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With the title

**The Tension Between Disciplinarity and Interdisciplinarity in CAPS: A
Content Analysis into Grade 8 Natural Sciences.**

Student Name: Kgothatso Setjakadume Thobejane

Student Number: 1949511

Supervisor: Dr. Alfred Masinire

Abstract

This study explores the tension between disciplinarity and interdisciplinarity in CAPS. Disciplinarity is understood as the typical approach to learning where bodies of knowledge are as isolated and less open to be brought into relation to one another. Interdisciplinarity is on the other hand, the opposite of the former- that is an approach to learning where knowledge bodies are understood and learnt in relation to one another, with the boundaries between them blurred (Chettiparamb, 2007).

A hybrid theoretical framework adopted to this study from the works of Niemela (2020) and Young & Muller (2010) entails an ideology of “three educational scenarios for the future” and “Places and the Range of boundaries & Boundary Crossing Points” from each scholar respectively. The study follows a qualitative methodology and an interpretivist paradigm will be used to work with data collected from the CAPS document, lesson observations, and interviews with teachers. Such an interpretivist approach will be a data analysis approach of content analysis and this is done on the grade 8 Natural Sciences CAPS document used for the subject. Further content analysis on interviews and lesson observations however found that not all teachers can realise the curriculum policy document as it is prescribe to them. Five teachers, from 2 schools (one in working class area, and the other in upper middle-class area) were purposively sample and interviewed data was collected from them. Exploring a play of tension between two ideas in a social setting requires the study to follow an interpretivist paradigm that critically consider ideas at play.

The findings of this study are that the Natural Sciences CAPS shows the characteristics of both approaches. The study further finds that prescriptive nature of CAPS, lack of competency and expertise in these multiple knowledge body, and lack of resources are some of the factors that contribute towards this inappropriate understanding and implementation. Thus, a more detailed curriculum statement, promotion of teacher autonomy, teacher professional development, collaboration, and supply or improvisation on resources are suggested as solutions to this factors and ultimately to achieving a better understanding of the tension that exists between disciplinarity and interdisciplinarity in CAPS. For future research. the study suggests looking into/for ways in which the curriculum can become solidly detailed in order to properly guide the teachers, while still allowing them enough autonomy in their craft.

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Chapter 1: Introduction

Knowledge to be learned at school is an integral part of the curriculum. These contents are, from a narrow perspective, sometimes referred to as the curriculum itself. "... the term is often used to refer to the formal academic programme provided by a school, as reflected in the subjects on the timetable." (Graham-Jolly, 2002, p.3). According to HSRC (1981, p.97-99, as cited in Graham-Jolly, 2002, p.3) the term curriculum can also be defined as "...the total contents of subjects...as well as matching study guides, manuals, and guidelines". This Study is concerned with contents of Grade 8 natural sciences along with its Curriculum Assessment Policy Statement (CAPS) as the manual and guideline for the subject. This document serves as what Graham-Jolly (2002) refers to as an intended curriculum; which could be understood as the plan for how these contents are to be delivered to learners. This is different from an enacted curriculum; which is what actually happens in schools or classrooms during the delivery of those contents (Graham-Jolly, 2002).

The current curriculum manuals and guidelines in South Africa (CAPS) imply a certain way of how knowledge should be organized. The objectives of the Natural Sciences grade 8 subject as intended by the CAPS document (Department of Education, 2011) imply that knowledge should be organized from both a disciplinary (separation of contents according to their disciplines) and interdisciplinary (integration of disciplinary contents) perspectives (Chettiparamb, 2007). These two perspectives to learning and knowledge serve and imply different purposes and approaches. The main aim of this study is to examine how well do teachers understand and implement these objectives as intended by the CAPS manual? This is done through a comparison between an analysis of the two topics that five teachers have taught in terms of how the CAPS intends for them to be implemented, and an analysis of these teachers actually implemented them.

1.1. Background

South Africa has provided a fertile terrain for studying and analysing curriculum for local and international scholars. Since the birth of democratic SA, a significant number of curricular structures have been put in place so as to improve education and address the injustices of the past colonial and apartheid heritage. The first curriculum implemented after 1994 was called Curriculum 2005 (C2005). This curriculum was implemented in 1998 and had appeared to be explicitly reactive to the problems of the previous curricula. We may for now, say reactive

rather than proactive due to how this first post-apartheid curriculum was later criticised, and how this study may also come to understand it as will be further discussed below. Hoadley (2010) however discusses this curriculum reform and analyses how it was a move from traditionalist to constructivist approach to curriculum and classroom organization.

The main critique to the old traditional curriculum was generally targeted towards the tenet of rigidity and prescriptiveness in the previous apartheid curriculum, especially Bantu education; previously meant for the majority of the natives (Christie, 1996). The first post-apartheid reform therefore proposed for knowledge in the curriculum to be locally and regionally decided, for learning in classroom to be learner-centred and prioritize learner's everyday experiences, for learning to be continuous, and most importantly for this study, for the erosion of subject boundaries and knowledge specialisation (Hoadley, 2010).

This reform represents very well a move from a collection code curriculum as alluded to us by Bernstein (1971) to the integrated code. This is seen in how the curriculum decisions on knowledge were decentralised and learning was centred around learners. C2005 has thus broken down the hierarchy of knowledge and discourse that characterizes a collection code and leaned towards the integrated code. In our understanding of the Bernstein/s (1971) curriculum framework, this implies the weakening of framing of school knowledge. Furthermore, the erosion of subject boundaries and suggestion for continuity in learning themes and contents, along with integration of school, and everyday knowledge (Hoadley, 2010) implies a weakening of classification of school knowledge. In this way, an education system that has flourished very well to serve the purposes of segregation in the previous apartheid curriculum was also weakened. This weakening of classification and framing again represents a move from a collection to an integrated curriculum code. The new system was hoped would bring positive social transformation, although would come to be met with hiccups.

C2005 was then revised in 2000 because of certain challenges that were faced in schools especially in schools attended by black children. Some of these challenges were mainly caused by this reduced rigidity and prescriptive nature of traditional curriculum, which was done with hopes that it would be liberatory. It was noted that centring learning on themes and/or everyday lives of learners has resulted in little to no learning as highlighted by Hoadley (2010). This was due to lack of conceptualization of the themes and experiences being discussed and was exacerbated by the fact that teachers in black schools were not skilled and knowledgeable enough to choose and organize their own contents like they were given freedom and power to.

The emancipatory role that C2005 was supposed to play ended up turning into injustice for the learners (Jansen, 1999). Apparently, although this weakening of classification and framing of educational knowledge was meant to empower, include, and ultimately work for the benefit of the previously marginalized, it however turned out to work for those who were already well catered for, that is the white minority learners (Jansen, 1999).

Research that looks deeply into this matter may help us understand why the weakening of classification and framing would not be beneficial to those coming from disadvantaged backgrounds. Charlot (2009) looks into the differences between everyday lives of learners from privileged backgrounds, and disadvantaged backgrounds in terms of the experiences that they provide to each group of learners. He finds that the experiences that learners from privileged backgrounds gain from their interactions with their immediate environment are likely to help them gain habitus that are useful in a formal school environment. This cannot be said about learners from disadvantaged backgrounds and the experiences they gain from their everyday lives. Thus, weakening the classification and framing between everyday and school knowledge as intended by C2005 would not be effective.

The rigidity of classified and framed knowledge, and prescriptive character was therefore brought back into the curriculum through the Revised National Curriculum Statement (RNCS). According to Hoadley (2010), the ministerial task force took a realist approach to curriculum and brought back the rigidity and prescriptiveness automatically downscaling the flexibility. By saying realist, it is implied that the curriculum does not necessarily go back to being a reflection of the apartheid Bantu curriculum (Young & Muller, 2010). The realisation is that although localized ways of knowing are important for curriculum and power over what goes into the curriculum need to be distributed more evenly, these still need to be regulated and there still needs to be a central system. Moreover, there still needs to be tangible knowledge systems that are worked with in classrooms than just mere everyday life experiences. From a Bernsteinian perspective, the review team tried to find a balance between a collection and the integrated code. They did not completely strengthen the classification and framing but tried to clarify their presence. “The *Curriculum 2005 Review Report* strongly recommended reduced integration and clearer specification of contents” (Hoadley, 2010, p.150).

Chisholm (2005, as cited in Hoadley, 2010) argues that the RNCS was a compromised curriculum and the orientations towards outcomes, constructivism, and progressivism still dominated education. These became too entangled to differentiate (Morrow, 2000; Harley and

Wedekind 2003, as cited in Hoadley, 2010), and it became unclear as to how they connect and disconnect with prescribed specialized content. The relevance and effectiveness of the second reform was then questioned and a new revision was made.

The third reform emerged in 2009 in the name of CAPS. For the reasons stated above, CAPS then completely removed aspect of thematic learning (Hoadley, 2010) and strengthened the classification and framing of knowledge in the curriculum. The boundaries between the contents were strengthened, and the content and pedagogical prescriptions were made even clearer (Hoadley, 2010). This implies CAPS thus adopted the Bernsteinian idea of collection code to curriculum organisation.

1.2. Understanding the current CAPS in South Africa

Due to the strengthened classification and framing of educational knowledge, CAPS is understood to be organized into subjects of content derived from traditional disciplines. It is therefore to a great extent organized around the idea of disciplinarity especially as you go up the phases and grades. One of the ideas that serves to demonstrate this orientation to disciplinarity is one of the general aims of the CAPS which states that the “National Curriculum Statement Grade R-12 is based on the principle of progression: content and context of each grade shows progression from simple to complex” (Department of Education, 2011, p.4-5). This aim characterizes solid disciplinary discourses.

The curricular reforms that happened since 1998 therefore represents what is normally called a return to knowledge (Young, 2013), (knowledge referring to the traditionalist disciplinary structures) and an abandonment of the thematic progressivist approaches to curriculum that were introduced immediately post-1994. This is perhaps the reason why CAPS is widely understood from a perspective of only disciplinarity, and actually an opposite or a rejection of integrated curriculum or interdisciplinarity. The design of CAPS itself actually explicitly emphasizes distancing oneself (curriculum) from the nature of interdisciplinarity that was embedded in C2005, and thus, it is thus nearly impossible for us not to understand it from only a perspective of disciplinarity.

Although at face value it may appear that CAPS is characterized by disciplinarity, an analysis of most of the general aims of the current South African curriculum may come to require that we understand it from beyond just a perspective of disciplinarity. In fact, amongst the objectives

of the current South African curriculum statement, most if not all the aims and objectives either directly or indirectly allude to the significance of interdisciplinary learning.

One of these objectives stated in subsection (d) under general aims of the South African curriculum is that “the National Curriculum Statement Grades R-12 aims to produce learners that are able to demonstrate an understanding of the world as a set of related systems by recognizing that problem-solving contexts do not exist in isolation” (Department of Education, 2011). This statement directly alludes to CAPS aiming and/or oriented towards interdisciplinarity. Moreover, subsection (a) is concerned with a curriculum that provides learners with knowledge that is sensitive to global imperatives (Department of Education, 2011, p.4). The second point of subsection (b) mentions that “the National Curriculum Statement Grades R-12 serves the purposes of providing access to higher education” (Department of Education, 2011, p.4).

While the last two aims of the CAPS mentioned above do not directly allude to the significance of interdisciplinary learning, they all however imply its need thereof if they are to be truly achieved. For example, with regards to global relevance, there exists a global trend on learning at school level to follow an interdisciplinary approach, for various reasons to be discussed in the literature review below (Gouvea et al, 2013). Furthermore, the idea of interdisciplinarity does not end at the school level but extend to undergraduate studies and postgraduate research level (Jaureguizar, 2018). Thus, if the curriculum is to prepare learners for higher education, it must begin to engage them in interdisciplinary learning from school level.

This is just a glimpse into CAPS as to how we can see not just elements of disciplinarity or collection code but also those of interdisciplinarity and/or the integrated code to curriculum. More can be found and clarified as to the extent to which the two approaches to knowledge and curriculum are present in CAPS if we can analyse more than just the objectives and go deep into the actual contents and organization of a specific subject such as the senior phase Natural Sciences.

