the 'real discourse' of Actuarial Science into an 'imaginary discourse' called *Introduction to Actuarial Science*. The redesign of the course and as a result the CR itself, created a new *pedagogic discourse* underpinned by *recontextualising rules* revealed through *selection, sequencing, pacing, criteria of the knowledge* and *control over the social base*. *Framing* values describe the pedagogic code that emerges as a particular instantiation of these rules. In the analysis I steer clear of *criteria of the knowledge* which is most pertinent in the *field of reproduction* to focus on *selection, sequencing* and *pacing* of the curriculum knowledge in the CR. In each

instance and in cases where the rules combine to create the pedagogic discourse, we are able to say whether the *framing* of the *pedagogic discourse* is strengthened or weakened (F+↑/ F-↓) and possibly to what extent. To allow for the nuance of *framing* that is very strong F++ is used, and for weak *framing* on the other end of the spectrum F- is used.

Framing is a theoretical concept that integrates two discourses or an '*internal logic'* (Bernstein, 2000, p.12) which manifest in the *pedagogic discourse*. *Selection, sequencing, pacing* and *criteria of the knowledge*, are the rules of the *discursive order* and together they form the *instructional discourse* (ID) whereas *control over the social base* represents the rules of *social order* forming the *regulative discourse* (RD).

$$\text{framing} = \frac{\text{instructional discourse}}{\text{regulative discourse}} \quad \frac{ID}{RD}$$

(Bernstein, 2000, p.13)

'In other words, the instructional discourse is always embedded in the regulative discourse, and the regulative discourse is the dominant discourse' (Bernstein, 1990, quoted in Bernstein, 2000, p.13).

Bernstein describes *framing* as being concerned with '*how* meanings are to be put together' and with '*who* controls *what*' (2000, p.12). Although they operate together to form the pedagogic discourse, for the purposes of analysis we will say that the ID is concerned with *how* meanings in the course and CR are put together and the RD is the relationship between the pedagogue and or the pedagogic text and the student (as novice actuary). Strong framing (F+) would be present in *pedagogic discourse* where the control of what is transmitted is firmly in the hands of what Bernstein refers to as the *transmitter* and at the other end of the scale, *framing* would be weak/er (F -) where the 'acquirer

appears to be in control' (Bernstein, 2000, p.13). In other words, where there is weak framing much is left for the learner to discover or bring to the pedagogic space to acquire the knowledge carried in the ID. Guidelines for acquisition are invariably implicit in such a context and the RD may be depicted as (F- ↓) where the downward pointing arrow depicts a weakening relative to the overall position of strength in that instance.

Legitimation Code Theory.

Bernstein's pedagogic codes based on *classification* and *framing* values can reveal the 'organising principles of actors' dispositions and practices' referred to by Maton as 'classical code theory' (2014, p.54) to which he adds a second dimension called *Legitimation Code Theory* or LCT. I draw on Maton's LCT (*Specialisation*) (2014) incorporating *specialisation codes* which can be used across all three fields of the *pedagogic device* to ascribing attributes to the data analysed. Not only does LCT (*Specialisation*) allow me to move between fields while analysing knowledge and possibly trace the source of the knowledge 'upstream' (Maton and Muller, 2007), it allows for a more nuanced interpretation of the nature of the knowledge expanding on the hitherto dichotomous or polarised descriptions such as vertical/horizontal (Bernstein, 1999), hard pure/soft pure, hard applied/soft applied (Biglan,1973a, 1973b) that although useful on a high level can oversimplify the picture.

Maton began developing Bernstein's work further in Bernstein's own lifetime– acknowledged by Bernstein himself in his last work on *Vertical and Horizontal Discourse* (1999) analysing the trend where 'segments of horizontal discourses are being inserted in vertical discourse', described by Maton (1999) and quoted by Bernstein (1999) as a 'discursive shift in legitimation from knowledge to knower.'

Maton ascribes relative strengths and weaknesses of Bernstein's c*lassification* and *framing* to *epistemic relations* (ER+/-) and *social relations* (SR+/-) of an object of study

within educational knowledge. By mapping these relations in a relative topological Cartesian plane, he uses two relations to create four *specialisation codes*: *knowledge codes, knower codes, élite codes* and *relativist codes.* In his latest work on LCT (Maton, 2014, chap.9) he has made visible more dimensions to the key concepts of *epistemic* and *social relations* exposing 'inner' dynamics of a previously two dimensional image of the structure of knowledge which opens up the possibility of being able to compare knowledge across fields (in the pedagogic device and in Bordieu's sense). He has mobilised the pedagogic device through LCT so that we stand to gain greater insight of the 'inner fields' (Luckett, 2011) where ideology may be at play. However, for the purposes of this study I will not analyse the data as deeply as Maton's new framework allows, (incorporating *ontic and discursive relations, insights and gazes*) although I will use LCT (*Specialisation*) to ascertain whether the relationship is between the object of knowledge and the knowledge claim or the subject of knowledge and the knowledge claim is dominant. Below is a representation of Maton's *specialisation codes* on a Cartesian plane (Luckett, 2012, slide 13).

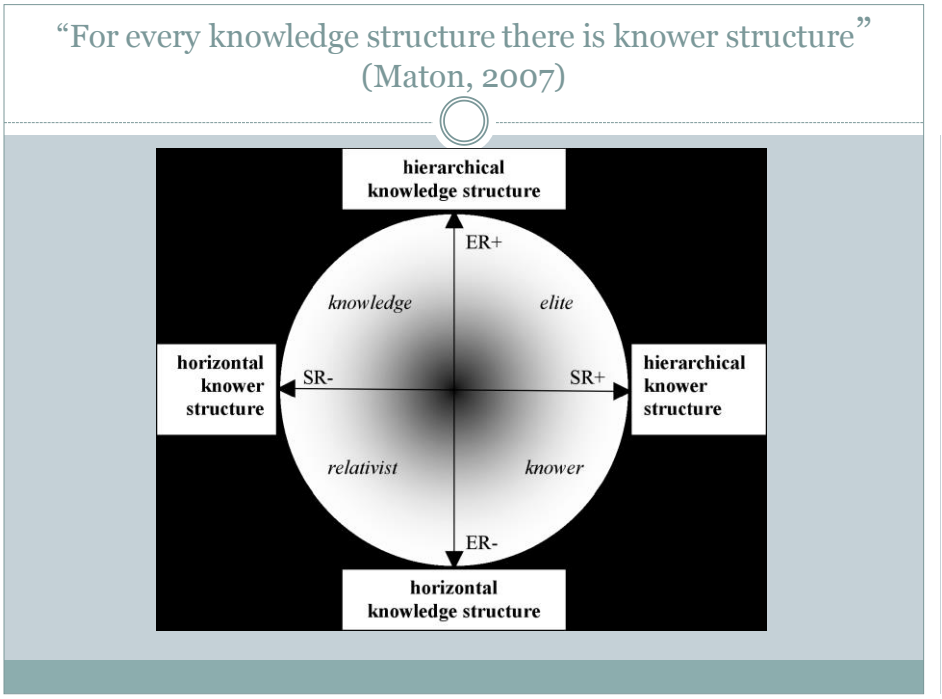

Figure 3. Specialisation Codes (Luckett, 2012, slide 13).

Maton is critical of the 'strong' versus 'weak' *grammars* that are inherent in Bernstein's *hierarchical* and *horizontal knowledge structures* as they entrench a deficit view of the Humanities and Social Sciences. He argues that we should uncover the principles that structure knowledge and work rather with a continuum of relative positions.

The next chapter explains what I did to collect data and how I set up *external languages of description* (L2's) to operationalise the concepts discussed in this chapter so that I could use them to analyse the datasets.

Chapter Four

Method of Enquiry and Data Sources

Overview

This chapter clarifies how the data was gathered, how I familiarised myself with the data and how I operationalised the three datasets: First Interview, course reader (CR) and Second Interview. Below is a timeline of the process starting with the review of the course curriculum in December 2012 which was seminal to my interest in the topic of epistemic access, closing with the development of an L2 for the First Interview and another for the CR.

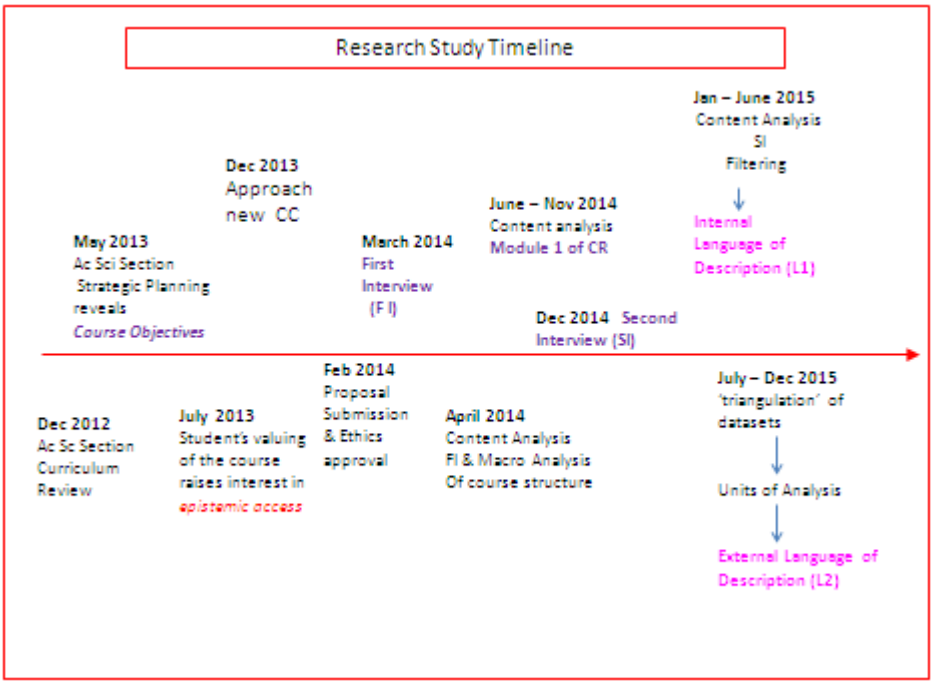

Figure 5. Research Study Timeline.

My proximity to the actuarial department as programme manager for SAADP gave me direct access to the course convenor (CC), the course objectives and the CR. The CC gave consent to be interviewed on two separate occasions, to be quoted and for the name of the course to be disclosed in the study.

Course Objectives.

I was privy to the course objectives (Appendix B), as from May 2013. These helped to develop the interviews as a research instrument and served to inform the data gathering and analysis. The objectives were not analysed separately as they formed the backdrop against which the analysis took place and not an additional dataset.

Rationale for two separate interviews.

Objectives two, three and four have direct bearing on what it means to be an actuary and this observation highlighted the potential importance in the course for orientating the student to the profession. Simultaneously there is mention of preparing the student for 'their university studies' and 'their professional exams' which drew attention to the *discipline* of actuarial science. As researcher with close proximity to the profession and the actuarial science section, but being outside of both, I needed to be sure what being an actuary meant. Additionally, confirmation from a source other than the CR was required to retain my objective stance and reflect on the portrayal of knowledge in the CR. This led me to my first two research questions:

1. What is the nature of the knowledge valued by the actuarial profession in the *field of practice*?
2. What type of knowledge is valued in the *discipline* of actuarial science?

These research questions focused on *what* forms of knowledge are valued and had to be addressed before the CR, located in Bernstein's *field of recontextualisation*, could be analysed to address the third question which focused on *how* these forms of knowledge were transmitted:

3. To what extent is epistemic access to this knowledge made explicit through the *pedagogic codes* of the course reader *Introduction to Actuarial Science?*

The data from the First Interview would be preparatory for the second and the two interviews would be analytically distinct from each other; for these reasons two separate interviews with the CC were chosen.

First Interview.

Development of research instrument.

In order to address the first two research questions a three-part design was created. The first was a short section asking for a description of the profession and the features that made it unique. The second was a detailed battery of questions on all the forms of knowledge that the actuary would be called upon to use in the workplace, and the third was a mirror set of the second, but with the focus on the knowledge valued in the formal university degree (*discipline*). It was a thorough schedule of 54 questions aimed at revealing to what extent actuarial science would conform to the notion of a *region*.

Process of data gathering.

At the time of submitting the dissertation proposal in February 2014, I obtained ethical clearance for the research along with consent from the CC to interview her on two separate occasions and to have the interviews transcribed and if necessary, appended to the thesis. The interview took place on the 20th March 2014 and lasted 59 minutes. The interview was recorded and the transcription was sent to the CC for checking.

Process of data analysis.

The first stage was one ‘content analysis’ (Bernstein, 2000, p.133). The entire interview was combed for any data that pertained to forms of knowledge which could be grouped together or stood out as different bringing potential ‘conceptual relations’

(Bernstein, 2000, p.133) between concepts and the data into focus. The filtered data allowed me to explore an L2 using Bernstein's concept of *classification* (C+/-) to describe the forms of knowledge valued by the profession in the *field of practice* on the one hand and curriculum knowledge in the discipline on the other. The concept of *framing* (F+/-) would not advance the notion of the forms of knowledge, but rather the control over the acquisition of this knowledge by the 'social base' (Bernstein, 2000, pp.12, 13) which is represented by student actuaries. The L2 also incorporated Maton's LCT (*Specialisation*) (ER+/-, SR+/-). This combination of concepts as an L2 would help to define to what extent the knowledge of actuarial science fitted the description of *singular*, *region* or *generic mode* (Bernstein, 2000, Young 2008, Muller and Young, 2014) and how it is legitimated through *epistemic relations* (ER+/-) and *social relations* (SR+/-) (Maton, 2014). The analysis of the data from the First Interview would be plotted on Maton's Cartesian plane depicting four principle modalities of specialisation viz. *knowledge codes* (ER+, SR-), *knower codes* (ER-, SR+), *élite codes* (ER+, SR +) and *relativist codes* (ER -, SR -). (Figure 3)

The L2 below is a theoretically enabling mechanism, making the concepts (L1) visible through indicators pertinent to this study alongside data examples ready for analysis. 'In other words, the external language of description (L^2) is the means by which the internal language (L^1) is activated as a reading device or vice versa' (Bernstein, 2000, p.133).

External Language of Description of First Interview				
Concept	**Indicators**	**Examples from data**	**Analysis**	**Codes**
C+	Strong/er *Classification* of the knowledge insulated by its own characteristics and purpose separating itself from other professions, operating in its own domain.	...there's two types of specialisation, either liability base, which is your insurance, or your asset base, which is your investment type of actuaries, and…well investment and I suppose the risk as well. (FI, p. 4, 93-95)		
C-	Weak/er *Classification* is where boundaries between disciplines blur and there is a drawing from other disciplines to provide solutions in the field of practice.	You can apply the knowledge within the discipline very broadly, and I think what's happening with the actuarial profession, is that it's finding itself in wider fields...that wouldn't have been traditionally actuarial. (FI, p.4, ll.24- 31)		
F+	Strong/er *Framing* is where there is 'explicit control over selection, sequence, pacing, criteria and the social base' (Bernstein, 2000, p.13)	...the way we think about the actuarial expertise is almost in two layers. I know the exam structure of the actuarial profession reflects that, which is that ... there's a lot of technical expertise that you need to have in order to be able to think widely and evaluate these wider impacts. (FI, p.2,3, ll.44 -46) ...they created an intermediate associateship, which you can get after a much shorter period of time. (FI, p.5, ll.104 – 109) ...we have certain outcomes which we look for, in terms of being able to do certain statistical types of models, ...(FI, p.23, ll.533 - 537)		
F-	Weak/er *Framing* is where control is implicit and more in the hands of the acquirer	I still think that students that start working in the workplace struggle to see the link between what they've been learning and what they…it takes a few years in order for the ideas to cross pollinate properly. (FI, p. 6, ll. 141-142) ... and it's also out of our hands in some ways, because we don't design the statistical modules, we just choose the ones that best suit us.' (FI, p.23, ll.533 - 537)		
ER+	A discrete, highly specialised form of knowledge is required, unique expertise of the actuary is emphasised.	... there's a lot of technical expertise that you need to have in order to be able to think widely and evaluate these wider impacts.... all the subjects that they learn, can all be applied to the evaluation of risk, in one way or another. (FI, p. 2,3, ll.46 -54)		
ER-	Expert knowledge is downplayed, more generic forms of knowledge are viewed as legitimate.	I think computer programming is not what actuarial work is about, but you might have to implement some actuarial thinking using computer programming, so it's giving them a tool. Same with Excel. (FI, p.12, ll. 282-285)		
SR +	A particular disposition, form of inferential reasoning by the actuary as professional is emphasised.	... yes to solve problems that you need judgement for, I think that's really where actuaries are needed, ...so it's that judgement, and that bigger picture, and often defining the problem is part of the judgement. (FI, p.14,ll. 330-335)		

		...it's only when they progress in business…in their business career, that they start being in charge of a team or a project and then they start actually having to see the problem themselves and try and develop a solution,' (FI, p.9, 10, ll.228-230).		
SR-	The attitudes of the actuary / professional are de emphasised, non experts can contribute to the role or function.	...normative skills are things like their communication skills, their ability to document and build models that somebody else can understand,…business skills and business understanding, so those are the ones that we see as more normative skills. (FI, p.9, ll. 208-212)		

Table 1. External Language of Description, First Interview.

The Course Reader.

Choosing Module 1 for analysis.

A full analysis of the CR was not possible as there was far too much data, but in order to assess which section/s of the CR should be analysed I embarked on a macro analysis of the Course Structure which was positioned before the first page of the CR. This cursory analysis provided evidence at a high level of whether the CR was aligned to the course objectives and a sense of what knowledge forms were valued in the course.

This preparatory work confirmed an intuition that to address the question of epistemic access, knowledge that is **first** presented to the reader and the manner of that presentation would impact its transmission due to the primacy effect. Module 1 therefore, which was the first contact with the student, would be the obvious choice as a relevant dataset. Module 1(hereinafter referred to as CR) comprised two very different chapters which would hopefully allow for more diversity in the analysis and shed light on the two subsidiary research questions:

- Why was it necessary to redesign the course reader to allow for improved epistemic access?
- What factors were pivotal in effecting these changes?

Development of the research instrument.

To address the third and most significant research question I needed to illustrate how the forms of actuarial knowledge were recontextualised in the *pedagogic discourse* of the CR as it was manifested through the *instructional* and *regulative discourse*; the two dimensions of *framing* which as a concept refers to the 'nature and control over:

- the selection of the communication;

- its sequencing (what comes first, what comes second);
- its pacing (the rate of expected acquisition);
- the criteria; and
- the control over the social base which makes this

transmission possible.' (Bernstein, 2000, pp.12,13)

Process of data gathering.

The focus was on gathering data which would illustrate *selection, sequencing* and *pacing* as the *rules of discursive order* (Bernstein, 2000, p. 13) and their relative *framing* (F+/-) values to uncover the *recontextualising rules* for this dataset. The challenge was to break the text up into manageable units of data by undertaking a textual functional analysis. Each line was evaluated in terms of its dominant textual function and labelled accordingly. For example, a *question* could occupy one line or three or more. In the case of an *explanation* it could be many lines. These would be separate units of analysis on a page. I developed a tool in Excel for textual functional analysis which allowed me to categorise each unit of analysis into for example; a *question, question and answer, explanation, definition, example, foregrounding, cross referencing, function and skills, etc*. each of which in turn became a *discursive feature* deployed within an overarching *discursive rule* within that section of *pedagogic discourse*. Appendix C is a visual depiction of the frequency of each of these instances and the number of lines each occupies on each page.

This analysis informed questions for the Second Interview and the subsequent analysis of the redesign – key to uncovering the *discursive features* which were driving the 'internal logic' (Bernstein, 2000, p.12) of the *pedagogic discourse* of the CR.

Process of data analysis.

I tried to be as consistent as possible with the pedantic counting of lines and the interpretation of each *discursive feature*. I tried to combine some of the *discursive features* to create a broader view, but that required more justification, cross checking and time. The more dominant features emerged in any event and the nuances of the less dominant features served the major objective of the tool which was to illustrate the pattern of *discursive features* which would then feed into the broader analysis of the *recontextualising rules*. A selection of the dominant *discursive features* in chapter 2 appears in graphs two and three in Appendix C.

In order to operationalise the descriptive data gathered I needed to develop a L2 which would assist in analysing how the *discursive features* impacted on the relative *framing* (F+/-) values of *selection, sequencing* and *pacing* which combine to form the ID. *Selection* is defined by what meanings the CC/ author has chosen for students to learn, *sequencing* represents the order that the CC/ author has chosen to present the *selection* and *pacing* is how quickly the student is expected to grasp the selected text.

The RD which is produced by the *rules of social order* is defined by the 'forms that hierarchical relations take' (Bernstein, 2000, p. 13) between the *transmitter* (CC/ author) and the *acquirer* ('imagined learner') including expectations about 'conduct, character and manner' (Bernstein, 2000, p. 13).

The L2 below has allowed for a range of strengthening (F+ ↑) and or weakening (F- ↓) of *framing* with F++ and F - at either end of a continuum. It also includes 'Social and Hierarchical Relations'. These assumptions were made for the purposes of an L2 and may vary in the actual data analysis. Where there is an *emphasis* or a *summary* in the text this would be **very** strongly framed (F++),

definitions, *examples* and *explanations* are generally strongly framed (F+) whereas a *question* which calls upon the reader to provide the answer or example is a *weakening* of the framing (F- ↓). On the other hand, a *question and answer* unit of analysis is typically where the two discursive features go directly after one another and this *selection* and *sequencing* could be very strongly framed (F++).

Data from the Second Interview had bearing on *pacing* as the CC was able to provide the timeframes for the lectures on the two chapters which are reflected in the L2 table below.

External Language of Description of CR and Second Interview					
Concept	Indicator	Discursive Feature	Examples from data	Analysis /coding	
Selection and Sequencing				ID	RD
F++	There is very strong control by the CC over what to learn and the order in which it must be learnt.	Question and answer Emphasis	How do we "make financial sense of the future"? • We analyse the past; • Model the future (i.e. forecast future financial outcomes); • Assess and mitigate the risks involved; and • Communicate what the results mean in financial terms. (CR, p.7, ll. 18-24) **The overarching principle is that when we need to compare the values of cashflows, we must compare their values at the same time point. (CR, p.23, ll.11,12)**		
F+	Relatively strong control by the CC over what to learn and the order in which it must be learnt.	Explanation Foregrounding; with figure	The two main characteristics of something that is risky are that it is **uncertain**, and that the outcome has a financial consequence, or **value**, attached to it. There are non-financial risks (can you think of some?), but for the purposes of this course, a financial value must be attached to the outcome in order for us to consider the event "risky". (CR, p.10, ll.14 -18) This type of diagram is called a **cashflow diagram**. Drawing a cashflow diagram helps you ensure that you have accounted for all cashflows, and it helps you spot patterns in cashflows which may make them easier to value (more about that later). (CR, p 24, ll.25-28)		
F-↓	Handing over control of what to learn and the sequence in which it must be learnt to the student. This never happens in Module 1, only a weakening as highlighted adjacently in the last part of the example.	Example	**Example 1.1** Financial risks are everywhere: • Someone who owes you money may not pay you back • The interest rate on your student loan may go up, making your repayments more expensive • You may fail a year and have to pay for an additional year of study • You could crash your car and need to pay for repairs • You could get a girlfriend/boyfriend - they are expensive! Think of the financial risks that someone who runs a corner shop may face. What about the financial risks of a building contractor? (CR, p.7,ll.5-14)		
Pacing					
F++	The CC/author has tight control over the pacing of the PD.	All discursive features pp 7 – 15	**INTERVIEWER:** ... how quickly did you go through the first chapter? **INTERVIEWEE:** I think it's one lecture. (SI, p.38, ll.884, 885)		
F+	The CC/author has firm control over the pacing of the PD.	Example	**Example 1.5** Let's see if we can apply the Actuarial Control Cycle to our personal problems (this is why people think actuaries are strange). Let's say that the problem is organising a party. (CR, p.13, ll.29- 31)		
F-↓	The CC/author allows for a weakening of the pacing of the PD.	Margin Margin	? Can you see the parallels between this present value and the calculation of /above? (CR, p.31, Margin) **Can you see how nominal**		

			rates may be good for marketing **loans?** Have a look at these:. You can see that any convertible rate is in actual fact higher than the nominal rate which is quoted. (CR, p.59, Margin)		
Social and Hierarchical Relations					
F++	The CC/author is set up as a powerful authority over the knowledge and the students. The distance between the authority and the student/reader is great.				
F+	Authority over the reader is apparent and there is a clear hierarchical relationship between the CC/author and the student/reader	Emphasis	(But do not memorize formulas like this one: memorizing formulas is never a good way of understanding what you are doing) (CR,p51.ll.26,27)		
F-↓	The social and hierarchical relation between the transmitter and acquirer begins to flatten.	Question and answer	**1.1 What do Actuaries and Quants do?** Actuaries and Quantitative Analysts (we'll call them quants from here on) are financial professionals who deal with the **financial impact** of **risk**, typically with a **long-term** outlook**.** (CR, p. 7, ll. 2 – 5)		

Table 2. External Language of Description for the Course Reader.

Second Interview.

Development of research instrument.

The preparation for the second interview was the CR analysis. A lot of time was spent preparing the questions. The final schedule ended up being over 4,000 words as I quoted extensively from the CR and probed the origin of the course objectives. The interview schedule is not provided in the appendices for reasons of space, but is available on request. The purpose of the Second Interview was to unravel how and why the CR was redesigned, verify and clarify any queries pertaining to the CR analysis and to give the CC a chance to explain how the course objectives were reflected in the CR. Objective five which focuses on 'bridging the gap between school and university' was amongst the key questions in addressing epistemic access. The final schedule was sent to the CC a few days in advance of the interview.

Process of data gathering.

The interview took place on 17 December 2014 and lasted for just under three hours. Consent for this interview had already been cleared at the time of the First Interview. The process was the same as it was for the First Interview, the recording was transcribed and the CC was provided with a copy for checking.

Process of data analysis.

I used Excel to reorganise the data along the lines of the most dominant course objectives as well as *selection, sequencing* and *pacing*. I did not develop an L2 for this dataset as it served as supporting data for the CR analysis. It would confirm, clarify, help to elaborate and build on the analysis of the CR and the *recontextualising rules* that structured the CC 's approach to the CR design.

Summary.

In this chapter I have sketched the outline of the three datasets, how they were gathered, the method of enquiry for each of the sets and how the data could be operationlised through the use of two L2's. The next chapter covers the analysis, findings and discussion of the First Interview, beginning with the assumption of actuarial science as a *region*.

Chapter Five

First Interview: Analysis, Findings and Discussion

Overview

This chapter covers the nature and description of the profession, probes what knowledge is valued in the *field of practice* and what knowledge is valued in the discipline[1] - in essence the focus is answering the first two research questions as revealed in the data from the First Interview (FI)[2] and to establish from that if actuarial science conforms to the description of a *region*.

Nature and description of the actuarial profession as a *region*.

The CC discloses that actuarial science is a 'business discipline[3] first of all' (FI, p. 1, l.14). A *singular* is defined primarily by its inward focus, its connectedness to the theory of a discipline, its loyalty to the abstract and intellectual boundaries that sets it apart from other disciplines. Although the noun 'discipline' has been used, the interviewee locates it in the working world, characterised by the adjective 'business'. This 'discipline' has a predominantly outward focus which may lead us to believe that the profession could fit into the definition of a *region* or a *generic mode* although this remains to be verified through the analysis. If it were not corroborated with the next characteristic that it has a 'strong numerical and mathematical core to it' (FI, p. 1, ll.15, 16) being a 'business discipline' could have led us to assume it may be leaning towards a *generic mode*. There is tension between the adjective and the noun; an allegiance to 'discipline' which harkens back to the abstract and the intellectual of the *singulars* on the one hand, but a grounding in serving the demands of 'business'on the

[1] By discipline I mean curriculum knowledge.
[2] FI is the acronym that will be used in citations from the First Interview
[3] The CC clarifies later that 'I could also interpret discipline as the whole field of actuarial practice' (FI., p.21, ll. 489-491)

other. Young's listing of the characteristics of the emergence of the *generic mode* referred to as 'genericism' in his work of 2008, clearly states that it emerged outside of the 'formal curriculum' and 'was based on what was assumed to be common to a widening range of occupations, tasks and jobs' (Young, 2008, p.155). The actuarial profession would of necessity need to include some of these elements, later referred to as *normative skills,* but could not be defined by them alone. I dismiss therefore that the actuarial profession is a *generic mode*.

Defining the profession as a 'business discipline' is to make the distinction between a pure and applied science up front. It is not just mathematics for the sake of mathematics, it has a purpose. We now have clarity on two dimensions; the profession is using the *singular* mathematics to engage with the world of business or '*Fields of practice'* (Muller and Young, 2014, p.14). However, as the definition continues, there is more which could deepen the theoretical underpinning of the actuarial profession, but broaden the scope of application; 'but the way that we think about it, is actually that it's focused on putting a financial value on risk.... And we describe risk as being a combination of uncertain events that have a financial outcome,' (FI, p. 1, ll.17, 18). There is a wide range of events in the 'business world' that could be deemed uncertain all of which have a financial outcome, 'and then really any actuarial work that you come across can be brought back to those two components' (FI, p. 1, ll.19, 20). Although there has been a narrowing down to the two components of risk, their contexts (*fields of practice*) could vary considerably making the profession 'kind of less well defined' (FI, p. 1, l.23). Originally 'skills' which 'were much more closely tied to insurance and investments' are now being applied 'across the board into banking or into completely other parts of the business world, that wouldn't have been traditionally actuarial' (FI, p. 1, ll.25-29).

The analysis of the First Interview indicates that boundaries in the *field of practice* have weakened as the domain in which the actuary operates has widened. This implies a weakening of the *classification* (C+ ↓) of the profession currently. As the *field of practice* widens, the profession takes time to gain jurisdiction over those areas, lagging behind the proliferation of actuarial skills in new contexts. Within the broadening of actuarial work, we cannot say whether it is the e*pistemic relations* that are more dominant (ER+) or the s*ocial relations* (SR+ /-) in those contexts because at this stage of the analysis there is insufficient evidence to describe either the knowledge used or the actuary using that knowledge. I now return to the concept of applying appropriate actuarial principles to specific, but wide ranging contexts to understand what knowledge is valued in *fields of practice* - the nexus of actuarial expertise (*knowledge*) - with the expert (*knower*) as the starting point.