1.3. Problem Statement

This study finds it problematic how CAPS and the processes of forming it, had come to criticize the one that precedes it (RNCS). The quest for clarity and less complications that came with the formation and especially the implementation of CAPS had come with a disregard or avoidance of certain factors without looking at their significance or the hazards that may come

with their lack thereof. Although the purposes of CAPS alludes to the significance of interdisciplinarity, and the inner contents of the natural sciences policy document may be hypothesized to characterize it [interdisciplinarity], CAPS is widely understood from a perspective of disciplinarity. In other words, CAPS is oriented towards what Eisner (1985) would refer to as academic rationalism which is concerned with mastery of knowledge derived from the specified contents.

It [CAPS] is therefore generally understood to embody disciplinarity while its interdisciplinary traits remain unexplored. Teachers that implement the curriculum therefore may not be able to realize this tension that exists between interdisciplinarity and disciplinarity, thus, not being able to embrace it in their practice. Furthermore, those who study and design curricula are obscured from the interdisciplinary side of CAPS. Their engagement with CAPS would therefore be one-sided and reflect a disciplinary discourse which Chettiparamb (2007) highlights that it only studies a single side of phenomena. Interdisciplinarity does exist within disciplinarity as Chettiparamb (2007) maintains. It then becomes problematic when CAPS is only widely perceived only from a disciplinary perspective whereas some of its aims demonstrate the need for interdisciplinarity, and the interdisciplinarity within the disciplines is not realised.

1.4. Purpose of the study

This one-sided understanding of CAPS (only from a disciplinary perspective) implies that there is a theoretical gap that exist (that of interdisciplinary traits) which this study hopes to fill.

The filling of the theoretical gap would pave a way for the filling of the pedagogical and assessment gap that exist because it may mean that pedagogies and assessments that are assumed, and taking place within the curriculum also do not account for interdisciplinarity and the tension that exist between it and disciplinarity, in working with knowledge. This study therefore establishes a foundation for thinking about pedagogies and assessment practices that embrace both disciplinarity and interdisciplinarity, and the conditions and opportunities for boundary crossing and maintenance between the two.

To establish this foundation, the study therefore assumed a purpose of analysing content from the grade 8 Natural Sciences CAPS document as well as the textbook so as to establish the tension that exists between disciplinarity and interdisciplinarity, and its extent.

Objectives of the study

This study therefore firstly searches for the presence of both a disciplinarity and interdisciplinarity within the grade 8 Natural Sciences CAPS. In the process of establishing an understanding of the interdisciplinary character of CAPS, the study establishes an understanding of the tension that exists (or would exist) between disciplinarity and interdisciplinarity within CAPS.

1.5. Research Questions

Main research question

What tension exists between disciplinarity and interdisciplinarity in grade 8 natural sciences CAPS?

Sub questions

1. What is the evidence, and the extent to which disciplinarity and interdisciplinarity are present in grade 8 natural sciences CAPS?
2. What is the nature of the tension that exist between disciplinarity and interdisciplinarity in grade 8 natural sciences CAPS?
3. How do teachers understand this tension and implement their understandings in classrooms discourse?
4. What could be the conditions for boundary crossing and maintenance in grade 8 natural sciences CAPS and beyond?

1.6. Conceptual Framework

Part 1: “Three educational scenarios for the future”

The study analysed the presence and nature of the tension that exists between interdisciplinarity and disciplinarity in CAPS. The Bernsteinian ideas of classification and framing were useful to generally analysing how weak or strong the boundaries between the natural sciences contents, and how strictly controlled is the sequencing. This lead us to use a conceptual framework derived from Young & Muller (2010). This framework is known as “Educational Scenarios for the Future”, and it conceptualizes boundary crossing and maintenance from three concepts.

The first concept/scenario is an “under-socialized conception of knowledge” and is leans more towards disciplinarity where subject boundaries would be clearly drawn and strictly maintained (Young & Muller 2010). The second scenario is an over-socialized conception where disciplinary boundaries are almost completely destroyed and the notion of interdisciplinarity is to the greatest extent dominant in how knowledge is conceived (Young & Muller 2010). The last scenario is known as “powerful knowledge” where the idea of disciplinarity is cautiously balanced with the notion of interdisciplinarity and the crossing and drawing of disciplinary boundaries are carefully made (Young & Muller 2010). An analysis of the contents of the natural sciences CAPS documents in this case helps us understand at what different points can these scenarios be applied, to what extent are they applied, in overall which scenario is prevalent in CAPS. Furthermore, which scenario would be desired, and thus how can it be made prevalent in further and continuous curricular development. This part of the framework was also very useful in getting a general idea on what scenario did each lesson follow

Part 2: Places and the Range of boundaries & Boundary Crossing Points

Furthermore, the content analysis have followed a framework of two concepts that account for the “place and the range of boundaries” and the “boundary crossing points”, adopted from Niemela (2020). On the first concepts, an analysis is made on how far apart are the contents of knowledge that are present on each side of the boundary (Niemela, 2020). For example, if the concept is in the Newton’s laws, is it put in relation with another concept in the Newton’s laws, something within Mechanics, within physics, physical sciences, natural sciences, or outside into the social sciences.

On the concept of “boundary crossing points” the two contents put in relation to one another are firstly analysed from a perspective of “**correlation**”: the extent of maintenance of the boundaries between them (Niemela 2020). Secondly from a perspective of the “**core subject**”: which content is at the core, and which is at the periphery (Niemela 2020)? For example, when learning photosynthesis, the concept of chemical formulae is integrated but stays at the periphery. Thirdly, from “**connective subjects, courses, and units**”: how strong the classification is (Niemela 2020)? The integration that occurs between photosynthesis and chemical formulae is between contents from physics and chemistry; absolutely two different disciplines. Fourthly, “**optionality**”: is it optional or compulsory to cross boundaries (Niemela 2020)? It is required to integrate these two concepts in order to understand the process of photosynthesis. And lastly, “**cross curricular integration**”: are the contents in either sides of

the boundaries sharing the same, or have differing objectives (Niemela, 2020). The concept of chemical formulae is oriented towards beyond just biological processes unlike photosynthesis which is specifically towards a certain biological process in plants. All these concepts provide an opportunity to understand the extent and nature of disciplinary boundary crossing and maintenance in the curriculum.

Chapter 2: Literature Review.

According to Flick (2015), a literature review is an in-depth analysis of the ideas, models and conceptual frameworks currently used within a given field of study. For Mertens (2010), a literature review is critical in primary research design because it establishes a solid foundation for contextualising the study within the broader body of prior research. An understanding of the limitations of previous research on a topic is gained through a literature review and new insights are generated that fit within this broader framework (Vicente-Saez & Martinez-Fuentes, 2018).

This study as primary therefore deserves a thorough literature review so that the data collected here may find foundation on well-integrated existing theories and concepts. The dual conceptual framework developed above is a first step in developing a base for understanding our primary data and answering the research questions. The literature that is included in the following review is that which can help us understand the two concepts of disciplinarity and interdisciplinarity and furthermore, the idea of tension between two. The two first concepts are more historical and have reinforced themselves as traditions and thus more old literature can help us get how they are classically understood. Possible practical examples that may represent any of the three possible ways of working with knowledge will be used to understand the three concepts, and the conceptual framework will be integrated into the relationship between to help clarify what it would mean to apply these abstract concepts.

To be more focused and clear the study simply follows the research questions and the conceptual framework is also useful in conceptualising the answers that are possible in the interpretation of the data collected.

Theory on disciplinarity and interdisciplinarity.

From the early days of mass schooling, knowledge has been organized into subjects of knowledge insulated from one another (Richmond, 1990). This organization and approach to knowledge is known as disciplinarity and is still dominant in schooling today (Foucault 1972, as cited in Shumway & Messer-Davidow, 1992). The term disciplinarity is derived from classic Latin word: *disciplina*: which was derived from Greek and Latin words: *didasko* and *disco* respectively. The former means to teach, while the later means to learn. In Latin, the word *disciplina* has double meaning: teaching and learning of scientific knowledge, and also militant

discipline (Shumway & Messer-Davidow, 1992). This implies the structuring of knowledge from this approach is meant for developing one's mind in a disciplined and orderly way. Because of the characteristics of systematization and discipline, disciplinarity was then until recently believed to be good for it went beyond the systems of enchantment that were not publicly systematized and lacked reasons for knowing under them. Disciplinarity is therefore an approach that emerged in the period of modernity and its systematizing and militant character implies universalized point of view to scholarship. This character again suggests a collection code to curriculum as understood by Bernstein (1971), where the seven liberal arts are strongly insulated from one another and engaged with through strictly prescribed methods (Shumway & Messer-Davidow, 1992).

This scholarship emerged at the dawn of modernity and has stayed dominant for centuries until the mid-20th century when it was then challenged by postmodernist scholarships. During a transition from enchantment to enlightenment in the West (in the mid 1700s), there existed an ambition in elite scholars such as Newton and Leibniz to come up with rigorous scientific accounts and systems for enquiring into, and knowing about the world (Smith, 2010). This ambition was aimed at challenging the then prevalent religious ordained accounts of being. For these scholars nature reflected the rationality of God, and if He has made humans in His image, then they [humans] are rightful in accessing that rationality through: experience (of nature), logic, and reason (Smith, 2010). Disciplinarity would then emerge as a tool or system to realize that ambition.

The systematization involves different forms of approaches which have evolved since the early days of modernity. This evolution, as will be discussed, may be somehow interpreted to the birth of the new forms or lines of thought which came in postmodernity. The first disciplinarian scholarship of line of thought in of modernity was positivism which is believed to be pioneered by Alexander Comte (Phillips, 2000). A group of scholars then formulated branch to positivism such that positivism would be practical, and they were called logical positivists. They followed a process known as inductivism and that was the beginning of disciplinarity becoming more justified and systematized than enchanted lines of thought. Inductivism involved making observations around reality and concluding based on frequency or consistency in the results that are observed. These conclusions would then serve as theories for knowing about that reality (Phillips, 2000).

Logical positivism and inductivism was then challenged by a subsequent version of positivism. Deductivism as pioneered by scholars such as Hempel have come to find fault in inductivism for that it is close to, if not impossible to know for sure that every part of reality (that is every phenomena) being studies around the world will be produce consistent results of observation. This is due to the fact that its is nearly impossible to know about, let alone go through each and every phenomenon. Thus, the deductivist approach then suggested that there should be a hypothesis derived from natural truths or laws of nature which the observations will be made against. This was a progress made in positivism and disciplinarity and the latter was therefore strengthened as a rigid line of thought.

Karl Popper however came to challenge this approach to enquiry for he believed that no scholarship could come to finally know of the world with absolute accuracy. If that was the case, then research would come to an end. He then proposed that the purpose of enquiry into reality should be concerned with continuously looking for faults in the most recent accounts in order to improve on them. This was the birth of what would then be known as falsificationism.

Disciplinary knowledge as have evolved so many stages has up to the present day come to be understood a certain way. When thought of in the curriculum by scholars such as Durkheim and Bernstein, it appears to be a formal, hierarchical, and sacred knowledge that defines academia (Muller, 2022). In short, it is understood to be purely oriented to academic rationalism (Eisner, 1985); that is the focus on having individuals acquire a purely disciplined academic knowledge and going on to develop a more heightened understanding of the knowledge so as to contribute to the growth and development of that discipline.

The ideas of testing and evidence that were key to the development of positivism throughout modernity are not properly embraced in the present day understanding of traditional approach to learning and disciplinary scholarship. The idea that disciplinarity is more about knowing than doing as highlighted by Chettiparamb (2007) takes away from the experimental nature and is pivotal to classical disciplinary scholarship. Moreover, this understanding then prevails in the understanding of CAPS as a curriculum by most Natural Sciences teachers as shown in the study by Tsotetsi (2021). The idea of doing is taken away from CAPS and this is evident in how strengthened the framing of this curriculum is understood to be. Teachers therefore prioritize the covering of content through only knowing, and the doing part is abandoned, and this becomes an understanding of how CAPS is a militant disciplinary curriculum (Tsotetsi, 2021).

The mistakes that happened in the development of CAPS from the RNCS is what would typically happen when an endeavour into powerful knowledge takes place. Muller (2022) highlights that disciplinary/sacred/hierarchical knowledge tends to be prioritized either consciously or not when trying to understand and/or implement powerful knowledge. The question asked in this study is whether this happens in the intended or enacted curriculum, or both for the South African CAPS.