Epistemic and social relations count in the description of an actuary.

It is clear from the analysis that actuaries are elevated above other business professionals because of their ability to apply their reasoning to new situations, think ahead, think widely and strategise; taking current and potential future factors into account for the business in question. Their expertise is the ability to make judgements on information garnered and observed, taking risk which is of paramount importance, into account (FI, p. 1, ll.33-40, 330 -335).

These descriptions place value on the *knower* as superior because of their difference (SR+). The mathematical core (*knowledge*) is not mentioned although I assume it is embedded in the actuary's ability to understand, assess and respond to the particular context of *risk* for a business. If this assumption is correct, the actuarial profession implies a position of an *élite code* 'where legitimacy is based on both

possessing specialist knowledge and being the right kind of knower' (Maton, 2014, p.31).

In view of its 'strong numerical and mathematical core' the profession would not be a distinctly *knower code* 'where specialised knowledge and objects are less significant and instead the attributes of actors are emphasised as measures of achievement,' (Maton, 2014, pp.30, 31). Rather 'it's a combination of skills, and it's a combination of thinking,' (FI, p. 3, ll.57, 58). This combination of knowledge lends itself to the concept of a *region*.

Two layers of actuarial expertise in practice and professional exams.

'Epistemic relations and social relations can be used to describe the *focus* and to analyse the *basis* of practices' (Maton, 2014, p.31). The professional exam structure reflects two distinct layers. The first is the technical layer and must be mastered before the second specialist layer. This claim is supported by data from the First Interview. There is a value placed on sound technical expertise in a range of fields 'to be able to think widely and evaluate these wider impacts. And those technical disciplines are usually the numerical, statistical, mathematical, and also the economics and accounting and all those kind of skill sets come in to that,' (FI, pp. 2, 3, ll.44-49).

However, being able to do the calculations doesn't make one an expert, even understanding the problem and applying the skills from various disciplines it appears is not enough '...but it's much more…to me it's much more about being able to *see* [italics added] the problem, understand what needs to be done to evaluate, or to solve it, and then use the skills that they've acquired to solve it' (FI, pp. 3, ll.49-54). This is the second, more definitive layer of the expert. It is clear that the focus on sound technical knowledge (ER+) is a *basis* (Maton, 2014) for legitimating the expertise of

the actuary while the second layer which is acquired subsequently and over time in the *field of practice* implies an acquired disposition which then strengthens the *social relations* (SR+ ↑).

Second layer hones specialised skills of two types of actuaries.

Setting aside for a moment that there is a widening of application of actuarial skills in business, currently it is possible to qualify in one of six areas and therein distinguish two types of actuaries 'either liability base, which is your insurance, or your asset base, which is your investment type of actuaries, and…well investment and I suppose the risk as well' (FI, pp. 4, 5, ll.91-94). It is possible to group them thus as they share the same theoretical foundation. Take for example the principles of insurance applied in the fields of 'healthcare or general insurance, which are different from each other and have a different experience, but it's very much strongly the same principles' (FI, pp. 4, 5, ll.96-98). The fourth year at UCT, provides preparation and orientation to the six areas in the course Asset and Risk Management '...it deals with all of them, and it gives you grounding in all of them, which you can then take forward into your specialisation and apply it more specifically within the specialisation' (FI, pp.5, ll.99-100).

Long route to qualification aid to acquiring 'big picture skill set'.

There are many reasons why the route is so long including '…that quite a lot is required of actuaries, in terms of their ability' (FI, pp.5, ll.102-103). To counter the long route to qualification and provide an interim qualification for those who choose not to spend time in specialising 'they created an intermediate associateship, which you can get after a much shorter period of time' (FI, pp.5, ll.106-107). Those with the associateship would have good technical skills (first layer), but lack that 'big picture skill set', 'which to a certain extent I actually find that students who have worked, are

actually much better suited to understanding those big picture issues, because they can then apply it back into the workplace' (FI, pp.5, ll.112-1114). Even when students qualify very shortly after university 'I feel like they just have all these raw skills but they haven't really been able to map it on to the business environment' (FI, pp.5, ll.115-116).

As an expert the CC recognises when there is a shortfall of these skills on the part of the novice and by implication when the skills are acquired. This could indicate that the *social relations* strengthen over time (SR + ↑) to match that of the *epistemic relations* which were first acquired. This is not to say that the knowledge of the 'big picture skill set' is legitimated solely on the basis of strong *social relations*, but that it appears to be a critical part of it. The ideal actuary possesses '*both* legitimate knowledge *and* legitimate dispositions' (Maton, 2014, p.31, original emphases).

Knowledge base used to address risk in workplace is context dependent.

'It really depends on where in the workplace you are, because it comes up in different areas, and it really depends on what area you've ended up working in' (FI, p.7, ll. 156,157).

The workplace mirrors to an extent the layers of the profession. The recently graduated junior actuarial analyst would initially work with knowledge from the first layer completed at university (FI, p.10, ll. 224- 231) while the more experienced analysts would use their specialised knowledge to value the financial impact of risk and the management of that risk.

Actuaries working in the general business environment would be considering the overall risks for a particular business, (FI, p. 7, ll.163 -165) which requires specialised knowledge of risk and therefore has strong *epistemic relations* (ER+) and yet the *classification* of the full body of knowledge to which skills are applied in this

setting is broad, weakening the boundaries between what is purely actuarial and what is general business knowledge. Foci could vary considerably depending on the nature of the business being assessed. However, the actuary working outside of already established actuarial domains requires experience and credibility which would bring the *social relations* (SR +) very much to the fore. The actuary would have needed to demonstrate ability over time to be entrusted with the risk management of a business.

All actuarial work narrowed down to risk as threat or risk as opportunity.

Not all risk is bad, there is a 'balance between risk as threat and risk as opportunity, so a lot of actuarial work has got to do with taking…seeing risk as an opportunity' (FI, p. 8, ll.165 – 167). These two distinctions of risk demarcate broadly the areas the actuary will work in; valuing risk and managing risk (FI, p. 8, ll. 171,172). However, there is always knowledge of other disciplines apart from the advanced statistics and financial mathematics that creates better understanding of risk, bringing once again the notion of actuarial science as *region* to mind.

Classification of the body of actuarial knowledge valued in the workplace is not strongly bounded at a superficial level considering the range of disciplines that needs to be understood to practice effectively and the range of contexts which involve risk. The specific context will dictate what skill set the actuary will use to solve a problem (FI, p.11, ll.258 -259).

Senior actuaries draw on the raw statistical skills of junior actuarial analysts with their own statistical knowledge working in the background. 'So I don't think everybody uses those skills as they were intended... it just sits there in the back of your mind, and it informs how you think' (FI, p. 12, ll. 274-278). This implies an embedded knowledge which is strongly classified (C+) but which can weaken (C- ↓) or strengthen (C+ ↑) when applied to the needs of the context.

Normative skills are a 'component' but are not actuarial science.

What is considered 'normative' is 'the ability to work with others basically and to make your work meaningful' (FI, p.13, ll.318, 319). Normative skills play a part in building the full complement of skills required by the actuary, but they are not to be confused with the 'thinking skills' which arise from actuarial theory, the core actuarial subjects (FI, p.12, ll.287, 288). Excel and Computer Science for example are 'tools' (ll.282) where actuarial thinking is used to respond to a problem and or provide a solution. These fall 'under the more normative component actually' (FI, p.12, ll.290) and are a necessary adjunct to operating effectively as an actuary.

The use of these skills may be a differentiator between actuaries and could imply relatively stronger or weaker *social relation* (SR+ ↑↓), but not being actuarial knowledge per se and not examined directly (exemption) would imply weak *framing* (F-). However, there is still uncertainty as to whether they are strictly 'normative' for the interviewee (FI, p. 14, ll. 318,319).

Communication and leadership as normative skills.

Communication and leadership are intertwined, but communication is essential for the actuary; 'increasingly the emphasis is on an actuary not just being able to solve a problem, but also explain the solution and explain the problem' (FI, p. 12, ll.290). Actuaries rarely work on their own, seldom only with other actuaries and mostly in a team (FI, p. 13, ll. 308-311). Being a team player therefore is vital and within teams opportunities for leading arise.

Effective communication is valued in the workplace, relying both on specialised knowledge (ER+) and the means of getting that across to a lay audience. This skill is seen as 'the ability of being able to take complicated technical concepts and break them down into the level of language that the audience will understand' (FI,

p. 13, ll.303-305). Although the skill may be 'normative' which would imply weak *classification* of the knowledge (C-), accreditation is firmly controlled by the profession in the form of an exam, which is indicative of strong *framing* (F+). The student would have to display adequate technical knowledge (ER+) and communication skills (SR +) to recontextualise the knowledge appropriately for a given audience. Here is an instance where there is high regard for the normative, but not without the underpinning of the specialised knowledge of the field.

Communication as normative is not industry specific discourse.

The discourse of the industry is context bound; specialised areas will have specialised terminology, but usually graduates don't start in those settings - they progress to that stage. In other words, 'language' has a generic or everyday (communication) level of discourse which graduates are meant to have on entry into the workplace, and a highly technical discourse which takes time to perfect and is a help 'to get that big picture right' (FI, pp.19, l.444). Proficiency in the discourse of actuarial science takes time and by the time the actuary needs to interpret complex legal texts they are quite senior (FI, pp.19, 20, ll.439 – 454).

Industry specific discourse is not a normative skill. It is strongly *classified* (C+) because it is directly connected to a specialised field and it is also strongly *framed* (F+) with precisely defined terms because of the legal ramifications of the concepts that are contained in the language appropriate to that specialisation which limits where and how the language may be used. This aspect of actuarial discursive knowledge is legitimated by strong *epistemic relations* (ER+) and strong *framing* (F+).

However, if the neophyte is able to **sound** as if they have got 'that big picture right'– it could be to their advantage. 'I think the only other mention of language

could be that one of the things that we try and train our students, at the senior level to do, is to sound like an actuary when they write the exams' (FI, pp.20, ll.462 – 464). Strong *social relations* (SR+) dominate in this instance, encouraging students to acquire a disposition, to move from *recognition* to *realisation* rules (Bernstein, 2000, chap1. p.17).

> …even if you don't quite know everything about the answer, still sounding like somebody who has a grasp on it, who sees the big picture, that's what we look for. And a lot of borderline cases get decided that way, did that person sound like an actuary. (FI, pp.20, ll.464 – 468)

Research was acknowledged in the interview as another normative skill set which the actuary must possess, but it was not elaborated on.

The essential 'big picture skill set' is not normative.

Although the 'standard distinction is between technical and normative' (FI, p.9, l.212) there is 'also the application kind of, the bigger picture kind of skills, and that's not normative, that's something else…I see that as a different thing' (FI, p.9, 10, ll.215-217). Graduates will start off as junior members of a team, 'they won't be applying their bigger picture skills as much, they will be applying the technical skills to something that somebody else has figured out as a bigger picture problem,' (FI, p.9, 10, ll.225-227).

Discussion: social relations (SR + /-) within 'big picture skill set'.

This implies that the novice is inculcated into a way of thinking over time. If this is so, then this skill has strong *social relations* (SR+ ↑) underpinned by strong *epistemic relations* (ER+) acquired first; 'it's only when they progress in business…in their business career, that they start being in charge of a team or a project and then they start actually having to see the problem themselves and try and develop a

solution,' (FI, p.9, 10, ll.228-230). The highly valued skill set that is not normative and that the 'big picture' forms an integral part includes ' being able to identify the problem, describe the problem and see the repercussions and the bigger picture of the problem' (FI, p.9, 10, ll.221,222). However having named the contents of the set, does not provide the actuary with a means to acquiring the skills. This could mean that the knowledge for this skill set (although present) is weakly *classified* (C-) which seems to be at odds with the expertise required to execute appropriately, but because experience plays an important role in acquiring the skills this points to strong *social relations* bordering on a *knower code* (ER-, SR+).

No consensus on providing solutions to complex problems in the workplace.

Although there will be questions where there is a single answer to a problem, 'Most of actuarial problems are the ones where there isn't one correct answer, and the answer is "it depends",' (FI, p.15, ll.348, 349). Actuarial solutions have a bias towards stakeholders so there will always be different outcomes for the same problem, depending on the angle of approach (FI, p.17, ll.404, 405). Nonetheless there would be assumptions and the solution would have to be adjusted from time to time as assumptions are checked against reality, 'but you can't set it…just set it there and wait for it to arrive, you have to manage it constantly' (FI, p. 16, ll.371 -373).

> the more interesting actuarial work and where most of actuarial work is going is setting out to try and develop something new, to go into a new field, yes to solve problems that you need judgement for, I think that's really where actuaries are needed, because everything else can be done by a computer really, so it's that judgement, and that bigger picture, and often defining the problem is part of the judgement. (FI, p. 16, ll.330 -335)

What is being described above could form part of the elusive 'cognitive substrate of all professional decisions and judgements' (Muller and Young, 2014, p.7)

which is beyond the scope of this project. I now move on to examine knowledge that is valued in the discipline which feeds into the first layer of the profession.

What knowledge is valued in the discipline.

I have used the word discipline both in this analysis and in the interview to refer to all curriculum knowledge (FI, p.21, ll. 479 – 484). The object of analysis is primarily the university curriculum, although the professional curriculum may also be referred to. The CC's use of 'discipline as the whole field of actuarial practice' (FI, p.21, ll. 489 – 491) is too broad to be useful in this analysis.

The CC feels strongly that there should be an 'overlap' between what is being taught at university and what is valued as knowledge in the *field of practice* and that if there isn't 'we should be aiming to make it overlap' (FI, p.22, ll. 504-509). Additionally, the CC sees that the same value that is placed on sound technical knowledge in the *field of practice* as a foundation; and the value for understanding the wider implications of risk using actuarial thinking skills or reasoning, are what is valued in the discipline (FI, p.22, ll. 505 – 508). Within the macro context of the university, once again the two layers of the profession both of which according to the CC are 'at the core of our teaching' (FI, p.22, l.508), are recognisable.

Maths in service to actuarial science.

Many students are attracted to the discipline because they are excellent at maths. It is very important for studying actuarial science, however 'It's more like the soil in which the discipline grows, you can't do actuarial science without being good at maths, but actuarial science is not maths' (FI, p.22, ll.518, 519).

For the purposes of gauging the relative strength of the *classification* of the knowledge of actuarial science, I will assume that pure maths as a discipline is a typical *singular*, strongly bounded to the abstract and advancing its own production of

knowledge by focusing inwards. The discipline of actuarial science on the other hand has a triple dependence on maths, from which it reconstitutes knowledge for its own purposes. First in 'being able to solve mathematical problems and see the logical mathematical structure behind problems' (FI, p.23, ll.523, 524) and secondly 'you have to learn a lot of maths, in order to be able to do financial maths,' (ll. 527,528) an 'offshoot of Maths' (l. 527) and thirdly 'the pure maths that they learn is much more the soil in which they grow things like advanced statistical skills'. Actuarial science is conforming to the characteristics of a *region*, being spawned by maths and heavily dependent on stats which is also indebted to maths. Maths is at the 'core' (FI, p.1, ll.15, 16), but 'it's the kind of the underlying background knowledge, not directly applied knowledge' (FI, p.23, ll.528, 529). This emphasis is reflected in the degree which includes two years of pure maths and three of statistics. It is only in the second year at UCT once they have mastered half the maths and a third of the stats content that students begin with the first actuarial science course, financial mathematics. This form of control over *entry* into the first actuarial course implies strong *framing* (F+) with regard to access. However, it is the theoretical underpinning that is largely in the hands of others that weakens control over the *framing* of the transmission of the knowledge.