Although modernity and disciplinarity have come to be challenged since the mid-20th century, we may have to agree that they have provided a huge steppingstone to knowing and tools embedded within them remain, to a great extent relevant even in today's world. The ideas of reasoning, knowing and experimenting are very important in systematically accounting for reality. For these reasons, the ideas and/or the systems rooted in disciplinarity are making a comeback as several scholars such as Young & Muller (2013) are questing for its returning especially in South Africa through a concept known as "powerful knowledge".

The idea of powerful knowledge as briefly alluded to in the conceptual framework is a balance between an undersocialized and oversocialized curriculum. It is helpful towards understanding curricular structures such as the CAPS for they may not be necessarily undersocialized. The study into the EE integration project in the Eastern Cape by Benjamin & Adu (2019) may suggest that CAPS is not a completely undersocialized. Specifically, the Natural Sciences CAPS document also suggests that it may be oversocialized. This is seen in how it has the requirements of practical testing and evidence ideas (meaning that it is more about doing than understood). Moreover, the classification is weakened although mostly just within the subject itself. This however still is evidence of how the subject embraces interdisciplinarity.

The problem is however with the realisation and enactment of this understanding of the oversocialized curriculum. Tsotesi (2017) finds that teachers do realise this socialized character of the Natural Sciences CAPS. The problem is then with marrying its undersocialized trait with its oversocialized one. The strengthened classification is blamed for preventing the realisation of interdisciplinarity. Teachers find that there would be no time to squeeze in the practical work when the curriculum is heavily packed with content and strictly sequenced. It is felt that it would again be a waste of time when you are teaching one concept and have to relate it with another concept that may not be required in assessment (Tsotetsi, 2021).

Nonetheless, powerful knowledge becomes a useful concept to understand, especially in the rethinking of CAPS. The fact that the Natural Science CAPS requires learners to accumulate

knowledge implies the need for a return to knowledge, without disturbing current curricular structures. Scholars such as Michael Young remain relevant and had come to influence most curricular structures around the globe including the South African CAPS curriculum (Harrop-Alin & Kros 2014). One of the key organizing strategies used within disciplinarity is the division of content knowledge into subjects (also known as disciplines) we know of today. These branches of knowledge as we know of them today are part of a whole philosophy established at the beginning of modernity. The curriculum organisation was initially divided into seven liberal arts (subjects) (Shumway & Messer-Davidow, 1992). The South African curriculum mentioned above is predominantly organized into these seven liberal arts, with slight variations, and continues a strong classification and framing of knowledge from these arts.

Regardless of making a come-back into scholarship, it makes logical sense that the evolution of disciplinarity and positivism would come to influence the development of interdisciplinarity. Chettiparamb (2007) acknowledges how there exists interdisciplinarity within disciplinarity. This was a result of the approach to enquiry as envisioned by falsificationism. One would imagine the process of developing new theory from a revision of an old one as a process that requires looking at the existing account for reality from a different perspective. How else would one uncover a new truth about reality without inspecting it from a different point of view? Looking at reality from more than one perspective is at the core of interdisciplinarity and falsificationism had come to inspire the idea that there exists multiple perspective to truth and knowledge, thus interdisciplinarity existing within disciplinarity. This study therefore finds it necessary that the idea of interdisciplinarity existing within disciplinarity be explore within certain structures that are widely accepted to be of a disciplinarian form such as the CAPS curriculum.

Postmodern approaches to education and organizing knowledge aim to go beyond the disciplined division of knowledge into traditional subject, and systematically integrate the contents of these subjects (Chettiparamb, 2007). One of the postmodernist scholars: Jean Francois Lyotard (1984) criticizes the totalitarian approach to knowledge as proposed by Habermas and argues for multiple ways of knowing to be considered (pluriversality) (Richmond, 1990). These multiple ways of knowing may present multiple perspectives to a single phenomenon, and may characterize interdisciplinarity as described by Chettiparamb

(2007) especially if they follow the notion of ‘transdisciplinarity’ as proposed by Le Grange (2016) for decolonization.

Strachan et al (2022) discusses how traditionally schools and specifically universities have developed professionals as boxed individuals who cannot think outside the confines of their disciplines. Disciplinary learning is characterized by fragmentation amongst different bodies of knowledge. Chettiparamb (2007) highlights how disciplinarity only enables the study of aspect of phenomena and how this does not allow for a holistic understanding of different aspect to phenomena. Several authors agree that modern day problems require solutions that integrated various forms of knowledge from different disciplines (Buanes & Jentoft, 2009; Klein, 1990). By integrating the contents from various subjects, it is then believed that multiple aspects of phenomena studied by those subjects will be understood and modern day problems requiring this integration would be tackled effectively. Thus, Strachan et al (2022) also suggests that schooling should be progressive and employ interdisciplinary approaches so as to unbox learners from the confines of their disciplines.

South Africa had once organized its curriculum using an interdisciplinarity approach at the birth of democracy to transform the education and address social, political, and economic challenges. In C2005, subject boundaries were blurred and contents of subjects were studied in relation to one (Hoadley, 2010). C2005 therefore adopted an integrated code of curriculum by weakening the classification. Furthermore, teachers as facilitators were given more pedagogical freedom. C2005 also weakened the framing of educational knowledge, if interpreted from a Bernsteinian theory (1971). Thus, the militant and disciplinarian approach to education had been minimized in this curriculum.

Interdisciplinarity is not really concerned with the what of knowing but the how of it (Chettiparamb, 2007). Rather than abstracted knowledge, interdisciplinarity would employ everyday issues and themes. That is the reason why Reznikova et al (2020) discusses global issues and themes being central to interdisciplinarity so as to promote sustainable addressing of such issues. Thus, C2005 also did not emphasize what knowledge but focused on themes and contexts which represented phenomena that will be studies from multiple perspectives, and not those perspectives in fragmentation (Hoadley, 2010). C2005 was however continuously revised until CAPS was established. Although CAPS is widely understood from a perspective of disciplinarity, this study claims that it has inherent tenets of interdisciplinarity that were dominant in C2005. These tenets continue to be unexplored and thus are not pedagogically

realized. If the interdisciplinary aspect of the CAPS is not understood, this should imply that there is a gap between the intended and enacted curriculum. Graham-Jolly (2002) defines the former as the plan in the guidelines for the delivery of the curriculum, and the latter as the actual execution of that plan. If the interdisciplinary aspect is unexplored and unrealized, teachers are therefore far from enacting the intended curriculum.

Interdisciplinary as strongly founded on post-modernism has rather than being hierarchical and sacred, been understood to be horizontal and profane (Muller, 2022). By being horizontal, interdisciplinary knowledge is not afraid of breaking boundaries between traditional disciplines, and by being profane, it is also not afraid of crossing into the so-called every day, 'mundane' world.

Disciplinarity is characterised by insulated subject contents or what Bernstein (1971) refers to as strong classification. On the other hand interdisciplinarity encourages the breaking of those subject boundaries. If as per the objectives of the CAPS curriculum, both disciplinarity and interdisciplinarity are perceived as significant, then they do or should exist in tension as they allude to completely two opposite ways of organising knowledge. This study thus aims to understand the tension between disciplinarity and interdisciplinarity in CAPS natural sciences. Revealing the nature and extent of this tension would help us make a judgment on whether CAPS is living up to powerful knowledge or is headed back into an undersocialised curriculum.

The two ways of thinking about knowledge above are discussed in isolation and this study seeks to understand the tension between them in the CAPS. It is now then a question of what does it mean to stay in one compartment of knowledge and work hierarchically while at the same time crossing boundaries between multiple compartments and becoming profane with knowledge? Bernstein (1971) as cited in Muller (2022) outlines these two types of curriculum knowledges in separateness and thus cannot be entirely helpful for a study that tries to understand the tension between disciplinarity and interdisciplinarity. For such a study, a neo-Bernsteinian ideology is needed and Wheelan (2007; 2010) as cited in Muller (2022), introduce us to the concept of powerful knowledge – a concept adopted as a part of the framework for this study as discovered through Young & Muller (2010).

Beyond the concept of powerful knowledge. Niemela (2020) presents a more practical framework of how this powerful knowledge can be realised, and this entails the idea of boundary crossing and maintaining which is pivotal to understanding the data gathered in this study.

Pedagogies of disciplinarity and interdisciplinarity

Research has established that the senior phase is widely under-researched when it comes to issues that are faced within classrooms. This study then becomes very significant to understanding such issues especially so as to understand the stem of the problems that both teachers and learners encounter later in the further education and training (FET) phase. In the lower phases, Natural Sciences and other subjects are amalgamations of certain disciplines, and various studies have explored how interdisciplinarity is actually doable and realistic in these subjects as there is less technicist requirements such as performance accountability.

There is less literature to refer to within our study. Although this may be the case, there has been studies around the integration of Natural Sciences and other subjects as have been inspired by the first post-apartheid curriculum (C2005). One of these by (Tsotetsi, 2021) has come to illustrate that there may be a disconnect between teachers' understandings and awareness of the CAPS and their enactment of it, and this is due to the disconnect between the classroom learning requirements, and accountability requirements.

The collective nature of disciplinarity in learning; that is the strengthened classification, is not the only important aspect of Bernsteinian theories that is considered in this study. Half of the two-fold understanding of the concept of disciplinarity also alludes to the framing of school knowledge (Bernstein, 1971). An understanding of the disciplinarity side of the pull is not only just about the insulation of content subjects from one another but also about the power relations that characterizes learning. The other side of the pull would also need to be looked at, as to what does it mean to learn in an interdisciplinary way. Does it mean to learn in an unordered way?

The framing would therefore allude more to the pedagogy that would be followed during learning (Bernstein, 1971). Multiple analyses to approaches to learning have been made over the history of education. These analyses cannot be concluded to have emerged in the following way: but often appear whenever traditionalist or disciplinarian approaches to working with knowledge are criticized. The word discipline, and its implications to order is often widely understood to be referring to how strict and regulated teaching and learning would be under curricular structures thereof (Chettiparamb, 2007). These understandings would come to apply pretty much to the current South African curriculum (CAPS), by both teachers and scholars. The struggle that most teachers have found with teaching under this curriculum was with how

strict and prescriptive it was. It is found to be bombarded with content requirements and this leaves teachers under a serious pedagogic pressure. Teachers find that the content is a lot and the manuals require them to teach it in a certain order, and this leaves them no choice but to teach it in a conventional way (Benjamin & Adu, 2019; Tsotetsi, 2021).

Teacher believe that they are forced by the accountability priority to follow the type of pedagogy that Freire (1970/1996.) would refer to as the banking education. The Eastern Cape teachers that were studied by Benjamin & Adu (2019) also felt the impossibility of teaching in an integrative way, partly because of the prescriptive nature of the CAPS document. They were therefore forced to approach teaching from a banking concept. This was also the case in Tsotetsi's (2021) study as mentioned above.

Following this concept has certain implication to the framing of educational knowledge as addressed by Bernstein (1971). Learners would not have much voice in how the knowledge is organized since their teachers have none, and would also have less voice in the lesson. This kind of curriculum would be understood to require learner to assimilate and store the content in their minds and would later be required reproduce it.

Scott et al (2006) understands this strengthened framing (in addition to classification) from a point of communicative approaches that happens in classrooms. The banking concept would be practically characterized by approaches to communication which uphold only the teacher's voice. In such teaching-learning spaces, the conversations therefore tend to be non-interactive, and the teacher assumes all the authority. In this way, they find it easy to deposit the information into the heads of the learners.

Now it would never be absolutely authoritative and non-interactive that only the teacher talks in class. It becomes pretty much authoritative because the teacher control what is discussed, and non-interactive because the teacher limits the extent to which the content is discussed. Hasan (2002) provides deeper and useful insights into how actually, classrooms conversations normally follow authoritative patterns as compared to dialogic and/or generic ones. This lies heavily in the type of questions that are normally asked in such classrooms. Hasan refers to these types of questions as assumptive and they do not require much from a learner. They are asked with an intention to have learner confirm and accept what the teacher is saying rather than thinking deeply about it. The learner is therefore simply required to store information, and

this is less chaotic as disciplinarity would require working with knowledge to be orderly (Chettiparamb, 2007).

These assumptive questions according to Hasan (2002) are predominantly asked in working-class families, and an analysis of Burgin (2020) leads us to realizing that these kinds of questions and other elements of discourse associated with them are also predominant in schools for learners from townships.