> we have certain outcomes which we look for, in terms of being able to do certain statistical types of models, I don't know how much those overlap with the syllabus at UCT, and it's also out of our hands in some ways, because we don't design the statistical modules, we just choose the ones that best suit us.' (FI, p.23, ll.533 - 537)[4]

[4] In the quote above the CC is speaking as a member of the profession; 'we have certain outcomes that we look for' and as a member of the academic staff, 'it's also out of our hands'.

Classification of the knowledge constituting the theoretical underpinning is weakened by the fact that these courses do not serve actuarial science solely (C+↓). 'I know that they come out with some of the skills that we look for, but I don't know what else they've learned that we might not know about'(FI, p.23, ll.537 - 539).

Actuarial theory is the heart of the epistemic relation.

Actuarial theory specifically is defined in the actuarial courses. 'Introduction to Financial Risk[5] as it is now called, is an actuarial subject, Financial Maths is what we see as an actuarial subject, Models and Contingencies, actuarial and then Financial Economics and Actuarial Risk Management' (FI, p. 24, ll. 550- 552). There is always a 'mix' of theory and application, although Models and Contingencies in the third year 'are heavy on the theory, still applying it to real world scenarios, I mean you don't just do the maths in abstraction, but most of the time you're really just learning techniques' (FI, p.24, ll.554 -556).

The relative strength of the *classification* of the knowledge appears to vary across the years. If we assume that the more theoretical the course, the more inward the focus on the discipline then it may be fair to say *classification* starts in a moderate position of strength with potential weakening (C+↓) in the first year introductory course where 'even though they learn theoretical techniques, there's always an answer to an application need' (FI, p.24, ll.557 -558). It then strengthens through the more theory laden second and third years (C+ ↑) reaching very strong *classification* with Financial Economics in fourth year (C++) (FI, p.24, ll.561, 562). Asset Reliability Management in final year 'is very much application only, and it's the first time they come across an application only subject,' (FI, p.24, ll.554 -556) where *classification* weakens considerably (C+ ↓). Despite the broadening of the application it would seem

[5] This is the new name (2014) for the course "introduction to Actuarial Science'.

that strong *espistemic relations* (ER+) are always valued, but not without knowing how to apply this specialised knowledge to a problem – a response which is not 'formulaic' (FI, p.26, l.597) and relies on *inferential reasoning* of the student developed over time.

Inferential reasoning highly valued and shaped by style of questioning.

The complexity lies in identifying the problem and then applying the appropriate 'bits of theory' (FI, p. 26, l. 596) to solve it. It isn't enough to know which bits of theory it is knowing *how* to apply them and when it is appropriate that completes the skill set. Questions are seldom straightforward 'in a lot of cases it's different, it's phrased differently and it asks you to figure that out' (FI, p.25, ll.586, 587).

The purposeful rephrasing of questions in order to make them less explicit so that the *acquirer* (Bernstein, 2000) has to be more creative and involved in working them out, is indicative of weak *framing* (F-). The *transmitter* knows what question lies within the question and this may be a clue as to the *social relations* of the knowledge of the prized thinking skills.

> I would say that the majority of the work that we do does require a lot of synthesis and comprehension of the question and then finding the right bits of theory, or even if you know what theory it relates to, finding the right solution and it isn't formulaic. (FI, p.26, l.597)

This 'know how' knowledge is not easily defined, but it would appear that the student's knowledge 'of the *inferential relations* between the propositions' (Winch quoted by Muller and Young, 2014, p.6) is key in the process of execution. With this lens 'thinking skills' or reasoning, favour strong *epistemic relations* (ER+) although

c*lassification* of the knowledge weakens (C -↓) as the discipline fails to insulate the boundaries of the knowledge of 'know how'.

This approach implies weak *framing* over the ID which places relatively more pressure on *recognition* and *realisation rules*; 'Power is never more fundamental as far as communication is concerned than when it acts on the distribution of recognition rules' (Bernstein, 2000. p.17). However, attempts are made to embed a way of reasoning right from the start with a focus on a wider view and where the question being asked fits in.

> ...even at first year level I try and get them to have that big picture, so it's always about where does this fit in, why you asking this kind of question, what is…you know what value does this type of question have, and then how to answer the question. (FI, p.26, ll.603 -606)

It isn't certain if this approach is sustained throughout the actuarial courses, as 'the senior application subjects and the more junior theory kind of subjects will have a very different approach' (FI, p.26, ll.611, 612) which leads me to assume that the *framing* of inferential reasoning is weak (F-). In addition, the fact that there is no direct route into the knowledge of thinking skills makes the knowledge tacit and correspondingly weakly *framed*. The transmitter creates the question within the question and recognises when the student has answered it - another clue as to the relative weighting of *social relations* in acquiring inferential reasoning. At this level we can see its presence, but not comment on its strength. Pedagogic practice is not being analysed here, but the data itself has evidenced that this knowledge is not theorised in the actuarial courses although it is required and it is not explicitly taught although it is examined. This confirms weak *framing* of inferential reasoning (F-) at a macro level of the curriculum.

Summary.

In this chapter I have tried to address the first two research questions:

1. What is the nature of the knowledge valued by the actuarial profession in the field of practice?
2. What type of knowledge is valued in the discipline of actuarial science?

The findings strongly suggest that the knowledge valued in both domains conforms to the description of a *region*. However, this is not a simple answer to understanding the forms of knowledge that make up this *region* as the points of discussion also revealed that many disciplines feed into the two layers of actuarial science and the differentiating skill of professional judgement which is its distinguishing feature, is not easily acquired. With strong *epistemic relations* (ER+) characteristic of the first layer and equally strong *social relations* (SR+) of the second, this *region* could be said to be an *élite code* (ER+, SR+). The next challenge is to analyse Module 1 of the CR and see whether and how knowledge that is valued in the *field of practice* and the *discipline* is made accessible to the student.

Chapter Six

Revealing the Recontextualising Rules in the Second Interview and Course Reader

Overview

This section will show how the *internal language of description* (L1), Bernstein's concept of *framing* has been applied to the Second Interview (SI) [6]and course reader (CR). The Second Interview covers the motivation for the redesign of the course, its objectives and detailed responses to examples of text from the first two chapters of the CR that were provisionally analysed. The focus in this section is on showing what these two data sets reveal about the *recontextualsing rules*.

What prompted the redesign of the course?

Critical to bringing the course redesign to fruition, was the willingness to take ownership of convening it; '...Well the reason why I volunteered to convene it was because I wanted to redesign it and I wanted to redesign it because I thought that no design had been done,' (SI, 2014, p.7, ll.146-147).

If there appeared to be no design in the previous CR then that would be termed weak *framing* of the *instructional discourse* (ID), leaving students to make their own links would also imply weak framing of the *regulative discourse* (RD) (refer to page 35 of this thesis). On the other hand with regard to the potential 2013 CR, the *framing* of the *regulative discourse* is strengthened at the outset as the redesign is contemplated with the student in view; 'if I was going to run this course which is what I wanted to do, it would have to be redesigned in a way that made sense to me and to the students' (SI, 2014, p.7, ll. 151-152).

[6] SI is the format that will be used in citations from the Second Interview.

Seminal to the redesign that was to bring about this 'imaginary discourse'[7] was identifying the opportunity to enhance the students' experience of actuarial science at first year level (SI, p.5, ll.107-108). It was clear to the course convenor (CC) that providing the links between theory and practice would help students make sense of the discipline. This exhibits a tendency towards strong framing of the *instructional discourse* by wanting to be in control of what they learned (F+). Gaps in the old course were being identified as the needs of the students were being borne in mind. These gaps indicate weak framing (F-) of the *instructional discourse* of the pre 2013 course. 'I could do so much by putting it in context' (SI, p.5, ll.114 – 116).

The lack of cohesion and structure pre 2013 could be attributed to a wide range of reasons, not all of which are explored, but it would imply that the *framing* of the *instructional discourse* was weak (F-). The CC highlights the fact that this is not an exemption course[8] which implies that there is no formal engagement between the university and the professional body around what content should be covered. This could account for the seemingly haphazard nature of its design, most notably in the CR (SI, p.9, ll.210-213). With 'no direction' or 'strategic thought to it', labelling the purpose of the course 'vague' is confirmation of very weak framing of the *instructional discourse* (F--) leaving the student to do much of the learning on their own resulting in a correspondingly weakly framed *regulative discourse* (F--). Bernstein asserts that 'where there is weak framing over the instructional discourse, there must be weak framing over the regulative discourse' (2000, p.13).

[7] Quoted earlier in the literature review; Bernstein, 2000, p.33.

[8] An 'exemption course' is a course which would count towards the student's professional qualification as an actuary if according to the agreement between the university and ASSA the student had passed sufficiently well enough. See Chapter 1.

The new CR would have a clear purpose.

"I started off saying 'what is the purpose of this course?'" (SI, p.10, l.220). In the pre 2013 phase the course was delivered by a large number of guest lecturers and this would be the first change. The CC wanted more control over the content and delivery which indicates a predisposition to strong *framing* of the *instructional discourse*. The CC delivered between 60 and 70% of the lectures in 2013 with the balance being delivered by other staff members. As far as the 2013 CR was concerned the CC maintained it was in complete alignment with the course structure and content; 'the idea is that the course reader by itself should stand and be a reference work for the students to be able to say, if I know everything in there then I know 95% or 98% of what I need to know,' (SI, p. ll.319-321).

Curriculum alignment is achieved.

Previously the major area of conflict was that the course was operating as an implicit 'filter'[9] for progression in the degree, but from 2013 it would no longer be the case (SI, p.19, ll.441-442). The CC was free to focus on what was core to the discipline of actuarial science and how that could be recontextualised in the course and CR.

The Module 1 is entitled *Risk and Value*. It clearly reflects objective one by introducing students to the concept of financial risk, with its components of uncertainty and time value of money and objective five which is to help students from disadvantaged backgrounds bridge the gap between school and university. Objectives two and three (Appendix B) feature here and there, but objectives one and five dominate.

[9] The idea of a 'filtering course' is explored again with objective five in greater detail. Essentially it means that it should be hard enough to separate out the weaker students so that they do not continue with the degree programme.

Apart from student evaluations and the results of the final exam, if the findings show that the *instructional discourse* is strongly framed and that the *regulative discourse* is too, then we would be able to say with relative certainty that the fourth objective which is 'allowing students to make an informed decision whether to continue with the course' would have been achieved. Although it may not follow that all *recontextualising rules* are strongly framed in the *instructional discourse* and that there is a one dimensional hierarchical relationship between the transmitter and acquirer. We move onto the analysis of the first chapter, tied closely to the first objective.

Analysis of first chapter in conjunction with course objectives.
First Objective: introducing students to the concept of financial risk with its components of uncertainty and time value of money.

This is the objective around which the entire course hinges, 'at the centre of the course and at the centre of our discipline is the idea of financial risk and its components of uncertainty and value (SI, 2014, p.18, ll.403-406).

When questioned on *how* the CR reflected the core concepts, the CC insisted that it was more than *selection, sequencing* and *pacing*

> ...it was definitely all of those things and more, I mean sequence and pace but it's also about explaining and it's also about language and it's also about sort of voice and language, you know it's about linking understanding to visual and real and mathematical concepts and trying to bring all those different things across in different ways so that there's more than one way of understanding something. (SI, p.12, ll. 260-264)

There are two principles operating here. There is always selection whether intuitive or conscious. There is a *discursive feature* [10]that has been selected to convey

[10] A discursive feature could be an explanation, example, definition, question, cross referencing, foregrounding to name but a few. See chapter four.

the selected content, but there is also a principle of being explicit which underlies the selection. 'I think my underlying principle...is that I fundamentally want people to walk out of a lecture or out of a course or whatever having understood it' (SI, p. 13, ll.285-287). Wanting students to understand and creating ways for that to happen is evidence of explicit control over the *pedagogic discourse* and therefore strong *framing* (F+) (Bernstein, 2000, p.13).

Selection: dominant rule of discursive order in organising course and course reader.

Having come to the conclusion that 'at the centre of our discipline is the idea of financial risk and its components of uncertainty and value' it would make sense to organise the text around it. 'so it sat right in the centre of it and it really felt like once I had that and everything else started around it and I think there are still ways of reshuffling the order of things but it always refers back to that central concept' (SI, p. 18, ll. 418-421). The CC refers to the defining of the central concept as her 'eureka moment' and although it may not appear very different to what there was before, it will be shown that the impact on the new CR was huge. Once the central concept (core to the discipline) had been selected it allowed for flexibility in sequencing the categories of the discipline which would follow. Moving from 'uncertainty and loss' (pre 2013 CR) to 'uncertainty and value' made it possible to 'get from it to insurance, you can get from it to pensions, you can get from it to assets and that sort of thing, (SI, p. 18, ll. 414 - 418).

Shortly after this choice was made and the CR redesign was in progress, the CC attended an ASSA educational session where it was agreed by the majority of actuaries present, that an actuary is a 'financial risk specialist' (SI, p. 19, l, 434) a view which was adopted by the professional body from that point onwards. The term used in the CR for these two roles is 'financial professionals' (CR 2013, p.7). It

would be the rationale for making the first chapter of the first module *Risk and Value* speak directly to the first objective and combine the second by prioritising the role of the actuary and quant up front; linking them directly to *Risk* and how 'on a high level' they would manage it in the real world, 'and then we spent the first lecture really just doing, talking about what actuaries and quants do' (SI, p.74, ll.1733-1735). It is observed at this point that *pacing* was very strongly framed in the delivery of that chapter (F ++).

On the whole the first chapter deals with the 'big picture' skill set of observing risk as a phenomenon which pervades society and then it becomes more specific as to how the actuary or quant would handle risk in the financial world. This movement is echoed in text using personal examples of risk as an entry point and moving out again to an external situation in an effort to show how the student could transfer knowledge of how to deal with risk across these domains. This is an observation of the text on a superficial level and doesn't tell us how the *instructional discourse* is framed until we examine the syntax and layout more carefully.

It is the very beginning of the CR and whatever content is *selected* is reinforced by its position (*sequence)* at the front of the CR; this is called the primacy effect. It is notable that the CC has chosen to use the collective pronoun 'we' in such a way as to allow students to identify with her and see themselves as novice actuaries right at the start of the CR. The tone is conversational, conveyed primarily through frequent questioning and break away techniques or asides. This appears to 'soften' the hierarchical relations in the *regulative discourse* between the 'transmitter' and 'acquirer'. This is supported by the writer's intentions; "if you say 'that's what we're doing' that kind of brings us together and we are figuring it out and I think that's a nice way of doing it as opposed to I know it and you don't" (SI, p. 26, ll. 594-596).