Understood from these multiple perspectives, disciplinarity is then characterised by an undersocialised educational scenario and the sacredness that plays out in the classroom interactions give disciplinarity the strength in the tension that it finds itself within, against interdisciplinarity. Understood on its own however cannot take us beyond the classical Bernsteinian theories of understanding curriculum (Muller, 2022). We thus, need to also understand how interdisciplinary pedagogies strengthen themselves in this tension we are trying to understand.

Interdisciplinarity does recognize and embrace the flexibility and freedom that goes into effective learning and/or inquiry. The pull that is coming from the interdisciplinary side: creating tension is also understood by Kirschner et al (2006) as minimal guidance. This pedagogic approach entails the remaining half of the Bernsteinian theories of curriculum and thus would be explained by a weakened classification and framing of curriculum knowledge (Bernstein, 1971). Communicative approaches that would make practical such framing of knowledge as understood by Scott et al (2006) would include non-authoritative and extremely dialogic discourses.

In the process of praxis (Freire, 1970/1996), learners are given more freedom to explore the problems and solutions to them rather than being instructed by the teacher, and thus the framing of educational knowledge is weakened as according to Bernstein (1971). The learner is given more freedom and authority over problem-solving and the knowledge to be learnt in class. Now, South Africa's first post-apartheid curriculum has followed such pedagogical approaches to teaching and learning (Hoadley, 2010). C2005 had come to assign teachers to the roles of facilitators of classroom discourse. They were understood to becoming less visible and disappearing from the classroom as understood by (Jansen, 2001). In Scott et al's (2006) terms, the problem-solving process and classroom discourse were at these times intended to be

dialogic and interactive with learners participating more than they would if the teacher is given more power over educational knowledge.

This pedagogic approach is not to be understood as the ultimate way of working with knowledge or understanding the curriculum but as an opposite to the disciplinary approach. It is therefore not a neo-Bernsteinian powerful knowledge pedagogic approach but still just an account for an oversocialised scenario of education as understood by Muller (2022); Young & Muller (2010)

It is easy to understand the idea of problem-solving as interdisciplinary as Freire (1971/1996) clearly opposes it to the banking concept of education and argues that the former is allowing of learners to rather than assimilating abstracted concepts, look into real world and everyday problems and attempt to solve them in a formal way. Problem-solving however is widely accepted in many other contexts as a tool of powerful knowledge which is a neo-Bernsteinian approach to be understood as the ultimate goal in this study (Karpov & Bransford, 1995; Gredler & Shields, 2008, Burgin, 2020, Villaroel et al, 2020, Luchinskaya, D. 2025). Chettiparamb (2007) also emphasized that what differentiates interdisciplinarity from disciplinarity is that the former is more about doing that knowing, and the problems-solving concept is suited to encourage both.

In these facilitation of discourse, the teacher's role would be asking what Hasan (2002) refers to as prefaced questions which are genuine questions causing an individual to think more deeply about the problem and knowledge in discussion, rather than simply accepting what may be said by the teacher or what is written in the book. This is likely to eject different ideas proposed by different learners and the fact that teachers power over knowledge and discourse around it is downplayed is likely to mean that such type of learning becomes more chaotic or unorderedly (ill-disciplined).

Regardless of the lack of order to be anticipated with weakened classification and framing of educational knowledge, the problem-solving idea which cannot avoid this lack of order is understood by many scholars to be one of, if not the best pedagogic approach to enabling meaningful learning. The ideas of Vygotsky are very influential towards the spark of this thought. Gredler and Shields (2008) unfolds a four-step process of development of scientific concepts. The idea around the importance of problem-solving towards true learning is that meaningful learning or acquisition of scientific knowledge can only be deemed to have had

occurred if one is able to use such acquired concepts to solve problems related to the reality that the concept is accounting for (Gredler & Shields, 2008). Karpov & Bransford (1995) also concur with this ideology of problem-solving as the best for teaching of scientific knowledge and concepts; sharing the same sediments with Gredler & Shields (2008). The concept of authenticity around pedagogy and assessment also put at the centre problem-solving of meaningful schooling activities (Villaroel et al, 2020; Burgin, 2020).

How these studies further understand problem-solving is very interesting to this study for the light it sheds towards disciplinarity and interdisciplinarity. They acknowledge both ideas for the unordered problem-solving is appreciated as important but not the end point of learning. The freedom of exploring ideas in solving problems is important towards developing those ideas and new ones. However, there should be theoretical basis on which the process derives direction. In this way, a “headless” inductivism as was used by logical positivists is avoided and a more advanced deductivist approach is adopted (Gredler & Shields, 2008). Karpov & Bransford (1995) refers to the kind of learning that follows no theory as empirical learning, and differentiates it from theoretical learning which is theory-laden. As was evident in their study, it took the learners who engaged in empirical learning about 1230 trials to learn how to write the 22 letter Russian alphabet, while it took only about 60 trials for those who were engaged in theoretical learning. This was because latter group of learners were headed into their real world with an idea of how to generally solve such problems posed to them.

Hasan (2002) also sheds lights towards us appreciating both disciplinarity and interdisciplinarity when highlighting the differences between the kinds of conversations that learners from families of different socio-economic classes, in terms of the extent to which they may lead towards developing concepts. Yes, instead of being asked assumptive questions, learners from well-to-do families may be asked prefaced questions so as to have them think deeply about the real world phenomena they are discussing. However one of the concepts that Hasan (2002) discusses that may be easier to be taken as less important for it accounts for kind of conversations that normally occur in working class households is that of ancillary use of language. He finds out that in working class families, children are normally engaged in language that is used to assist actions or activities whereas in well-off families, the kinds of conversations held are highly directed towards meaning-making or abstraction. If interdisciplinary learning is more about doing, it may be apparent that the ancillary use of language is very important in learning.

This ancillary use of language however should not lead to a simple memorization of steps that are perhaps to be followed in doing an activity because it would reflect the banking concept and the deeper conceptual development would not be possible. If interdisciplinarity is more about doing and more of doing may lead to a banking of procedures, how can this be mitigated? How can doing lead to knowing at the highest possible or required cognitive level? This is where Karpov & Bransford's (1995) of theoretical learning over empirical learning are now useful; that problem solving should be guided or based on certain theory. In this way, individuals are able to understand their world; develop knowledge, from the doing they are engaged in.

The two concepts at hand: disciplinarity and interdisciplinarity are have become more clear from both a theoretical and pedagogical perspective. There are several reasons why it would be important for curricula to adhere to an approach that amalgamates both ideas to develop the tension. Not only should a curriculum be structured around solid bound disciplines because “coherence within a subject depends on how it is supported by other subjects”. Nor should it be based around weak bound intertwined disciplines because “coherence between subjects depends on how the subjects are constructed internally” (Niemela, 2020, p.360). The idea of the tension between disciplinarity and interdisciplinarity becomes important if the two are to co-exist, and the concept of powerful knowledge can be useful towards better understanding this tension. Them co-existing both in thought and action would be made possible if think about The two quotes by Niemela (2020) suggest that the intentions of CAPS as per the objectives outlined above are relevant to current ideas around curriculum, and the big question should be about how well the curriculum is enacted so as to achieve these objectives?

Chapter 3: Research Design and Methodology

The study is purely empirical: collecting **qualitative** data from an existing policy document, and later from a school context. The research methodologies used are understood as qualitative because they employed data collection methods such as interviews and lesson observations. An enquiry into a tension between two phenomena (disciplinarity and interdisciplinarity) is a complex process. Thus, qualitative enquiry methodologies are very necessary than quantitative data collection methods. "Qualitative research methods are valuable in providing rich descriptions of complex phenomena;" (Sofaer, 1999, p.1101).

3.1.Research Paradigm.

The data was interpreted from existing concepts as established in the conceptual framework. Thus, the research paradigm to be followed in this study is **interpretivism** simply because the study does not aim to challenge any theory or understandings. The two fold conceptual framework chosen for this study is already a point of reference for analysis of the contents of both the grade 8 Natural Sciences CAPS document and the data collected from the interviews with the teachers and the classroom lesson.

3.2.Research Design

As mentioned above, the study is designed around qualitative methodologies of enquiry because it is enquiring into a complex process. The qualitative research design adopted to this is a content analysis method and it is used through all the data collected throughout. It should be noted that a content analysis research method is not applicable to only written text but can also include any other meaning-making discourse. Holsti (1969, p.14 as cited in Stemler, 2000, p.1) "offers a broad definition of content analysis as", "any technique for making inferences by objectively and systematically identifying specified characteristics of messages". The audio content from the interviews with the teachers as well as its transcriptions will be analysed through this methodology. The audio content from multiple classroom lessons will also be analysed and thus a classroom discourse analysis will form part of the content analysis.

Part 1: Content Analysis of a topic in natural sciences CAPS document & textbook

The first part of the study used the conceptual framework outlined above to analyse the presence and extent of disciplinarity and interdisciplinarity in the CAPS natural sciences

document and textbook, and the tension that exists between them. Holsti (1969, p.14 as cited in Stemler, 2000, p.1) "offers a broad definition of content analysis as", "any technique for making inferences by objectively and systematically identifying specified characteristics of messages". The topics that the teachers had conducted lessons on was analysed so as to establish all the possibilities on boundary crossing and maintenance illustrated by the framework. The prescription of these contents as per the CAPS document on this topic and the more details contents from the textbook were analysed.

3.3.Sampling Strategies

Since the study was engaged in qualitative research, It could not use a probability sampling strategy and randomly select my sample, but could use a **purposive non-probability** sampling strategy, and select my sample based on researcher's own subjective judgement as Berndt (2020) suggests that quantitative studies are only confined to non-probability strategies. Although Berndt (2020) acknowledges that such strategies have some cons such as great sampling bias and difficulty in error calculation, he also acknowledges that they can be time saving, makes it easier to identify the sample, and be analytically, theoretically, or logically justified. Hasan (2002) and Charlot (2009) understand that the kinds of discourses that occur in communities of different socioeconomic classes are different and afford children of each class different mental functions. The study therefore choose on school in a working class environment, and another in a middle class environment so as to understand how discourses are employed in pedagogy and if they enable disciplinarity, interdisciplinarity, or the tension between the two. The study does not serve a comparative purpose, although this comparison is helpful towards understanding the relevance of the arguments from the literature above by Hasan (2002) and Charlot (2009).

Why Grade 8?

The choice made on grade 8 for this study was based on the idea that in South Africa, this is the first grade in secondary schools. Grade 8 was chosen with an assumption that this is the beginning of a secondary schooling stage right before University. According to Agim (2009), the purpose of secondary education is to prepare learners for higher education. If the aim of CAPS is to prepare learners for higher education, and interdisciplinarity is a skill even more significant in colleges and universities, how well are learners acculturated into interdisciplinarity early in their secondary schooling days. Furthermore, learners at lower grades (in primary

schools) may be engaged more in interdisciplinary learning than disciplinary learning while those in higher grades (FET) are engaged more in disciplinary learning. In the intermediate phase, the natural sciences is collided with technology whereas physical sciences is separated from life sciences in the FET phase. So, the senior phase was a great phase to study the tension that may exist between interdisciplinarity and disciplinarity for at face value, the natural sciences is now differentiated from technology but not yet divided into physical sciences and life sciences.

Two schools were selected for this study. One was in a township and one in a suburban school. According to Basson (2004) there had been suburban schools that were employing interdisciplinary strategies in apartheid times such as the Riverside secondary while rural and township schools were engaged in indoctrinatory rote learning. Although this may be of little significance to the study, we would wanted to get a glimpse into how histories of schools also play a role in the approach to learning taken in present times because curriculum enacted is closely influenced at school level.

3.4. Data Collection Methods.

Data for the study was collected through teacher interviews and classroom observations. The interviews were semi-structured so as to enable a follow-up on the responses given by the interviewees. A draft of interview questions is attached in the appendices. The audio from the data collection were recorded, and the records stored in a password protected computer and destroyed after five years. The classroom observations were also audio recorded and both sets of records were later transcribed and then analysed through the conceptual framework established above.