However, the CC also states that much of the use of the personal pronouns was not strategic it was produced intuitively (ll.592 -594) and came from trying to make it 'real' for them – more meaningful (ll.691-693) and again (ll.695- 696). This is achieved by moving from students' own experiences to that of a third party in a short space of five examples while simultaneously including them as financial professionals two lines thereafter in "How do **we** [bold added] 'make financial sense of the future'?" (CR, p.7, ll.18-19). The question serves as an introduction to the theory of that process. The *regulative discourse* is at work in this short section flattening the hierarchical relations over the social base through encouraging the student to identify with the role of an actuary or quant and at the same time strengthening the *framing* of the *instructional discourse* (F+ ↑) by providing common place examples of risk and allowing students to relate to those as a means of entry into a financial sphere, although not as yet definitively actuarial.

> – so I'm trying to make a leap into the business world but a small one so once again it's about the kids who don't have CEO fathers,..so it is a deliberate way of bringing it into a business context but not too esoteric. (SI, p. 30, ll.696 – 705)

Critical to the choice of examples and their sequencing is the 'deliberate' scaffolding that the CC has used in bridging a **social** gap, a conscious move towards bridging the academic gap from school to university (objective five) and preparing the student for the workplace (objective three) (SI, p.31, ll.710- 713).

Immediately following the examples of 1.1 and still on the first page, the reader is told 'how' an actuary or quant would make 'financial sense of the future'. The language of the four bullet points constituting this 'process' uses emphatic verbs and is conceptually dense, but the points are explained right afterwards by using one

of the examples given earlier. In the third application point *Assess and mitigate the risks* ll.13 – 17 the first part of these questions implicitly explains *assess* through reflecting on one's behaviour in the context and the second part implicitly explains *mitigating the risks* using the words *reduce* and *effect*.

How does this affect the *instructional discourse*? It could be argued that once the context is provided the reader would not need the words defined however, at a micro level the *framing* of the *instructional discourse* is weakened temporarily (F- ↓) (p.7) to get the reader to ask what the individual words mean; and then strengthened shortly thereafter (F+↑) (p.8), allowing for understanding of the concepts. It could slow the pace (F-↓) as the reader takes time to think about the new concepts, or it could quicken the pace (F+ ↑) if the reader is anxious to rush ahead and check for further explanation or confirmation of understanding. This is a feature that is used a lot in the CR, a weakening of *framing* of the *instructional discourse* through getting the reader to question the meaning of something or to provide an example of their own, followed directly thereafter by an explanation often through an example previously provided by the text (F- ↓, F+↑). The latter has the effect of strengthening the *framing* of the *instructional discourse* making the knowledge explicit through reinforcing what has been preceded. This sequence also has the effect of affirming the reader's intuition of the meaning of specific words and concepts in the discipline.

In this instance (CR, p. 8) the student is asked how they would apply this 'process'. A strong sense of application is privileged right at the beginning of the chapter underlining the importance of the practical. The 'process' foregrounds the *actuarial control cycle* which is presented three pages later, but which the convenor is at pains to describe is not 'the holy symbol of actuarial science it's just a way of doing something' in fact its overreliance could hinder one's ability to look at a problem

differently (SI, p. 32, ll.739-744). Rather its position (*sequencing*) right at the beginning of the CR is to get the student thinking differently right away and denotes the importance of the 'thinking skills' or reasoning valued in the discipline.

At times the author mixes up the *sequencing* of the *discursive features* intuitively which was indeed the case of the *actuarial cycle* where theory (*definition*) is presented before the *explanation* (strong *framing* over the ID, F+). Evidence of this as the author's intuition comes from the Second Interview, '...because the actuarial control cycle is not self-discoverable'. It is only one way of solving a problem the author asserts 'it's not the only one and I think that's the thing, if I made them self-discover it they wouldn't, they would discover something else' (SI, p. 34, ll.785 -794). In this section (CR, pp 12 -14) almost all *discursive features* are working to maintain strong *framing* over the *instructional discourse* (F+), but the *figure* slows down the *pacing* temporarily as the reader engages with how the control cycle is represented visually. In Figure 5 below, the *y* axis (perpendicular) represents lines on the page and the *x* axis (horizontal) represents the *discursive features* (see appendix C for more detail). Each step on the solid blue line marks the start of a new page. Page 12 has eleven *discursive features*, page 13 has eight and page 14 one. The *example* on page 14 takes up 25 lines.

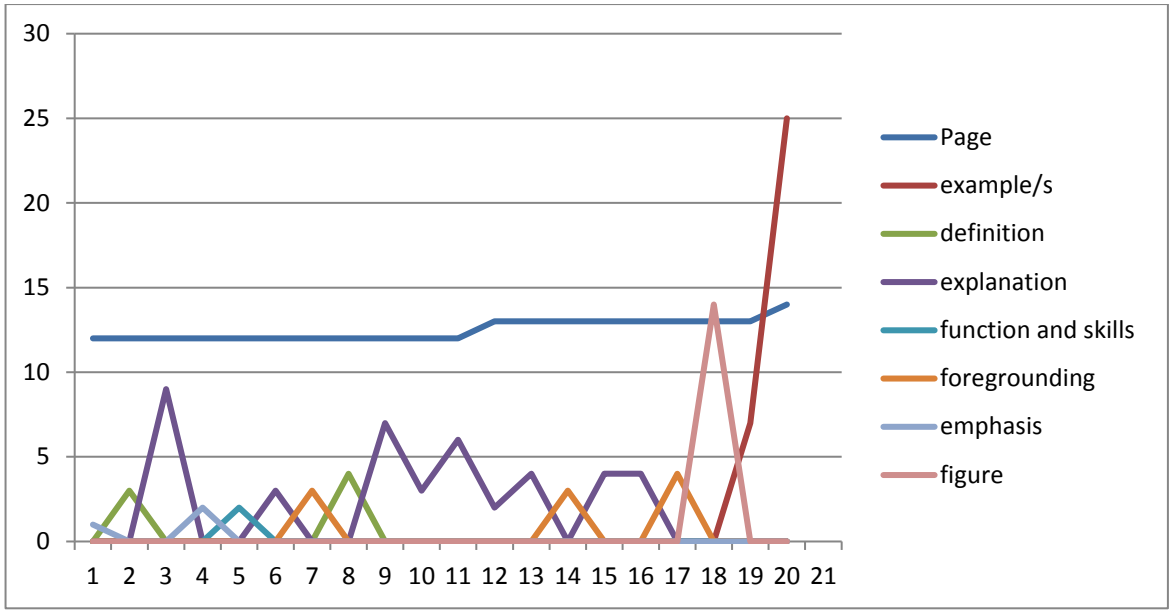

Figure 5. Discursive features used in pages 12 – 14.

Selection includes what the author has chosen to omit.

There is a lot of discussion about *Risk* in the first chapter and a deliberate omission of any mathematical calculations in handling those risks, it privileges the 'bigger picture' that comes across so strongly in the First Interview and most of all problem solving (thinking) skills. The purposeful non selection of mathematical calculations on the convenor's part is a message to students that actuarial science is not only mathematics. '…you will be learning a lot of stuff that is not maths here, the idea is applying mathematics to solve some of the problems but it's not maths' (SI, pp.35, ll.825- 826).

Pacing manifest in repetition of important principles.

In terms of *pacing* the first chapter is covered in one lecture, and this would imply very strong *framing* over the *instructional discourse* (F++). However, the exercises at the end of the chapter could be very time consuming and are left for the student to work on in their own time which contrarily indicates weaker *framing* over the *instructional discourse* **if** the student took advantage of the section in that way (SI, pp.38, ll.888- 889). Not leaving the student to acquire it all on their own, the CC has

interwoven the principles in the rest of the CR, 'I think the rest of the course reader embeds that chapter actually, so it's not a, it's something that you really can't assimilate at once' (SI, pp.38, 39, ll.888- 901). Bringing to the fore the fifth objective by 'bridging the gap' once again in acknowledging that 'they're not ready to know the depths of it' (SI, p.38, 39, ll.894- 901). The interweaving and repeating of principles would confirm weak *framing* (F-) over the *instructional discourse* in respect to *pacing* of these particular skills throughout the CR although that is beyond the scope of the study to assess.

Additional discursive features which aid strong framing.

It was very important for the CC that the CR was well compiled and presented so that the students would 'trust' the material. 'It's almost like they can plunge into this with confidence as opposed to treating it with suspicion... so I think high production value it takes a lot of time but I think it makes a thing that is trusted' (SI, pp.41, ll. 965 – 969).

This consistency supports a *regulative discourse* that is student and reader near. Features such as bolded new words, phrases and important concepts 'interrupt the flow and once again it stops being a dense block of text and it gives you something to focus on' (SI, pp.35, ll.921-923). Text boxes in colour for explanations and definitions break up the main text creating a 'lightness that comes with separating it out and changing pace, changing from this paragraph to this box to another paragraph and that sort of thing,' (SI, pp.35, ll.917- 920). Frequent use of the *margin* for questions and comments, a solid blue or red line perpendicular to the text for explanations and examples - all contribute to the sense that this is a credible product. It forms part of the design to 'mix things up' as the author put it so that the text does not flow easily and the reader has to stop and think about the content, pre-empting the

reader's engagement with the text. This is a subtle but purposeful technique which slows the pace down (F-↓), 'but I don't really mind if they confusing the examples with the explanations [indistinct 0:76:19] it's just idea of breaking the pace, so it's more about that' (SI, pp.35, ll.919-937).

The use of margins and textboxes is to illustrate or define new and or difficult concepts, but the placement on the page, punctuation, mini graphics and language used attracts the reader while interrupting strong *pacing* (F++, F-↓) and maintaining a conversational tone- which provides consistent proximity to the student or reader in the *regulative discourse*. This practice is another way of bridging the gap (objective five) and although not *all* foreign or new concepts are explained, most are.

All in all, the analysis thus far supports the notion of a cohesive and predominantly explicit text which produces strong framing over the *instructional discourse*, and possibly a strengthening of the *regulative discourse* if the features are used consistently. It will be interesting to examine how the second chapter manifests the *recontextualising rules* and supporting *discursive features* to allow for epistemic access.

Course objectives three and five come to the fore in chapter 2.

Course objective three is about preparing students for their university studies, their professional exams and their careers as actuaries or quants and was evident at a high level in chapter 1. This is a 'mathematical chapter' (SI, p.74, l.1741) which is in stark contrast to the first chapter which has no mathematics. In addition, the first chapter has one set of exercises at the end of the chapter whereas there are twelve sets of exercises spread across the second chapter with a bumper set at the end comprising 133 lines. The technical emphasis seems to suggest, at least for this section at a macro level, that actuarial science *is* mathematics. 'But it's not all about actuarial science, its

fundamental' (SI, p.73, l. 1713). 'And you wouldn't be able to understand actuarial science if you didn't crack at least most of this chapter, except for interpolation' (SI, p.73, ll.1710-1711). These statements lead us to examine the *recontextualising rules* which manifest in the second chapter. The findings and discussion follow closely on each other and at times they are intertwined, but in general are sequenced according to the pages of the CR highlighting those elements that serve to enhance a *pedagogic discourse* which allows for *epistemic access*.

Purpose of chapter two is to prepare students for their exams and careers.

Objective three, is served in this chapter by providing a foundation for financial mathematics (CR, p. 19, ll.7-8) the first official actuarial science course in the degree programme, but very significantly the chapter is also 'the basis for the rest of the course which then feeds through into other parts of the reader' (SI, p 74, ll.1737 – 1741). It also has the very important role of demonstrating how applied the discipline is and 'how the concept of intuition and the concept of being able to evaluate things and explain stuff that comes through,' (SI, p 74, ll.1741 – 1743) it's not just about plugging in a formula and getting an answer 'it's also saying well would you buy it then, then being able to kind of apply that calculation to some sort of decision making' (SI, p 74, ll.1743 – 1745).

In the opening line of the second paragraph entitled **Time value of money** the reader is asked 'If you are offered R50 now or R50 in one year's time, which would you prefer and why?' (CR, p.19). This is typical of the author to turn a complex title around by asking a simple question at the heart of the concept before launching into any theory. This form of engagement between text and reader is constant, forming a veritable wave of weakening and strengthening of the *instructional discourse* through *selection* and *sequencing*. It allows for agency on the part of the reader (weakening of the ID, F-↓)

which has the effect of affirming their financial intuition in successive lines when the explanation is given (strengthening of the ID, F+↑). For example, in **Ex. 2.3** (CR, p. 21) there is a balance between applying the mathematical skills just acquired and 'considering' their effects (F- ↓, F- ↓, F- ↓, F++). By asking the student to work out the relationship before the relationship is spelt out, self discovery of knowledge is made possible (SI, p.56, l.1304). 'I think self-discovery needs to be obvious enough....so that you feel like you discovered it for yourself and you got it right,' (SI, p.56, l.1304).

The voice of the CR remains near to the reader with the ongoing use of the inclusive collective pronoun 'we' and the direct questioning of the reader as 'you', second person singular pronoun. 'Which would you prefer?' is a common question in this short section (pp. 19- 23) appearing four times and 'what do you think' occurs twice. This has the effect of getting the reader involved in the examples and applying their intuition to making financial decisions right from the start. On a subtle level inferential reasoning is being elicited and the flattened hierarchical relation that was set up in the first chapter is maintained – this strengthens the *regulative discourse* (F+↑).

Selection and sequencing facilitating epistemic access.

Exposing the layers of *time value of money* is making the knowledge explicit and bridging the gap, 'making sure that the foundations are explicitly explained as opposed to assumed' (SI, p. 55, ll. 1284-1285). This is strong *framing* of the ID (F+) through *selection* and *sequencing* and indicative of *epistemic access*. Second Interview data reveals that although there was a pre-registration questionnaire to assess amongst other things, familiarity of certain terms and notation, a conscious effort is made to explain any notation that is not believed to be embedded in the school syllabus and even with familiar notation or symbols wording in the context clarifies meaning. One

example is the symbol ∑ which is summation and is also called sigma (CR, p.26). Students should be familiar with it, but it is also self explanatory from the text. Integrating meaning in the text is a potential weakening of the *framing* of *instructional discourse* buffered by the intention 'not to assume too much about their prior knowledge' bringing the *instructional discourse* back to (F+). 'Also doing stuff from first principles, I'm a big fan of doing stuff from first principles' (SI, p. 55, ll. 1285-1287), resulting in (F++).

Under the sub heading of **Single cashflows** the text goes straight into explaining *future value (FV)* which incorporates; rate of interest (*i*), per annum (p.a.) and capital (*C)* and can be expressed when calculated over *t* years as:

$$C\,(1+i\,)^{t}.$$

Present value (PV) is slightly more complex to explain, but is reduced to a very similar expression:

$$X\,(1+i\,)^{-n}.$$

Each of these expressions is explained step by step and then the two concepts are covered through examples, exercises and comparisons in three pages using **single cashflows** emphasising **'The overarching principle is that when we need to compare the values of cashflows, we must compare their values at the same time point'** (CR, p.23, original emphases). This is the second mention of the principle indicative of very strong *framing* of the ID (F++).

The format of the text in this section is predictable; *definition*/*statement*, followed by *explanation*, *example* then *exercises*. This sequence is followed throughout the chapter effectively strengthening the framing of the *instructional*

discourse (F+↑). This is in keeping with the author's intent of making the knowledge visible and epistemic access possible.

The elusive 'thinking skills' that the CC is trying to inculcate comes through the continuous use of *questioning* in the body of the text and the regular use of the *margin* housing more questions, explanations, important notes and useful formulae. There are also less subtle strategies like '(Hint: draw a timeline for the second option and do not forget to deduct the tax payments.)' (CR, p., 34, ll. 3- 4) occurring in several exercises in the body of the text which perpetuate the conversational tone set up in the first chapter and modify or confirm thinking patterns. There are often bolded question marks, exclamation marks or clip art visuals preceding the first sentence of the margin text as if to say 'listen up this is important' (CR, pp.25,) or for additional emphasis of an important principle (CR, p.29, 30). This is an explicit way of alerting the student to what is valued, defining concepts and clarifying what could be confusing between common usage and the actuarial meaning. The principle underlying the use of the *margins* for new words and concepts is to engage the reader and discourage 'skimming over words' because '... if you skim over this word and you make up a meaning for it you won't get the concept quite right' which serves the *instructional discourse* positively and then as importantly it is 'also such a confidence boost right, the book knows that I don't know the word I'm not stupid, the book knows it's a new word' (SI, p. 44, ll. 1036-1038). The *regulative discourse* is implicitly at work boosting the confidence of the learner. '...you feel like you're on a level with this thing as opposed to this thing is written for somebody else, this is written for the kids that know the words' (SI, p. 44, ll. 1040-1042). An example of this is the concept of *discounting* found on page 21 (CR).

Another purpose of the *margin* is to ask questions. The effect is the same, you stop the reader from glossing over text, 'but if a question is asked in the middle of it, and especially the question that relates it back to yourself' you have to internalise it' (SI, p. 47, ll. 1093-1094). A purposeful technique 'to make it real' (SI, p. 47, ll. 1094-1096).

Content becomes more complicated from page 24 onwards with the introduction of a series of cash flows, illustrated with the first **cashflow diagram.** There are two and half pages of *definitions* (F++), *explanations* (F+) and an *example* (F-↓) of 'your student loan' depicted in a bar graph before the first of a series of formulae for a variety of annuities are derived. The use of 'your student loan' is another instance of making the knowledge 'real' and at the same time proximity to the student via the *regulative discourse* is maintained.

Explanatory power of visual representation.

Bar graphs and timelines are used to demonstrate the *time value of money;* a highly abstract concept the understanding of which is aided by visual representation of the *cashflows* within the time period being referred to and critical to the understanding of *present value (PV).* 'It doesn't make sense to do this without visuals to me' (SI, p.59, l.1395). The way in which *present value (PV)* has been presented in the CR has been informed by the author's own experience of learning it for the first time, bringing back the redesign of the course and the CR to address 'Why before how' (SI, p.71, l. 1780). As a visual representation the bar graph dominates in the CR. The pattern of the cashflows is made clear. It can also weaken the *pacing* (F-) as the student takes time to makes sense of the content depicted in that format.

There are three distinct layers of *instructional discourse* in teaching *present value* and these can be accessed via the visual component, 'so it's a tool for

understanding the text, for translating the text into a picture and then into mathematics' (SI, p.60, l. 1423-1424). The visual component of the knowledge may not be immediately evident to all students without the accompanying text, but its presence enhances visible pedagogy (F+↑).

Sequencing critical when working from 'first principles'.

Sequencing is critical when working from first principles. If all steps are provided pedagogy is visible resulting in strong framing of the *instructional discourse* (F+) as the author exposes the layers of meaning in selected formulae through the process of derivation. The first of these is '**Present value of a level annuity certain, payable annually in arrear**' (CR, p. 26). This is an eleven-word concept; in itself housing several others. It is semantically dense, although here too the reader has been prepared for the full understanding of the concept on page 25 and before that with explanations for present value. Each layer is carefully laid down and the final formula derived. Where *FV* and *PV* had three layers to the final expression of $C(1+ i)^{t}$ and $X(1+ i)^{-n}$ respectively, the **present value of a level annuity certain, payable annually in arrear** has five, but we must remember that v or v_i is the condensed version of $(1+ i)^{-1}$ and is represented as the condensed version from this point onwards. This is just the beginning of a complex set of expressions (notations) which use both numbers and letters and the reader has to be careful to note which letter stands for a mathematical expression and which for an amount of money. This chapter is careful to use non conflicting capital letters for the latter, as in *C* and *X* above which do not denote a concept as does *i* for example. The student has to become accustomed to letters representing concepts and also understand a range of symbols which is distinctly mathematical such as ∞ which means infinity. It is appropriate that preceding the mathematical calculations and derivation of formulae in the CR, the

expression ‘It is just’ prefaces each of the first three derivations so as to signal explicitly to the students that they should stick to the notation provided and not add or take anything away from it. This analysis confirms explicit pedagogy and reinforces strong *framing* of the *instructional discourse*.

The **present value of a level annuity certain, payable annually in arrear** is derived and then the first step of the *present value of a level annuity certain, payable annually in **advance*** is set up for derivation by providing the first line and then the reader is asked to do it for themselves. The tempting question comes from the margin ‘**?** See if you can show this.’ (CR, p. 27) ‘they can see the summation and they can see the results they just need to link the two and it’s very similar to the one they have just done’ (SI, p.65, ll.1519-1520). The CR does not provide the worked solution ‘that question gets actually worked through in the tutorial’ (SI, p.64, ll.1504-1505).

Not providing the steps in the CR weakens the *instructional discourse* (F-↓). This is the same sequence for subsequent derivations; ‘accumulations’ (CR, p. 28) and ‘perpetuities’ (CR, p.29). In fact, ‘all of the **in advance** [bold added] are prove for yourself whereas the **arrear** [bold added] ones are proved in the course reader, but the thing is once you crack this one proof all the other ones **in advance** [bold added] are the same,’ (SI, p.64, ll.1508-1510).

This raises the question of whether or not to give solutions. ‘I think the worry is that they learn proofs off by heart without understanding them so can they actually apply it to a very similar second case now’ (SI, p.64, ll.1514-1515). This is a chance for ‘self discovery’ and although it signals a weakening of the *instructional discourse* (F-↓) the effect could be very positive for the student. Later in the chapter, the author warns ‘But do not memorise formulas like this one, memorizing formulas is never a good way of understanding what you are doing!’ (CR, p.51). In this instance the

framing of the *instructional discourse* is strengthened by raising the hierarchical relations (F+↑).

Building the disposition of the 'knower' through the RD.

In contrast to perfect notation and correct answers the author encourages students to follow their 'gut feel'. Interspersed with explicit steps students are often asked their preference between options without calculating the result. The idea of 'intuition' links to both thinking skills and identifying with being an actuary; 'This should make intuitive sense.' (CR, p.31) is supported by the margin comment; '**?** Can you see the parallels between this present value and the calculation of *l* above?' (CR, p. 31) and then significantly, **Ex.2.10** 'Give an intuitive explanation for this result.' (CR, p. 33). The author calls on intuition as a means of internalising the maths (SI, p.67, ll.1576-1579), 'I'm a big intuitive person so all this to me has to make sense intuitively, we're only doing the maths to put numbers on the intuition' (SI, p.68, ll.1605-1607). It affirms the student's intuition has value in this context, 'Yes, I'm thinking like an actuary' (SI, p.68, l.1617). The design of the CR at a micro level is 'developing a new intuition as well right' (SI, p.68, l.1620).

This is implicitly reinforcing the readers' notion of themselves as actuaries, weakening the framing of the *instructional discourse* (F-↓) but arguably producing positive framing of the *regulative discourse* (F+) as the author retains proximity to the reader consistent with the pattern established in the first chapter.

From the start of annuities on page 26 until **Cashflow patterns of real assets and financial products** on page 34, there is an overall pattern commencing with a *definition* followed by a *statement* or derivation of formula, an *example, explanation* and then *exercises*. The cumulative effect is building the foundation for all calculations and concepts that follow. The predictable pattern allows the reader to

refer to the text rapidly when in doubt – it also strengthens *framing* of the *instructional discourse* (F+↑). Apart from the *exercises*, notation dominates pages 26 to 34 interrupted temporarily on page 30 to illustrate via the use of two bar graphs using actual values, *geometrically* and *arithmetically* increasing annuities. It is well positioned to have the two graphs on the same page so that the 'shape' of the cashflows emphasises their similarities and difference. It is in this section that 'intuitive' is used (CR, p.31, 33), which makes sense coming at the end of a series of derivation of formulae for calculating annuities which forms the basis of the logic. Here is a passage where strong *framing* of the *instructional discourse* (F+) is working hand in hand with a *regulative discourse* affirming the students' financial intuition, although these entities are analytically distinct.

Visual representation as a discursive feature.

In the section **Cashflow patterns of real assets and financial products** (CR, pp 34 – 49) there are eleven *figures*, 10 of which form part of examples and explanations. Suitably, the illustrated example of the cashflow pattern of an *interest-only* loan appears above the illustrated example of the cashflow pattern for a loan with *level repayments* on the same page (CR, p 45). These graphs are embedded in the text explanation with accompanying formulae using actual values.

The attention to detail which appears so simple provides strong reinforcement of the principles and strengthens the framing of the *instructional discourse* once again (F+↑). Illustrating contrasting principles on the same page is also very effective.

In pages 49 -57 there is only one graph (CR, p.51) and very little use of the margin (four times), but despite this the body of the text is engaging, explanations are clear with no steps omitted and examples are relatable strengthening the *instructional discourse* once more (F+↑).

On page 65 the full benefit of reducing a table to a cashflow diagram is realised by the simple juxtaposition of the two representations on the same page. This is followed on page 66 by a cashflow diagram which identifies a range of regular cashflows which are in turn reflected as potentially four series of cashflows. Here the text is a vital accompaniment to both illustrations and a fitting climax to the end of the chapter. It is a taste of just how complex cashflows can be, while providing the logic of how to untangle them. Importantly the comment that the four series in the second diagram 'is not the only possibility, there are alternative groupings which you could have used and they would give the same answer. Can you think of any of these alternatives?' (CR, p.67) leaves the reader with the challenge of looking for more and with the notion that there isn't a definitive right or wrong set of groupings in such a context. Within the *framing* of the *pedagogic discourse* the *instructional discourse* is strengthened (F+↑) by the joint impact of visual representation and mathematical expressions and then weakened at the close with an open ended question and the notion of more than one correct answer (F-↓). Although the *question* is a purposefully selected *discursive feature* of the *instructional discourse* - the *regulative discourse* is also present exhibiting a conversational tone which maintains the flattened hierarchical relationship set up at the start of the CR. This consistency produces strong *framing* of the *regulative discourse* (F+).

Summary.

The third research question as the main focus of the analysis of the CR as *pedagogic discourse*, was to establish whether *epistemic access* was afforded through the *rules of discursive order*: *selection*, *sequencing* and *pacing* and what impact these would have on the overall *framing* of the *instructional discourse* and the *regulative discourse*. As the findings and discussion confirm, the overall *selection* and

sequencing of content is closely tied to the course objectives with deliberate emphasis on what knowledge is valued in the *field of practice,* the core knowledge of the *discipline* and on bridging the gap between school and university. Although there were one or two opportunities which were missed in this respect[11], the overall effect is very strong *framing* of the *instructional discourse* (F++) with respect to *selection* and *sequencing*. This is despite observations of a pattern of temporary weakening of *framing (*F-↓) when deploying the use of *questions*, only to strengthen *framing* (F+) shortly thereafter in support of visible pedagogy. *Pacing* on the other hand is quite unpredictable at the micro level, with many and myriad interruptions, most notably through the use of the *margin* as a *discursive feature* thereby weakening the *framing* in the *instructional discourse* (F- ↓), but not enough to maintain this position on a macro level which is very strong in chapter 1 (F++) and relatively strong (F+) in chapter 2.

The *hierarchical relation* of the *regulative discourse* is flattened in the opening line of the CR by including students as novice actuaries and valued participants in the process of uncovering knowledge about actuaries. This relationship is maintained throughout the two chapters and culminates in an *instructional discourse* that is consistently student near and yet firmly in control; resulting in relatively strong *framing* of this vital component in facilitating epistemic access through effective communication with the social base – despite a flattened hierarchical relation.

[11] I am referring to potential confusion around the use of 'nominal' (pp.36, 37, 58) only clarified on page 59, and the term 'annuity factor' which is not explained in this chapter as well as 'factor' which has a specific meaning in mathematics.

Chapter Seven

Summary of Key Findings and Conclusion

Recontextualising Rules Drive the Formation of Pedagogic Discourse in the Course Reader

The real world motivation for this research is the pressing need to transform the demographics of the actuarial profession which is exacerbated by the sluggish tempo at which this is happening. The purpose of the study was to provide context to the problem and this necessitated a brief history of ASSA and its relationship with the university first within the constraints of apartheid and later within a democratic state. The continued high attrition rate in the discipline together with the perception of the profession as élitist has led directly to the first two of my research questions namely: to understand the nature of the knowledge that is valued in actuarial science both as a discipline and in the workplace. This enquiry formed the backdrop of an analysis of Module 1 of the CR in answer to the third question on facilitating access to this knowledge. There followed a critique of the CR's merit in facilitating *epistemic access* uncovering Bernstein's *recontextualising rules* operating in the *field of recontextualisation* which in turn 'regulate the formation of specific pedagogic discourse' (Bernstein, 2000, p.28).

Recontextualising rule 1.

Pressure from the state to transform the demographic composition of the profession identifiable as the *Official Recontextualising Field* or ORF, (Bernstein, 2000, p.33) is the first *recontextualsing rule*. It places pressure on the professional body - *Pedagogic Recontextualising Field* or PRF, which in turn puts pressure on the university to produce certain kinds of graduates. It is a key finding that the profession

controls the *pedagogic device* through accreditation, exerting strong power over and shaping the *recontextualsing rules* for the curriculum.

Recontextualising rule 2.

Further findings are that the profession is small and the knowledge that is valued in the workplace sets the actuarial graduate apart, entrenching a view of 'gate keeping' by the profession. Actuarial knowledge is complex, drawing from both *singulars* (pure mathematics) and *regions* (mathematical statistics) to form its own theoretical base which although highly abstract also requires context dependent solutions, both in the curriculum and in the workplace. This makes it difficult to identify the properties which insulate this interdisciplinary 'discipline' from others, exacerbated by the widening fields of application making it difficult to discern its relative strength of *classification* (C+ / -), both in the *field of practice* and *field of recontextualisation*, overall. This conundrum brings into view a second *recontextualsing rule* working on the formation of curriculum knowledge incorporating; 2a) the nature of the knowledge in the profession (*field of practice*) and 2b) the nature of the knowledge in the *discipline* (*field of production*).

It is evident that actuarial knowledge consists of two layers, a techno-theoretical layer which forms a solid foundation from which the neophyte can potentially specialise in any one of six areas; and a broader more elusive layer which is the 'big picture skill set', the essence of which is a form of reasoning and professional judgement which gives the profession its unique contribution - catering for all forms of financial risk. Increasingly actuarial skills are being called upon where there is a need for this type of judgement, but not only in traditional domains. In the profession there is high regard for specialised knowledge (*knowledge code*), but at the same time actuaries are valued for their acquired professional judgement and

reasoning, highlighting the actuary as being the right kind of *knower*; for these reasons actuarial science is identified as encompassing an *élite code* (Maton, 2014, p.31).