These methods were effective for collecting such qualitative data as compared quantitative data collection methods such as questionnaires and surveys. This study is an enquiry into two complex phenomena and the fact that we look at them in relation to one another makes it even more complex. Thus, we needed interviews and classroom observations to establish how these phenomena and their relationships are understood and enacted in practice. However, these methods were time consuming and could not be extended to a large sample. Because of time constraints, these methods thus made it difficult for us to make general inferences based on the results of our study.

3.5.Data Collection Procedures

The first step of data collection was already beginning to be analytical as it has to understand how specific contents of the grade 8 Natural Sciences CAPS relate to the conceptual framework. In the classroom observations, the researcher ensured to stay passive so as to not interfere with the classroom discourse. The participants were not given much detail (other than that which was included in the participant information sheet) around what the study aims to understand because the study itself aims to interpret whatever data is organically collected. The interview questions were also composed in such a way that the teachers would be able to understand them. Much more common concepts were used in place of those that are used in this conceptual framework and the literature review to phrase the questions.

3.6.Data Analysis procedures

The study adopted a content analysis method as outlined in Elo & Kyngas (2007). Although criticised as too simplistic, Neundorf (2002, as cited in Elo & Kyngas, 2007) argue that this method is as simple or difficult as a researcher determines it to be. This study thus does not simply look for frequency of words in the data analysed, like how content analysis is normally conducted (Holsti, 1969), but follows a **deductive** approach to content analysis; looking for certain patterns within the content (policy document and textbook) analysed through the conceptual framework briefly illustrated above. The reason for taking a deductive approach is that we already have broad framework that we are working with, and we are trying to use it to think about the tension that exists between disciplinarity and interdisciplinarity to a particular topic. In other words, the study moves from general to specific (Elo & Kyngas, 2007).

Three content analysis phases

The content analysis process is divided into three phases: preparation, organising, and reporting.

Preparation

This phase involves the selection of content to be analysed (unit of analysis). In our case, the contents on the topics of visible light and the solar system from the CAPS document and textbook is our unit of analysis. The conceptual frameworking is

essentially the tool through which these concepts from the CAPS documents will be analysed.

Organising

This phase is self-explanatory. It involves classifying the data from the unit of analysis. Since we are engaged in a deductive content analysis, an observation tool will be designed to classify the data, and the main ideas from the conceptual framework will comprise the table; guiding how the data is classified. Multiple tools were used to organise the data. From the conceptual framework and the literature review a classroom observation protocol was developed and is attached in the indices. This tool was used to classify dataset as per to which piece of the framework does it adhere.

Reporting

This phase focuses on analysing what the data actually mean. In our case, we will establish and report on the presence and extent of the tension between disciplinarity and interdisciplinarity specifically within our unit of analysis. Furthermore, this should help us think about how we are going to engage in the second part of the study; collecting data through interviews and lesson observations. The data collected for our study was then presented in chapter 4 below, and the classroom observation tool made it easier to classify and begin to present. To analyse the data from the interviews, the researcher had to convert the simpler answers into more complex understandings that match the concepts within the framework and literature engaged with in this study.

Empirical study: Teacher interview and classroom discourse analysis.

The second part of the research is an empirical study where five teachers were interviewed to establish their views and understandings of the tension that exists between interdisciplinarity and disciplinarity in the classrooms, and as imply by CAPS. Since it required views and understanding, the study is therefore **qualitative**, and the first part of the conceptual framework is used to analyse if the teachers understand CAPS as an oversocialized, under-socialized, or powerful knowledge curriculum.

The second part of the framework will be used to analyse the classroom discourse for five lessons conducted by the interviewed teachers. The analysis will be on the dynamics of

boundary crossing and maintenance, and the content analysis made in the first part on CAPS will be used as a yardstick to see if the same dynamics are played out during a classroom discourse, as analysed in CAPS. To give more details, the analysis will seek to establish points where the classroom discourse blurs and clarifies disciplinary boundaries to figure out the extent to which interdisciplinarity and disciplinarity are embraced in a classroom guided by CAPS.

The data collected from both the interviews and lesson observations were however still analysed through the content analysis process described above. At this point our unit of analysis was the verbal content provided by the teacher and the discourse in classroom. A similar organizing tool was used to classify the given data as derived from both parts of the conceptual framework. Again, a similar report was compiled as to how the tension that exists between interdisciplinarity and disciplinarity is understood by teacher in CAPS, and enacted during lessons in the classroom.

3.7. Ethical implications of data collecting strategies

The data was collected from human participants and this means that the researcher had to get consent before they can proceed with the data collection. An application was made to the Gauteng Department of Education (GDE) to conduct a study at two of their schools and this was approved. An invitation was also sent to the principals of particular schools, teachers, learners, parents and the school governing body to get consent. All these parties have given consent, except for some learners who have been delaying the submission of the consent forms, and those who have lost them. Nevertheless, the learners and teachers were made aware of their choice of ceasing participation at any time at their own will. Furthermore, ethics clearance was applied for, to experts around ethics so that a decision is taken about how ethical my data collection methods will be. Both the applications were approved before data collection could proceed.

The methods used in this were categorised in minimal risk for they may not expose participants to any risk beyond what may happen in their everyday normal lives. The learners were merely observed and were not asked any questions at all by the researcher throughout the classroom observation/discourse analysis. This is what regularly happens during integrated quality management system (IQMS) processes and student teacher crits. The teachers were also exposed to little to no danger for the interview questions did not ask for anything not related to their work.

Chapter 4: Presentation of Results

The following chapter will present the results of data collection from five different teachers that were observed as part of the study. To reiterate, the study aimed at understanding the tension that exists between disciplinarity and interdisciplinary within the grade 8 Natural Sciences CAPS. Thus, most of the results presentation will keep in mind the presence, strength, and nature of this tension. The main research question, and the first three subquestions will be used as thinking tools to identify this tension. The process shall first involve thinking about what evidence there exists of this tension within the CAPS policy document, what is its nature, and how do teachers understand and implement it. These areas of thought will be identified in the carefully selected bits of data from the CAPS document as well as observed and collected in five classroom lessons from five different. The two-part framework (three educational scenarios & Places and the Range of boundaries & Boundary Crossing Points) adapted from the works of Young & Muller (2010) and Niemela (2020) respectively will then be used to bring to light or introduce this idea of tensionism as to how it is prescribed in CAPS and implemented by teachers.

Presentation of Data from the CAPS document

The observed teachers chose different topics for their lessons, and thus, the content analysis will cover these different topics and their contents so as to figure out where they stand in relation the tension between disciplinarity and interdisciplinarity. Four teachers taught a lesson on the solar system while one teacher taught a lesson on the visible light. The objective of this study was not to disrupt lessons going on in schools but to organically understand the processes that go behind teaching and learning in classrooms with regards to the choices teachers make in maintaining and dissolving disciplinary boundaries. Observing lessons on more than one topic actually expands the scope of observation and allows for a better generalisation opportunity about what we are trying to study on CAPS.

This section on the CAPS document analysis will therefore be looking into these different topics and analyse the presence of the tension between disciplinarity and interdisciplinarity within them. The process shall follow the conceptual framework established above.

Teacher have chosen different topics for their lessons as in the table below:

Figure 1: topics analysed from different lessons presented by different teachers

Participant	Topic
Teacher A	The solar system
Teacher B	Visible light/Seeing Light
Teacher C	The solar system
Teacher D	The solar system
Teacher E	The solar system

Topic 1: The Solar System

The concept of Educational Scenarios helps us understand if CAPS presents the topic of the solar system as oversocialised, undersocialised, or based off powerful knowledge.

The topic of “The Solar System” as intended in CAPS requires learners to understand the content that “the Sun is like all other stars – it produces large amounts of heat and light continuously” amongst other snippets of factual knowledge. It is not only required for the teacher to deposit, and learners, to store the knowledge. The CAPS document also requires that learners should construct a “model of the Solar System showing relative distances of the planets from the Earth and relative sizes of planets” (Department of Basic Education, 2011a, p.53).. The interdisciplinary side of the tension is also embodied in the content as learners are allowing “doing”, and not only just knowing (Chettiparamb, 2007). In other words, by allowing and/or encouraging learner agency into their knowing of the solar system, educational knowledge therefore becomes weakly framed (Bernstein, 1971), and the CAPS therefore in this topic allows for an oversocialised learning environment (Young & Muller, 2010)

The topic as prescribed by CAPS however does not only require oversocialisation. The element of undersocialisation is evident in the requirement to also know factual disciplinary knowledge

such as that “the Sun is like all other stars – it produces large amounts of heat and light continuously”, or that “the energy in our Sun comes from powerful nuclear reactions during which hydrogen gas changes into helium gas” (Department of Basic Education, 2011a, p. 53).

This factual knowledge has more to it than just being a fact. The movement of mental faculties from simply recalling it to understanding what it means could help us imagine a point of connection between an undersocialised and an oversocialised curriculum and thus helpful towards working with powerful knowledge; a neo-Bernsteinian approach merging two polar approaches to working with educational knowledge (Muller, 2022). Backing one’s understanding of real world phenomena with solid factual knowledge gives power to the knowledge that learners acquire at school as the everyday world is understood in a constant and structured way, and Karpov & Bransford (1995) have proved that such kind of learning is more effective and saves time.

Places and Ranges of Boundaries & Boundary Crossing Points

The topic on “The Solar System” as intended by CAPS has significant implications to the tension that can be established between disciplinarity and interdisciplinarity. The concept of the solar system as presented in the document and the textbook also focuses on the Earth’s place in the solar system, and how it is suited for life. Niemela’s (2020) concepts of places and ranges of boundaries & boundary crossing points then become useful to understanding the structuring of knowledge within the policy document as we have two different disciplines in relation to one another: Biology and astronomy/geography. Furthermore, the topic also includes knowledge around how the Sun is supplied with energy for combustion. With respect to the conditions that support life on earth, the **correlation** – that is the extent of the boundary maintenance becomes limited. The outlining of the contents within the CAPS document becomes such that the lesson or at least the segment of the lesson becomes solely on these conditions as taught in a biology context.

At the point where it is required to learn about, the earth’s position in the solar system, the **correlation** becomes very apparent; meaning the boundaries are now weakened. It however stays clear that the focus is or should be on the earth’s position in the solar system, which is the **core subject**. As mentioned above, the integration is still within the natural sciences. The **classification** is however fairly weakened when we consider the fact that integration is between the concepts from different disciplines within the natural sciences. The fact that the integration

is documented as an intention implies that the crossing of subject boundaries is not **optional** but **compulsory**.

- the Earth is the only planet that is known to support life
- the conditions that support life on Earth include:
 - temperature: Earth's distance from the Sun provides the ideal temperature range
 - water is a liquid, gas or solid in Earth's temperature range
 - sunlight provides the energy in the food chain
 - oxygen: early life forms and algae produced enough oxygen for the evolution of more sophisticated life forms

(Department of Basic Education, 2011a, p.53)

Lastly the two concepts at hand are **not sharing the same objectives**, and the clarification of the 'position of the earth in the solar system' as the core subject is what alludes to the need or requirement to maintain disciplinarity when the line had been crossed before.

When it comes to the concept of the sun and how it self-supplies with energy, the **correlation** is established with a chemical concept of fusion and this correlation is not so strongly classified since it is within the non-living world. The boundary-crossing however still happens between concepts from disciplines that are fairly at wide range: the concept at the **core** (the sun as a star) is supposed to be concerned with astronomy and fusion from chemistry is at the **periphery**. The **connective subjects** are therefore still fairly classified. The CAPS document does require that the two concepts be integrated and thus the boundary-crossing is **not optional**. The concept of the sun and that of fusion are both concerned with the non-living world and thus there is a great of commonality in terms of orientation. The difference in principles is however only that that of fusion is a more generalist account of specific phenomena that occur in the sun. There is therefore **not much difference in objectives** or orientations between the two concepts since one is simply a generalisation of the other.

Topic 2: Visible Light.

This is a topic within the optical phenomena strand of the physics discipline. It is therefore undersocialised in nature for the understanding of visible light is concerned with the physical nature of light. However, the contents of this physics topic also prompt learners to think about

a biological phenomenon. Thus, this topic requires a very significant boundary crossing. The factual knowledge that is mentioned in the CAPS document about seeing light causes us to think about the eye from a biological perspective:

- the frequencies/colours that are reflected enter the eye
- specialised receptor cells in the eye's retina are stimulated by specific frequencies (colours)
- in the eye, light energy is converted to electrical nerve impulses
- impulses travel to the brain and the brain interprets them as our perceptions of light
- the frequencies/colours of light that are absorbed by the surface of an object do not reach the eye

(Department of Basic Education, 2011a, p. 51)

The boundary crossing should however be carefully done so as to make sure that learners are still able to come back to understanding how light is seen, as the main objective of the lesson, and not the eye.

Where then is the boundary crossing point and thus establishment of powerful knowledge through the undersocialised and oversocialised points in curriculum? The knowledge of the visible light is a factual presentation that requires barely beyond remembering. The same is true for the eye, its parts, and their functions. The point of powerful knowledge is therefore established in the crossing and the maintaining of the boundaries between the two content knowledges. The merging and relating of the two polar opposite approaches realises neo-Bernsteinian approach advocated for by (Muller, 2022) as the tension between disciplinarity and interdisciplinarity comes into play.

Places and Ranges of Boundaries & Boundary Crossing Points

The correlation between “seeing light” and “the eye” as implied in the CAPS and textbook however is clarified – that is the contents are clear on that the knowledge is on seeing light and not the eye. It is therefore also clear that the lesson should be on seeing light as the **core** subject and the eye is at the **periphery**. The **connective subjects** fall within disciplines that are fairly, widely separated and thus it is very necessary that the **correlation** between the concepts, and core vs periphery concepts are clarified. The boundary crossing is however required by CAPS it is briefly outlined how the eye sees the light in the content. The complex part is however the

extent to which this boundary crossing should be done. The cross curricular integration aspect of the framework will however help us determine this extent. The concept of “the eye” is a biological concern and thus is oriented towards different objective as compared to that of seeing light, which is a physics concept concerned with the non-living world. It is therefore important to note that the contents of the CAPS document and textbook do allude to not only the boundary crossing but also the maintenance.

The two topics as discussed above so far show us that the tension or powerful knowledge can come to play out in two ways. The first way is through practical work which Gredler & Shields (2008) suggests that it should be theory laden. The suggestion or hint towards the concept of an eye in learning of the concept of seeing light as required by the grade 8 Natural Science CAPS, on the other hand required the tension to play out through the crossing and maintaining of disciplinary boundaries and Niemela (2020) provides a framework of concepts suited for that. Let us see if, and how the two ways are enacted in various classrooms.

Presentation of Data from Lesson Observations and Interviews

As mentioned just above, the natural sciences CAPS embodies both the approaches to knowledge at hand. However, if these approaches are to co-exist and be useful, the teacher has to find a way to cross and maintain boundaries, since one is about knowing, and the other about doing, they have to, in their lessons accommodate both knowing and doing. The observation that can be made across all the lessons was that there was little to no doing, From this first point, the lessons thus only embraced the disciplinary side of the tension. The documents, or intended curriculum however requires both sides.

Lesson 1/ Teacher A

The lesson occurs in a grade 8 class within a school located in an upper middle class community. This lesson is conducted by a novice teacher in their 4th year of teaching. This lesson is conducted by a novice teacher with a year of experience and is on the topic of the solar system.

Educational scenarios

The topic of “The Solar System” that was taught by Teacher A, as intended in CAPS requires that it is known that “the Sun is like all other stars – it produces large amounts of heat and light

continuously” amongst other snippets of factual knowledge. It is not only required for the teacher to deposit, and learners to store the knowledge. The CAPS document also requires that learners should construct a “model of the Solar System showing relative distances of the planets from the Earth and relative sizes of planets” (Department of Basic Education, 2011a, p.53). In this way, the interdisciplinary side of the tension is also embodied in the content.

The tension was not realised in the enactment. Mostly because little to no doing was witnessed or even planned in the lesson. The teacher only called out the information that the learners were required to remember, and the learners tried to recall it as they were taught. For example the teacher at one point simply required the learners to recall the planets of the solar system. *“Alright learner X is going to give us the planets Learner: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, And Pluto.”* After the learner has attempted the to recall the information they have mastered, another learner went onto challenge the first learner’s attempt. The teacher however did not give them a chance and moved on with the lesson. This is evidence of how undersocialized the lesson was, and how the communicative approach was non-interactive and authoritative (Young & Muller, 2010; Scott et al, 2006). All the power to talk and decide the direction of the lesson was preserved in the hands of the teacher. The framing was therefore very strong. The teacher took an authoritative approach to communication, and the lesson was not so interactive. Looking at this lesson, one would realise that the lesson was less of a dialogue and more of a direction. There are minimal turns where the discourse is shared amongst the class, and thus the lesson followed a non-interactive and authoritative approach to communication.

Places and Ranges of Boundaries & Boundary Crossing Points

Furthermore, the topic that was discussed as intended by CAPS has significant implications to the tension that can be established between disciplinarity and interdisciplinarity. The concept of the solar system as presented in the document and the textbook also focuses on the Earth’s place in the solar system, and most importantly for our study, how it is suited for life. Teacher A has acknowledged in the interview how natural sciences is an amalgamation of three subjects: physical sciences (which is divided into chemistry and physics), life sciences, and geography. *“Oh yeah. I see. I think there are points of connection between these subjects yeah. Especially because NS is combination of subjects that learners will choose from later in grade 10”.* The teacher thus understands the subject and this topic as the point where the contents of this geographic topic cross the boundaries by going into the biology to enable better

understanding of the earth as a part of the solar systems. The discussions of the first term concept around photosynthesis and the sustenance of life are now being brought up to explain 'earth in the solar system'.

Teacher A's awareness of the place and range of boundaries, & and boundary crossing points seemed to have been present in how they conducted their lesson. All the content that the CAPS document have required to be covered in teaching this lesson was apparently mentioned. The reference to the life sciences content covered in term 1 was briefly made. *"So the earth is positioned in a clear position to say now it is conducive for us to have oxygen, and, and, and, right? So now that is why we have life on earth."*

However, the disciplinary side of the tension becomes more favoured in how the content is being delivered. The passiveness that appears in the mentioning of knowledge is what privileges the traditionalist way of teaching and learning. The lesson was very undersocialized in a sense that integrated knowledge is taught as readily new knowledge, and in a passive way; meaning that it is to be banked as knowledge on its own without worrying about how it is an integration of different forms of knowledge. Furthermore, the ignorance of the doing in learning weakens the interdisciplinarity's pull in the existent tension. Ignoring the requirement of having to construct a model of the solar system does not help anyhow with making the lesson more active, and thus takes away the authenticity of the teacher's pedagogies the way Villaroel (2020) understands. This then becomes our primary point of understanding the direction from which the bigger pull of the tension between disciplinarity and interdisciplinarity within CAPS.

The practicality was absent in the lesson even though it was recommended by the curriculum document, let alone it being theory-laden as suggested by Gredler & Shields (2008). Teacher A however tried to include another topic of life and living from the first term, into teaching the Solar System. However, the tension or powerful knowledge could not be achieved since the two concepts were mentioned in isolation to one another. This meant that the two classical approaches to classification and framing to educational knowledge as presented to us by Bernstein (1971) were enacted in dichotomy and the neo-Bernsteinian approach of powerful knowledge as suggested by Muller (2022) could not be fulfilled.

The interview with Teacher A, however would come to help us understand what goes behind the choices that were made for them to teach in this way. The commonality was found between what this teacher thinks of CAPS, the education arena in SA, and what the teachers from

Austen's (2017) study believed or perceived about the teaching of Natural Sciences. The perception was on the on how packed the curriculum is and given so little time.

When it comes to the teaching pace. I don't think CAPS is that strict because most of the time, you may be ahead of the syllabus. So, I think it is only strict in a sense that you cannot be slower than what it says. But most definitely you can be ahead and that is what the advisors mostly promote.

Extract from teacher A interview

The teacher understands the curriculum to require teachers to save time and this could be reason why they choose to teach an integrated knowledge in a passive manner.

Lesson 2/Teacher B

The lesson occurs in a grade 8 class within a school located in an upper middle class community. This lesson is conducted by a novice teacher in their sophomore year of teaching. This lesson is conducted by a novice teacher with a year of experience and is on the topic of the visible. The teacher puts this topic in relation to another topic of the eye which is not in the grade 8 syllabus.

Educational Scenarios.

The lesson included a couple of a topics some of which were done recently and were revised. What was interesting and special to note was how it literally depicted a militant image of the disciplinary. The depiction of a militant image appeared in the direction from the teacher when the discussion or the conversation around the concept of the eye was very controlled and focused. One may however argue that the militant nature of the disciplinarity is what makes it more socialized. For example, the teacher would ask that the class may at some points move as a group in answering the questions and drilling the facts about the eye. *"Alright. Let's move as a class now. What is the third part?"*

The scenario of a socialized curriculum as understood by Young & Muller (2010) can however not be painted by such an approach to learning. The socialisation is concerned with the strength of the framing and classification of knowledge. The militant nature of disciplinarity was therefore represented by a deeply strengthened classification and framing, making the lesson undersocialized. Learners were simply engaged in a recall of facts and concepts and thus the lesson followed the banking concept (Freire, 1970/1996). No chance was given to them that they can independently think of the concepts and facts and express their thoughts. Their teacher was requiring them to give answers in a specific way. When interviewed, they already had a

perspective of the subject and CAPS as promoting and requiring such a teaching and/or approach to curriculum.

Considering how deep the teacher, went into the understanding of the eye, the narrative to the educational scenario is completely changed at face value because the teaching of this lesson was not as required by the topic as outlined in the CAPS document. The lesson was meant to base a foundation for an understanding of the visible light. The requirement by CAPS is that learners should learn how light is seen (seeing light), interpreted, and perceived by humans and this is a physics phenomenon. It would be a cherry on top for the teacher to go beyond just explaining this and go on to Grade 12 content that focuses on the structure of the eye. This has not just been a crossing of disciplinary boundaries but also a crossing of “complexity boundaries”; something which interdisciplinarity holds highly. The interesting part is that the teacher is mostly likely to be aware of the need to cross both the types of boundaries for the sake of helping learners understand the concepts and content from different perspectives.

Teacher B’s awareness towards the prescriptiveness of CAPS was also observed in how they thought of the system. The emphasis on following the syllabus by the department officials is understood as policing of the curriculum, by Teacher B. They go onto refer to teachers as “*the puppets of the system*”. The teacher also believes that the curriculum is also strongly classified because they went on to tell that going on to have learners engaged in the content that was not prescribed for them, and is actually of a higher grade, could have them get into trouble with the “*people from the district*” (facilitators), or “*polices of the curriculum*”. Teachers who participated in Benjamin & Adu’s (2019) study also find a similar problem with that it might land them in hot waters when it comes to finishing the syllabus, because they may not have enough time to thinking about integrating contents. The issue of time and accounting was also a concern with teachers that have participated in Tsotetsi (2021)

Part 2: Places and Ranges of Boundaries/Boundary Crossing Points

Teacher B has went outside the grade 8 Natural Sciences and into the Life Sciences grade 12. Thus, the range of the boundary was very big. The concept that was learnt was in the physics discipline and was put in relation with another concept in the biology discipline. What is even more interesting is that the concept at the periphery was that it is from grade 12 which is levels higher than grade 8. This added another dimension of height to that of the range between the two concepts. It then becomes a question of how appropriate it is to introduce a higher-level

concept at an earlier stage? Would this be a good way of pedagogical link-making to promoting continuity as suggested by Scott et al (2011) – the idea of promoting continuity in pedagogical link making as understood by Scott et al (2011) involves referring to topics that are discussed in other stages of learning in the present lesson so as to help students makes links between distant concepts and understand one from the other. The question asked prior is due to the fact that teacher B's link-making is into the future – that is they are linking present concepts with those that learners are yet to encounter in the future. Pedagogical link making to promote continuity is normally done between the present concept and the one that the learner has already learnt before, and thus we are question how effective would it be; linking to future concepts.