Within the university context as a *region*, the actuarial science section has no control over what is taught and assessed in the *singulars* and *regions* that underpin its theoretical base and this is indicative of a relatively weaker *framing* of that knowledge. The style of assessment within actuarial science also leans towards weak *framing* (F-) because there are rarely instances where questions are explicit or answers straightforward. These elements are indicators of weak *framing* of the *instructional discourse* (F-). In addition, there is a deliberate strategy in the actuarial specific courses in the curriculum, to inculcate the type of *inferential reasoning* ('thinking skills', FI) which is valued. Whether or not the strategy is successful is beyond the scope of this research, but it was found that weak *framing* over the *instructional discourse* places pressure on the acquisition of the *recognition* and *realisation rules*; 'Power is never more fundamental as far as communication is concerned than when it acts on the distribution of recognition rules' (Bernstein, 2000. p.17).

Recontextualising rule 3, the 'imagined learner'.

The question of making the knowledge explicit and thereby facilitating *epistemic access* was examined closely in the CR analysis, the focus of the third research question and sub-questions. The study does not address directly why there is a high attrition rate nor provide answers to contain or mitigate it. However, the fact of attrition was used to support the redesign of a CR inclusive of the objectives to orientate students to the discipline and bridge the gap between school and university. Poor schooling in SA, diversity in the class room and high attrition rates work as a third *recontextualsing rule* putting pressure on academics to teach better; that is more explicitly.

The course objectives served as a backdrop from which the *rules of discursive order*: *selection, sequencing* and *pacing* as manifested in the *framing* (F++, F+, F-↓, F-) of the *pedagogic discourse,* are referenced in the analysis. The manifestations exhibit strong links to the objectives and most notably objective one; which concerns introducing students to the concept of financial risk and time value of money, and as importantly objective five; which is bridging the gap between school and university. In this case study, the *recontextualsing rules* have realised a *pedagogic discourse* which makes explicit the demands of the knowledge and this has contributed to a cohesive text; a text which is attractive and engaging for the reader and has resulted in strong *framing* of the *instructional discourse* (F +). A feature of the *pedagogic discourse* has been ruptures in the flow of the *instructional discourse* through weakening and strengthening of *framing* (F-↓, F+↑) in close succession, in particular when new concepts are introduced. The ruptures have added to an effective weakening of *pacing* in the *instructional discourse*, they serve to reinforce confidence in the reader's ability, intuition and identity as a novice actuary which has a positive effect on sustaining a flattened hierarchical relationship throughout. This consistency of the *regulative discourse* is a powerful mechanism which instils trust and enhances a visible *pedagogic discourse* amounting to correspondingly strong *framing* of the *regulative discourse* (F+). Strong *framing* of the *instructional discourse* and *regulative discourse* in itself cannot guarantee an effective *pedagogic discourse*, but with the accompanying detailed analysis of the CR supports the claim that this is an example of good curriculum design and visible pedagogy.

Bernstein was clear that successful learning was only enhanced through weak *framing* of *pacing* (Morais, 2002, p. 559) and from the analysis we can see that this has been the cumulative effect of the *discursive features* embedded in the *selection*

and *sequencing* which have interrupted the flow of the text in order to reinforce specialised meanings. This is not a guarantee of success however, and in terms of *epistemic access*, we need to acknowledge that those 'who have access to a second site of acquisition (the family) have been likely to succeed' (Morais, 2002, p.559). Yet the flattening of the hierarchical relationship between *transmitter* and *acquirer* has produced a *regulative discourse* that is conducive to engagement with the social base, a view supported by Morais who has evidenced that 'weak framing[12] of the hierarchical rules creates a context where children can question, discuss and share ideas, thus strengthening the framing of evaluation criteria' (2002, p.561)[13].

The theoretical framework has been sufficiently robust to reveal the organising principles of knowledge at work, thus highlighting the forms that curriculum design and *pedagogic discourse* take to facilitate *epistemic access*. The *pedagogic discourse* analysed here can serve as an exemplar of a *pedagogic discourse* that has the potential to interrupt the legacy of poor schooling, namely pedagogic strategies that encourage rote learning and a lack of critical thinking.

The CC, who fortunately embodies membership of the profession and of the discipline has produced the CR in response to the three *recontextualising rules* that have been revealed above, namely; 1) the state as an ORF, 2a) the nature of the knowledge valued in *practice* and 2b) in the *discipline* as the formation of curriculum knowledge and 3) the 'imagined learner' for whom the CR is intended.

Conclusion

Finally, I return to the research questions:

[12] I have argued that the consistent *flattening* of the hierarchical relation in this case study has produced a stable and therefore relatively strong *regulative discourse*.

[13] Evaluation criteria are not part of the scope of this research.

1. What is the nature of the knowledge valued by the actuarial profession in the *field of practice*?
2. What type of knowledge is valued in the discipline of actuarial science?
3. To what extent is *epistemic access* to this knowledge made explicit through the *pedagogic discourse* of the course reader *Introduction to Actuarial Science*?

In response to the first question, analysis of the First Interview has shown that as a 'business discipline' actuarial science is a *region* (Bernstein, 2000). There are two layers to the profession, comprising a highly specialised techno-theoretical knowledge that is valued in the first layer (ER+) and a second layer which emphasises the unique judgement and inferential reasoning of an actuary which takes time to acquire (SR+). The knowledge is complex as its various forms do not conform to one type of *classification* (C+/ C-) rather its relative strength or weakness will depend on the given context in the workplace. It is appropriate that in terms of LCT (*Specialisation*) this knowledge conforms to an *élite code* as both *epistemic* and *social relations* are valued.

In response to the second question it was revealed that the knowledge that is valued in the *discipline* is a mirror of the two layers that form the profession and although the emphasis at university is on the first layer as the theoretical underpinning of the distinctive actuarial reasoning and judgement which is cultivated through practice and over time, the theory is always in response to an application need. This shows that there is a strong resemblance between the knowledge valued in the *field of practice* and the *discipline* at least for the first layer. However, the First Interview data

revealed that the curriculum is limited in that it cannot teach everything that would be required in the *field of practice* (FI, p.24, ll. 554-556).

The first two questions were central to understanding the properties of the knowledge valued in the profession and the *discipline* in order to answer the third and most important question of the analysis which is whether the *pedagogic discourse* in the CR provides explicit guidance to its acquisition. The data analysis has shown and the literature suggests that weak *framing* (F-) of *pacing* is important in the acquisition of knowledge and although this is difficult to ascertain in a CR, it is evident that the overall strong *framing* of *selection* and *sequencing* when focused on the object of knowledge (*statement*, *definition*, *explanation*) is interrupted by *discursive features* such as *questioning* and the frequent use of the *margin*. Not only is the pace interrupted to allow for more time on the concept, the net effect is explicit or more visible pedagogy and therefore positive *framing* of the *instructional discourse* in terms of *selection* and *sequencing*.

The *pedagogic disocurse* also encourages social access by flattening the hierarchical relations in the *regulative discourse* through inviting the student to take part in discovering what an actuary does, using personal pronouns and asides. The text foregrounds their role in the future and encourages them to take on this new professional identity and to begin to show agency as an independent thinker affirming their financial intuition.

While not claiming that this small beginning will succeed in developing the complex inferential reasoning that is required of the actuarial professional, the findings demonstrate that commitment to constructing visible pedagogy goes a long way to providing a *pedagogic discourse* which serves both *conceptual* and *contextual coherence* (Muller, 2009) facilitating access to powerful knowledge. However, this

study has merely scratched the surface of a veritable gold mine of opportunity for unlocking the power of actuarial science and overcoming the barriers to its mastery.

The research journey has deepened my understanding of actuarial science as a profession and a discipline and consequently I feel better equipped to engage with lecturers on curriculum and pedagogic challenges and to support students in the pursuit of the qualification.

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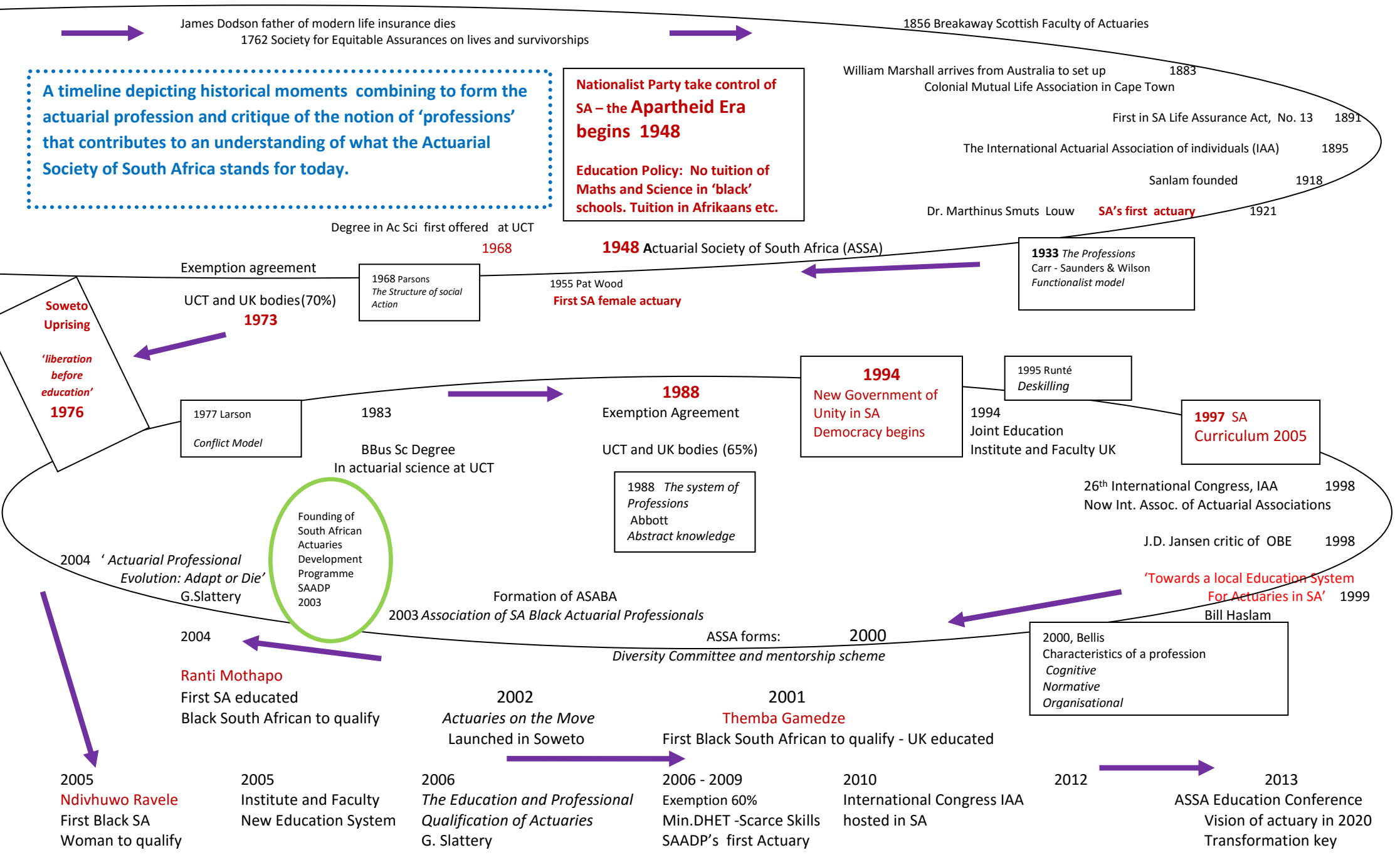
James Dodson father of modern life insurance dies
1762 Society for Equitable Assurances on lives and survivorships
1856 Breakaway Scottish Faculty of Actuaries
A timeline depicting historical moments combining to form the actuarial profession and critique of the notion of 'professions' that contributes to an understanding of what the Actuarial Society of South Africa stands for today.
Nationalist Party take control of SA – the Apartheid Era begins 1948
Education Policy: No tuition of Maths and Science in 'black' schools. Tuition in Afrikaans etc.
William Marshall arrives from Australia to set up Colonial Mutual Life Association in Cape Town 1883
First in SA Life Assurance Act, No. 13 1891
The International Actuarial Association of individuals (IAA) 1895
Sanlam founded 1918
Dr. Marthinus Smuts Louw SA's first actuary 1921
Degree in Ac Sci first offered at UCT 1968
1948 Actuarial Society of South Africa (ASSA)
1933 The Professions Carr - Saunders & Wilson Functionalist model
Exemption agreement
UCT and UK bodies(70%)
1973
1968 Parsons The Structure of social Action
1955 Pat Wood
First SA female actuary
Soweto Uprising
'liberation before education'
1976
1977 Larson
Conflict Model
1983
BBus Sc Degree
In actuarial science at UCT
1988
Exemption Agreement
UCT and UK bodies (65%)
1988 The system of Professions Abbott Abstract knowledge
1994
New Government of Unity in SA
Democracy begins
1995 Runté
Deskilling
1994
Joint Education
Institute and Faculty UK
1997 SA
Curriculum 2005
26th International Congress, IAA 1998
Now Int. Assoc. of Actuarial Associations
J.D. Jansen critic of OBE 1998
'Towards a local Education System For Actuaries in SA' 1999
Bill Haslam
2000, Bellis
Characteristics of a profession
Cognitive
Normative
Organisational
ASSA forms: 2000
Diversity Committee and mentorship scheme
Formation of ASABA
2003 Association of SA Black Actuarial Professionals
Founding of South African Actuaries Development Programme SAADP 2003
2004 'Actuarial Professional Evolution: Adapt or Die' G.Slattery
2004
Ranti Mothapo
First SA educated
Black South African to qualify
2002
Actuaries on the Move
Launched in Soweto
2001
Themba Gamedze
First Black South African to qualify - UK educated
2005
Ndivhuwo Ravele
First Black SA
Woman to qualify
2005
Institute and Faculty
New Education System
2006
The Education and Professional Qualification of Actuaries
G. Slattery
2006 - 2009
Exemption 60%
Min.DHET -Scarce Skills
SAADP's first Actuary
2010
International Congress IAA
hosted in SA
2012
2013
ASSA Education Conference
Vision of actuary in 2020
Transformation key

Course objectives a critical backdrop for analysis

In preparation for a strategic planning session for the actuarial science department in 2013, the CC and principle author of the CR summarised the objectives of the course as follows:

1. Introducing students to the concept of financial risk, with its components of uncertainty and time value of money.
2. Giving students a good working framework of what being an actuary/quant[1] entails, in terms of the main concepts, practice areas and techniques used by actuaries and quants.
3. Preparing students for their university studies, their professional exams and their careers as actuaries or quants.
4. Allowing students to make an informed decision whether to continue with the course.
5. Helping students from disadvantaged backgrounds bridge the gap between school and university.

(Strategic planning session - Actuarial Science Section, May 2013)

[1] 'quant' is a commonly used abbreviation of 'quantitative financial analyst'. There is much in their technical training that actuaries and quants share although there are also significant differences when it comes to specialisation. The degree differentiates at third year level, but both streams fall under the Actuarial Science Section.