Teacher B here has taken a very passionate and autonomous decision to go fetch content from grade 12 to teach concepts in grade 8. The boundaries are weakened in two dimensions (both between different disciplines and different grades) as mentioned above. The curriculum documents do not make it apparent that learners should learn about the eye in order to understand how human beings see light. What makes the **correlation** to not become so clear is that the lesson seemed and would probably appear to the learners that they are learning about the eye, and not what is prescribed by the CAPS document. In this way, and considering the time it was spent on mastering the eye, it would also appear that the **core subject** of the lesson was the eye, and seeing of light is at the periphery. As mentioned above, the interconnection is still within the natural sciences (from a traditional understanding). The **classification** is however fairly weakened when we consider the fact that integration is between the concepts from different disciplines within the natural sciences. In this case now, the curriculum document does not necessarily require learners to understand and master features of an eye in order to know how light is seen, thus, integration between these two concepts would be **optional**. Lastly the two concepts at hand are **not sharing the same objectives**. Seeing of light is a concern within physics: a discipline concerned with the non-living aspect of reality, whereas the eye is a concern within biology: that which is concerned with the living aspect.

The lesson with Teacher B is very significant in helping us think about what it really means to teach and/or work with knowledge from an interdisciplinary perspective, and still being able to go back to maintaining boundaries between disciplines. The question that one would ask themselves is whether teacher B was integrating two concepts, or was entirely teaching one concept which they were not supposed to teach?

Going out of, or beyond the prescription may indicate to us two contrasting possibilities. The first being that the teacher understands and appreciates the tension that exists between disciplinarity and interdisciplinarity. The second may be that the teacher is far-fetching and/or deviating. Furthermore, tension may be established between these two ideas that the teacher has identified the opportunity for integration and is voluntarily pursuing it while still keeping in mind the core subject. However, in the case of teacher B, it appears that they have crossed the boundaries and never returned back to maintaining them again.

Lesson 3/Teacher C

The lesson occurs in a school situated in a deprived community and is conducted by novice teacher in their first year of teaching. The school has had a challenge of having to use a platooning system for the first semester of the academic year. A platooning system is that which certain grades are rotating and not having the full learning hours as required by the policy documents and teachers have to manage their time effectively so as to cover the syllabus. The teacher conducts a lesson on the topic of the solar system to the grade 8 class.

Educational Scenarios

The idea of how socialized a curriculum is becomes more questionable when we look into teacher C's lesson. The overall mood becomes that the teacher opens up learners to having power in the classroom conversations around the knowledge discussed, thus having the lesson being oversocialised. The interview even gives an even bigger impression that learners are to be allowed more expression in the classroom discourse. *"Alright, here is a very good question...bathi: do we live inside earth, or on Earth"*. Here the teacher is posing the problems that arise in classroom discourse back to the whole class. The structure of the lesson and the turns that were taken shows that Teacher C was allowing learners a chance to talk about the concepts at hand most of the time. The communicative approach followed here imply that the classroom discourse was dialogic and non-authoritative as per Scott et al (2006), and this might go on to suggest that the lesson was pretty well over-socialised according Young & Muller (2010).

However, we may need to look into the quality of the conversations in order to determine the extent and quality of socialisation and/or framing that may characterise this classroom discourse. At some points, if we think about the kind of questions that the teacher has been asking to the learners, they would reflect those which Hasan (2002) refers to as assumptive and

are normally asked to children in working-class families. For example, the teacher asked *“Alright shap. Now how many planets did we have before?”* The concern is not with the background dominated by this kind of discourse but how enabling they are towards creating meaning out of content being discussed, how and socializing they are. The asking of assumptive questions simply implies that the teacher is already expecting learners to answer in a certain way and the answering would not require any intense or deep thinking as is normally short, or a recall of what has been taught before.

This recall would then reflect disciplinarity in multiple ways. Firstly, it may be seen that the teacher is thinking to have had banked knowledge around the planets in the solar systems, and is now expecting learners to reproduce them. The reproduction would reflect mastery of knowledge.

Our understanding of Freire’s (1970/1996) banking concept of education is that it is very violating and undermining to the learner’s cognitive abilities and does not allow them deep meaningful learning. This then takes away from the socialisation that may be present in teaching and learning. The teacher is given all the authority to decide on and validate the correctness of learners’ mastery and thus the framing of educational knowledge is strengthened. This was done when the learners suggest that there is life on Mars, and the teacher took a brief decision as to why only Earth is known to support life. *“...Okay, now, it is not scientifically proven. So we will have to say no for now”*.

Teacher C is very aware of some of the conditions that would be required to teach in an integrated fashion. For example, they mention the idea of collaboration and how it would be helpful for an integrated curriculum set up.

“Uhm, Collaboration. I think it’s a great idea to sometimes call anyone who is more knowledgeable on the topic you are trying to borrow from to come and explain it better to learners. Even if they don’t come to your class but go to them for clarification on that topic so that you understand it better”.

They had mentioned that different teacher working together would help towards sharing clarity on contents that have to be integrated but not well understood by those that have to do the job. This is a very good knowledge that recognises most recent understanding (collaboration) of professionalism as time lined by Hargreaves (2000).

It makes sense that for the teaching and learning of the solar system, expertise will have to be shared between geography and life sciences teachers. It is therefore possible that contents from these two subjects or disciplines could not be integrated because expertise were not shared between relevant parties. As a Natural Sciences Teacher, teacher C is also a Life Sciences Teacher. One would assume that since the content that they would have to go and fetch from is within their circle of expertise, they would excellently integrate it with the core concept. However, it is possible that they were not so knowledgeable of the core subject, and thus could not relate it to what CAPS has required them to do. Nonetheless, they still made a significant comment to the importance of collaboration.

Places and Ranges of boundaries, & Boundary Crossing points

Teacher C have not adequately realised the interdisciplinary approach to teaching and learning that was required by CAPS. Thus, it can be concluded that the teacher have not enacted what the curriculum document was intending.

The teacher's awareness of the boundary crossing that has to happen here is very limited. The focus was put more on the **core subject**, and the subject at the periphery was mentioned in and was most likely due to that it is mentioned in the CAPS document under the topic: Earth's Position in the Solar System. In fact, the Natural Sciences Grade 8 CAPS and textbook themselves intends that learners should understand more than what the teacher has simply outlined. The whole content was not covered for the curriculum document goes onto require elaborating on the conditions that enable the earth to support life. These were not covered in the lesson and thus, Teacher C could not be opened up to bringing in the aspect of Life Sciences to explain the aspect of life maintenance. The question that one can ask now is whether or not, this is avoidance of the complexities that may come with working with knowledge from an interdisciplinary perspective. Furthermore, is this avoidance deliberate or due to lack of capacity and expertise to handle the content they are trying to borrow from? Should it be latter, it is then a good thing that teacher C is able to recognize the value of collaboration as elaborated in the interview.

This lesson showed great appreciation of both the polar opposite approaches to curriculum. However, it remains that the two are not brought together to establish the tension between disciplinarity and interdisciplinarity, as the concepts seeing light and the eye. The two concepts are purely taught separately and thus, the neo-Bernsteinian concept of powerful knowledge

advocated for by Muller (2022) is failed in this enactment of the curriculum. We cannot even begin to talk about the practicality let alone it being theory-laden, nor the boundary crossing and maintaining as presented by Niemela (2020).

Teacher D/Lesson 4.

This lesson is conducted by teacher D: a pretty well experienced educator with six years in the field. This teacher is working in a school located in an informal settlement where they have a problem of overcrowding and thus have to use the platooning system especially post COVID-19.

Educational Scenarios

Teacher D and the lesson conducted gives us another perspective to teaching concepts and relating them to one another. One thing that we can pick is on how socialized the lesson was. The teacher had asked learners to explain three concepts (axis, atmosphere, and rotation). When learners are trying to explain the concepts in scientific terms as they were taught, the teacher would require them to explain them [concepts] in general terms first before thinking about them scientifically. For example, when explaining the concept of an air, the teacher even allowed them to think about the concept in their home language “*Hhayi! Don’t tell me the definition, I just want you to tell me roughly what axis is*”. Crossing boundaries between everyday and scientific knowledge goes on to show how well socialised the lesson was. The framing of educational knowledge as understood by Bernstein (1971) was also weakened for learners were given more power to talking about knowledge in ways that they are more comfortable and relatable with. At the same time it was also strengthened since the teacher follow Scott’s et al (2006) authoritative approach to communication by telling learners what they want to talk about, and what to not talk about.

An understanding of scientific knowledge from an everyday perspective also helps with doing away with the banking concept of education because it enables that scientific concepts are not discussed only in abstract terms that learners may find hard to understand but instead only memorise them. The kinds and extensions of patterns of interaction as presented by Scott et al (2006) were also very effectively used in the lesson when integration between generalist and specialised knowledges was made. The teacher did not just follow the traditionalist IRF (initiation, response and feedback) pattern which refers to the kinds of classroom discourse where the teacher would ask a question, the learner responds and the teacher confirms the

answer. Instead, the teacher starting from generalist perspectives allowed for the conversation to have multiple turns that enable opportunities to take the learner from the point where their understanding is, to a point where they need to be. Teacher was having multiple responses and evaluation turns with the learners; and this should be evidence of how empowered learners were in the discourse around knowledge; thus weakening the framing as understood from Bernstein (1971).

The teacher did not only integrate everyday and scientific knowledge. When asking learners to explain the concept of axis, the teacher has directed the learners to think about the concept as used in mathematics.

Angithi in Mathematics you do graphs?

Learners: Yes. We have started yesterday.

Teacher: Good. What are these lines?

Learners: (argue around the answer... and get to agree on axis) Axis.

Teacher: Can you name them?

Learners: x-axis and y-axis.

This is a boundary crossing that is not required by the curriculum document. In fact, the discourse around these concepts, and how it has occurred may not be as required in the curriculum. When asked about the aspects of CAPS that may be prescriptive, teacher D has highlighted the matter of assessment.

...For example, you would have the normal teaching and learning run for 10 weeks in a term according to the ATP. But then the exams would start in week 7. So you already feel like there is no room for a breather and you have to take care of business.

This may be one of the reasons behind getting learners to ‘master’ defining a couple of concepts. This is an experienced teacher, and have highlighted what it would take for learners to meet the minimum pass requirements, do good, and eventually perform very well. They mentioned that

for learners to at least meet the minimum requirements, they must know definitions and master formulas (formulae) for calculations. You have to make sure that every learner is able to define concepts...and also make sure that they get to define them in ways that they will not forget”.

Hence it may have been orientation to assessment that has caused the teacher to focus on helping learners master definitions.

The mastery that Teacher D was trying to encourage is however not so typical to the banking concept. The use of understandings from everyday knowledge and other scientific forms of knowledge goes on to indicate how interdisciplinarity does exist within disciplinarity as Chettiparamb (2007) maintains. This also enables the realisation of multiple perspectives to phenomena in discussion, and that is what is at the core of interdisciplinary approach to knowledge.

Place and range of the boundaries, & boundary-crossing points

The concepts that were taught were however not easily located within the Natural Sciences curriculum policy document. It was however traced within a concept of objects around the sun within the topic of the solar system. Teacher D had simply identified some of the phenomena existent in the solar system to explain how the solar system looks like, and in the meantime drawing from her expertise in Mathematics. An understanding of axis from a mathematical perspective goes on to show that the **place** of the boundary is between the astronomy/geography element of the Natural Sciences and Mathematics. The **range** is thus very wide. In other words, the boundary crossing is done beyond the Natural Sciences.

For the concept of axis, the **correlation** becomes very apparent when the teacher ask the learners to understand the concept from a mathematical perspective first. It is not only realised by the teacher that the lesson is crossing into mathematics but also the learners realise that. This realisation is also the case even when the boundaries between the Natural Sciences and everyday knowledge are crossed. The direction of the lesson being realised by everyone goes onto prove how empowered learners are and thus how weakened the framing of educational knowledge is. After allowing learners to draw understandings from other subjects and everyday lives, Teacher D goes to require them to come back and now explain how would these concept be imagined, and relevant in the solar system. By so doing, the teacher clarifies that the core subject is that of the phenomena in the solar system and mathematical and everyday concepts are at the periphery since the lesson is not about them. It is clear how the lessons cross boundaries between disciplines. The concept of axis as understood in mathematics is in a generalist sense; that it may be used to explain and understand specific phenomena. In this sense, the two concepts **do not share the same objectives** since an astronomical understanding

of axis would not be applicable to many other understandings of phenomena like the mathematical understanding is. Fourthly the teacher was not required by CAPS to realise such an integration. Thus, it was **optional** for them to do so.