These graphs show the frequency, pattern and number of lines afforded each instance of a *discursive feature* (horizontal axis). The pages are represented by the solid blue line running across the graph in the background from left to right. The Y axis represents the number of lines devoted to that particular *discursive feature* as well as the number of the page. The graphs illustrate the wide range of *discursive features* deployed within *selection*, *sequencing* and *pacing* which together create the *recontextualising rules* of the *PD*. At a glance one can see how pervasive *foregrounding* the students' careers in actuarial science (objective 3) is in the chapter and how the *margin* interrupts the pace of delivery midway as well as the *figure* near the end. The second graph shows how overall the DF's maintain relatively strong *framing* of the ID (F+) through *selection* and *sequencing* but with very strong *framing* of the *pacing* (one lecture) interrupted by *definition blocks*, *margin* and *figure.*

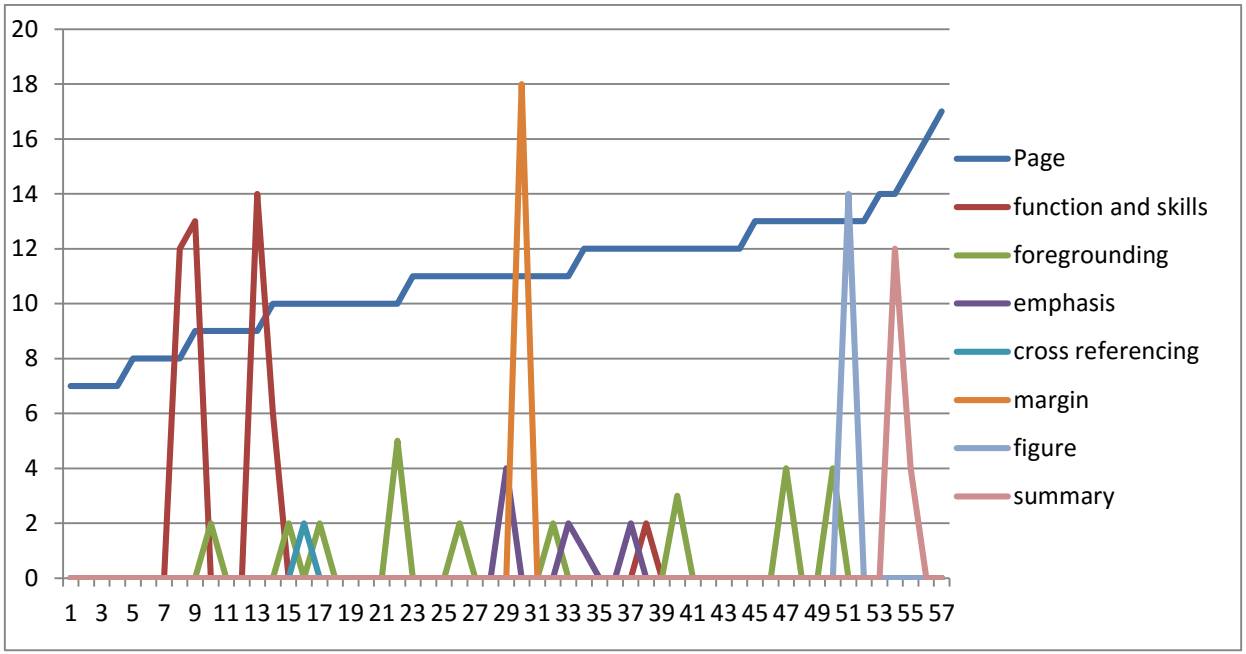

Figure 1. Selected *discursive features* of Chapter 1 of the CR.

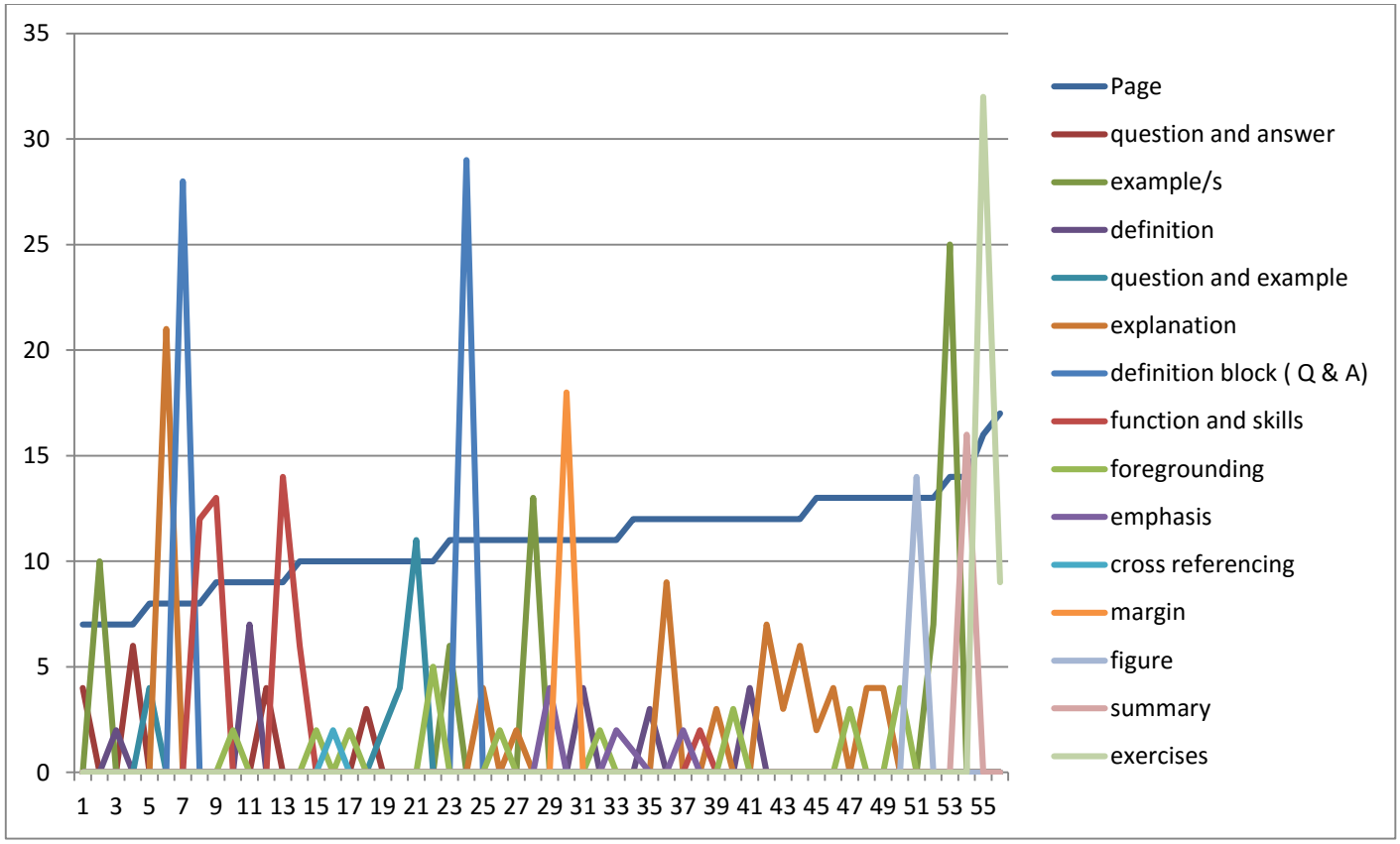

Figure 2. All fourteen *discursive features* of Chapter 1 of the CR, pages 7 – 16

There are fewer *discursive features* in the second chapter, but the most common ones are depicted below. The content is highly mathematical and the chapter took approximately eight lectures to complete, which I believe is still relatively strong *framing* over the *pacing***.** However, the *margin* as a DF works well to weaken that *framing* wherever it occurs. *Selection* and *sequencing* of the remaining DF's work positively to strengthen the *framing* of the ID.

The format of the text in Chapter 2 is largely predictable; *definition/statement* followed by *explanation, example* then *exercises*. Hierarchical relations are not evident in the graphs. *Figures* are not presented below although there were eleven of these, ten formed part of *examples* or *explanations*.

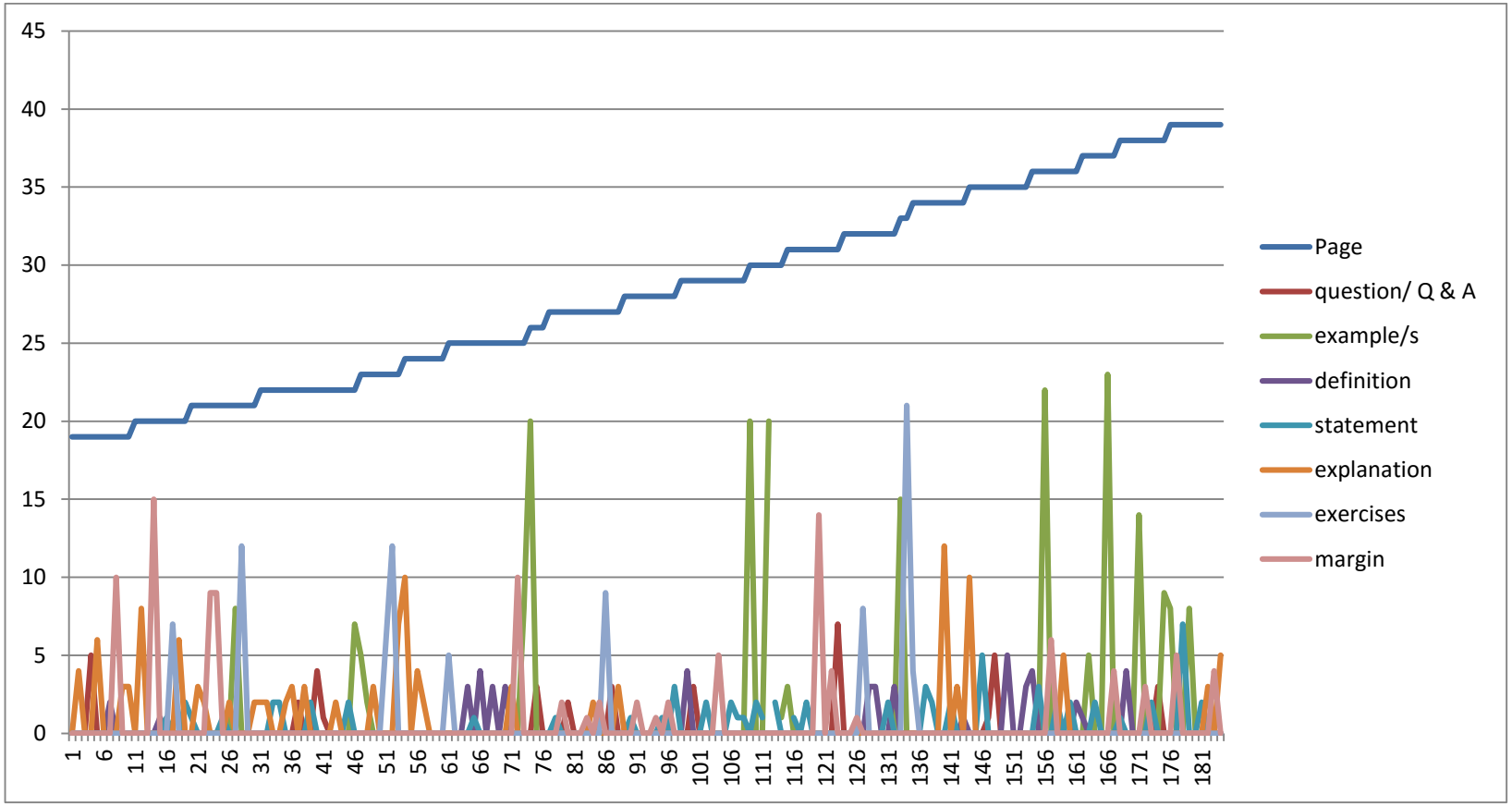

Figure 3. Selected *discursive features* of Chapter 2 of the CR, pp 19-39.

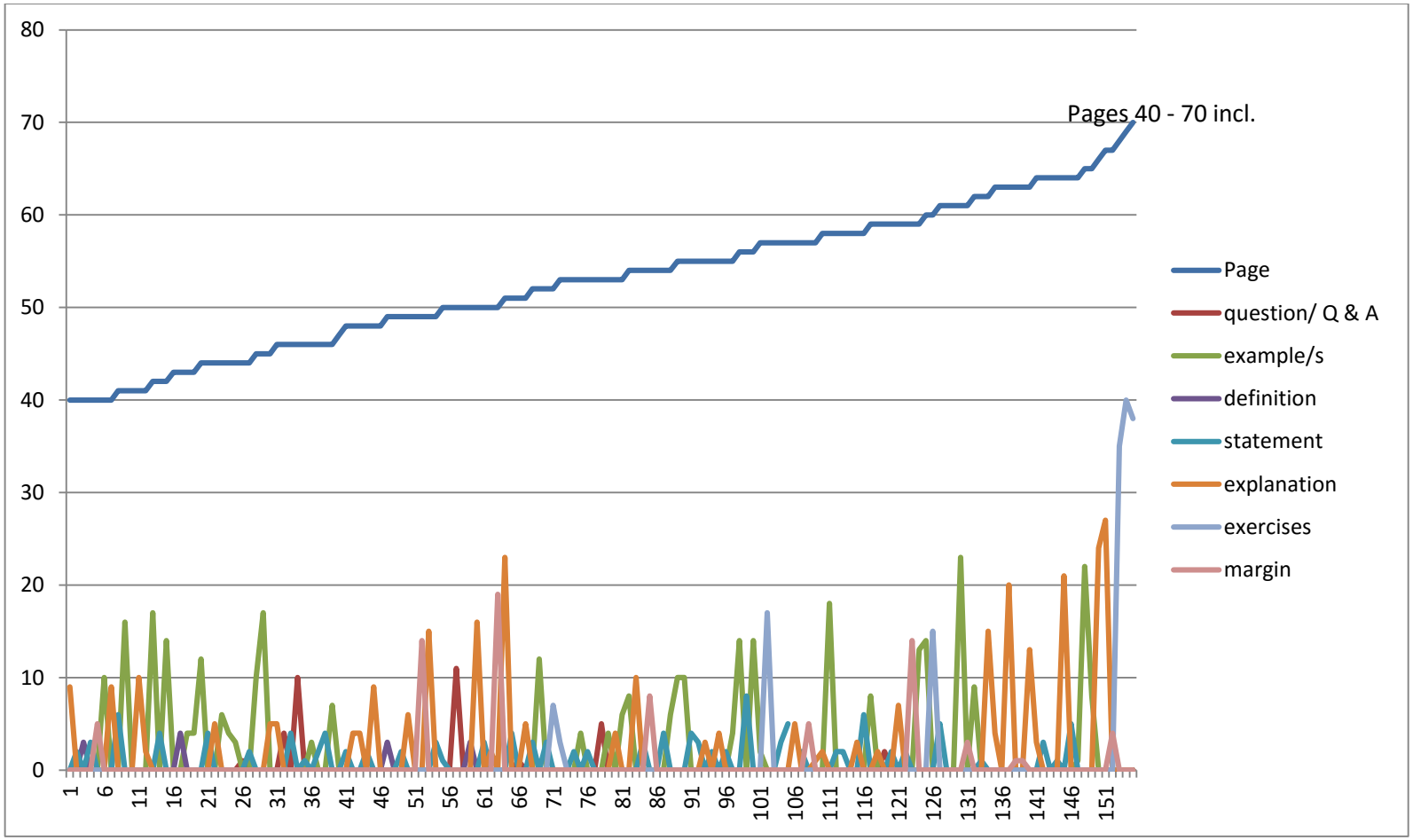

Figure 4. Selected *discursive features* of Chapter 2 of the CR, pp 40-70.