Teacher D has generally done a good job establishing the tension between concepts from different sides of disciplinary boundaries. This is evident in how they were crossing boundaries and coming back to maintain them. That is what is at the core of tension as understood by this study. One of the elements that however puts disciplinarity ahead of interdisciplinarity is that more knowing and less doing. Even though the integration may have allowed for a deeper understanding of the concepts, the idea problem-solving over mastery of information is still not yet achieved. The CAPS document recommends the construction of the solar systems, and this was going to enable the concretisation of the imaginary lines (axis). The teacher had not implemented this requirement.

Although the theory-laden practicality by Gredler & Shields (2008) required for proper learning of concepts was not achieved, the symbolic boundary crossing and maintaining was well established fairly how Niemela (2020) have suggested and in this way, the neo-Bernsteinian concept of powerful knowledge as suggested by Muller (2022) was achieved.

Lesson 5/Teacher E:

Educational Scenarios

The lesson has been conducted in English and a vernacular language (IsiZulu to be specific), and this goes on to begin weakening the framing of educational knowledge. Learners were taught in the language that they are most comfortable and for this part, the inconsistencies between everyday lives of the learners and schooling environment are eradicated. Charlot (2009) emphasizes on the importance of the habitus that learners bring into the classroom from home. When there is inconsistency between habitus from home and that which is required at school, learners will find it hard to work with what is provided at school. They will however find it easier when there is similarities between the two habitus. Language is more than just a communication tool but also tool to tap into one's culture; an aspect of reality which is closely tied with education and/or knowledge (Ngugi' wa Thiong'o 1972/2002). Teacher E has not only weakened the framing but also accommodated learners strengths in teaching in their language (Bernsteinian, 1971).

Educational knowledge was not only discussed in home language but also examples from learners everyday lives were also brought in to help learners make sense of the concept of The Sun. For example, a reference was made to “apollos” (street lights) to explain the shape at which we see stars and also the reference to phone torch to explain why we cannot see other stars during the day. In this way, knowledge is now treated as profane rather than sacred (Durkheim, as cited in Muller , 2022), and the framing of educational knowledge continues to be weakened (Bernstein, 1971)

“Teacher: Now here comes a question. Why is it that we see our star as round shaped, but other stars as typical star shapes we know from our childhood? Now, have you ever seen that an apollo, when you see it from close range it looks normal and round, but at a distance they take a star shape?”.

Learners got to understand multiple events isolated from them through those that they are experiencing everyday. In this way, the curriculum was therefore oversocialised.

As highlighted earlier in this study. One of, if not the primary aims of CAPS as stated in the documents is “National Curriculum Statement Grade R-12 is based on the principle of progression: content and context of each grade shows progression from simple to complex” (Department of Education, 2011, p.4-5). The lesson by Teacher E has come to embody such an aim as earlier on understood to be of disciplinary nature. On so many turns, the learners have been asking for questions outside the topic and concepts of the sun. Teacher E has been very cognizant of the boundaries between the concept at hand and the ones learners are trying to understand and have constantly repeated that those will be addressed at their own time. The learners had kept on asking about such concepts that the teacher had promised to punish them if they continued. Even when they were asking about Mars and the Project X by Elon Musk: a topic that is following immediately after the current one, Teacher E would not even try to help them anticipate it, more especially because what they were asking about Mars is not in the curriculum *“Teacher: Indaba ka Elon Musk and planet Mars. But were are not talking about the planets now. We will talk about Elon Musk and Project X when we are talking about the planets.”.* Teacher E deciding what is to be talked about, and at what times was now beginning to strengthen the framing of educational knowledge, and creating an undersocialised learning environment.

The maintenance of boundaries with so much strength may stand in the way of some of the pedagogical possibilities that may help learners understand the concepts better. Scott et al (2011) maintains the importance of promoting continuity as a pedagogical tool. Reference to other concepts that were, or are to be learned at other times may help learners establish relationships (make links) between these concepts. Learning is fundamentally a process of seeing how new and existing ideas connect.

The lesson was not entirely strongly classified because there was a point where Teacher E had brought in the concepts from chemistry to explain where the sun gets its energy to produce heat and light.

yes, the energy changes, As time goes on, nuclear reactions in the sun continues, and the hydrogen get used up, so the sun is also getting smaller. It is estimated that the sun is about five billion years old, and it is left with five billion more years.

This is the requirement as in the CAPS document and also evidence of how CAPS have elements of interdisciplinarity regardless of whether teacher are aware of this. Luckily, Teacher E was very aware of having to explain the reaction between a couple of hydrogen atoms to produce helium gas as a source of the sun's energy.

Places and Range of boundaries, & boundary crossing points.

The place of the boundary is between the geography/astronomy and chemistry disciplines within the natural sciences. The weakening and crossing of boundaries was to a very great extent as the process through which the sun produces its own energy was elaborated in much detail. The teacher did not even go back to any concept in astronomy since the requirement was actually explaining the chemical reaction that produces energy for the sun. The **correlation** was therefore very evident. At this point the boundaries were so weak that it was not easy to see what the core subject is.

Leaving the lesson at a point where the classification is extremely weakened is very hazardous that learners may leave the classroom having learnt nothing and/or with misconceptions. According to Karpov & Bransford (1995), the evidence of true learning is when learners are able to take use the scientific concepts acquired and use it to solve problems beyond the ones through which the concepts were learnt. Had it been clarified that the kind of reaction explained

here is not only applicable to the sun, learners curiosity would also have been triggered to think about how the reaction would apply to other real-life situations. Teacher E may have used an example of nuclear bombs to allude to the applicability of the nuclear reaction to other phenomena than the sun.

As mentioned above, from “**connective subjects, courses, and units**”, the classification was weak that the boundaries between chemistry and astronomy/geography were not clarified. When it comes to optionality, the CAPS document has required the teacher to clarify the process. Lastly, the two concepts put in relation to one another are **not sharing the same objectives**. As mentioned before, the chemical reaction amongst hydrogen atoms is not only applicable to the sun and thus this should be clarified such that the learners understand the chemical reaction as generalist, and its application to the sun as problem-solving, or at least towards understanding the sun as a phenomenon.

Both classical Bernsteinian approaches to curriculum were present in teacher E’s lesson. The lesson was both strongly and weakly framed at the same time (Bernstein, 1971). The communicative approach used was dialogic and yet authoritative as interpreted from a perspective of Scott et al (2006). When it comes to classification, the concepts of nuclear fusion were highlighted as to how the sun makes its own energy and the grade 8 Natural Sciences CAPS only required the that clarification. Teacher E could not go on to find ways in which they can cross and maintain boundaries; using Niemela (2020) concepts, or any other concepts, and thus staying within the classical Bernsteinian enacting of curriculum dichotomising disciplinarity and interdisciplinarity, and ultimately failing to establish the neo-Bernsteinian approach of powerful knowledge as suggested by Muller (2022) to play out the tension.

Chapter 5: Discussion of Findings

This chapter provide a discussions of the results presented above as to how they help us answer our research questions. As presented in chapter 1, this study seeks to answer four sub questions, and these shall be answered here, and eventually the answers shall help us consolidate an answer to the main research question. The answering of this question will follow the framework provided in chapter one and the literature review provided in chapter 2. The two tools (conceptual framework and literature review) will be used to discuss the data collected and presented in chapter four and this analysis will provide answers to our research questions.

Without any extensive analysis, the results reported above already begin to show that there are elements of both disciplinarity and interdisciplinarity present in the Natural Sciences CAPS. The teachers in our study are also, to some and different extents, working with the prescribed knowledge in ways that embrace the two approaches of working with knowledge. From a perspective of socialisation, the Natural Sciences CAPS have generally prescribed more socialisation than the teachers have managed to achieve. When it comes to the crossing of boundaries there were teachers who were able to realise more of opportunities for crossing boundaries than CAPS is requiring. This may imply that the idea of crossing boundaries is prevalent in the current South African curriculum. It may therefore be the case that the crossing of boundaries is attempted under undersocialized conditions. There may hence be a contradiction of interest if the result may bring us to an understanding that crossing of disciplinary boundaries is attempted under a disciplined and controlled environment.

What is the evidence, and the extent to which disciplinarity and interdisciplinarity are present in grade 8 natural sciences CAPS?

Evidence of Disciplinarity

When it comes to the elements of the disciplinarity pull of the tension that is present within the grade 8 Natural Sciences CAPS, the sequencing of the concepts is one of the elements representing it. The lesson by Teacher E presented above is one of the evidence for this strict sequencing. The persistence to stay within the concept of the sun and not move to other concepts that may be related to it may come to show us that teachers also are aware of this disciplined and bound requirement to working with, and managing educational knowledge. This is also identified in the interview with Teacher B where they highlighted the dangers of

not adhering to the sequence prescribed in the CAPS document; that it might land teacher in hot waters with the government officials. Such an understanding would imply that CAPS does not allow for crossing of disciplinary boundaries, and thus strongly classified (Bernstein, 1971), and very disciplinarian in nature.

Another evidence for the disciplinarity end of the spectrum is in the approach to acquiring knowledge or orientation to curriculum that is prevalent in the policy. Disciplinarity as illustrated above was an attempt to disenchant the enchanted and open them up to academic rationalism. This orientation to curriculum as explained by Eisner (1985) is concerned with the mastery of knowledge from the great books or the seven liberal arts. The Natural Sciences CAPS is also showing such orientation to curriculum. The curriculum document is putting an emphasis on the content and concepts that have to be learnt that it is actually included and specified. For example, on the topic of “The Solar System”, the document requires that learners should be given a table of facts about the Solar System. This implies that the mastery is a requirement and prioritised in the Natural Sciences CAPS. What the learners are going to do with the knowledge they have mastered? It would only encourage the banking concept of education when learners are engaged in a mastery of knowledge (Freire, 1970/1996).

The thought around an emphasis on sacred knowledge in order to liberate (disenchant) the learners however would not do justice to the same learners as Freire (1970/1996) has emphasised that the banking concept is not liberatory but rather a continued oppression upon them. This though also fails to achieve the neo-Bernsteinian suggested by Muller (2022) since it only approaches curriculum with a strengthened classification and framing (Bernstein, 1971).

The banking concept as discussed above says something about the socialisation of the curriculum. When learners are only required to mastery knowledge, their thoughts about that knowledge do not matter, they would only bank what is given in the textbook, and what they are told by their teacher. Them not having an opportunity to think about the knowledge is an indication of a strongly framed curriculum. From a perspective of strong classification and framing, the Natural Sciences grade 8 CAPS is therefore very undersocialized and therefore disciplinary in nature (Young & Muller, 2010).

Evidence of Interdisciplinary

Although the caps may be sequenced in a strict manner that it seems to be having strong boundaries between concepts, there are some aspects in those classified concepts that may guide teachers and learners to end up crossing these boundaries. As Chettiparamb (2007) maintains, interdisciplinarity does exist within disciplinarity. For example, the concept of “seeing light” (as taught by teacher B) already requires one to know a scientific fact that the “specialised receptor cells in the eye’s retina are stimulated by specific frequencies (colours)” (Department of Education, 2011a, p.51). The only way that the learners may get to understand this process of stimulation is if they understand the structure of an eye and the functions of its parts like the retina. This would then require crossing of boundaries between Physics and Biology, and thus the weakening of classification.

Chettiparamb (2007) also emphasizes that interdisciplinarity is all about doing more than knowing. The Natural Sciences Grade 8 CAPS at least suggest that learners do some investigations on the knowledge within almost all the topics and concepts. One example of these is on the concept of the solar systems from the lesson that was studied above where it is suggested that learners may construct a model of the solar system. Such investigations are generally understood to take learners beyond just a mastery of facts towards application of these facts to understanding reality and problem-solving. The most important point in this instance is however regarding how empowered learners become when they are posed with problems.

Freire (1970/1996) perceived this problem-posing concept to be empowering for unlike in the banking concept, learners are no longer treated as passive beings who should have information dumped into their heads but are now active and allowed to engage with knowledge at higher cognitive levels. When learners now have a say in the knowledge they are engaged with, we can say that the framing of educational knowledge is now weakened. The weakening of classification and framing within the Natural Sciences CAPS thus shows the oversocialized aspect of the curriculum, and therefore is enough evidence of the interdisciplinary pull of the tension.

The problem-posing that is present within the grade 8 Natural Sciences CAPS however should not be understood only from a perspective of interdisciplinarity as the ultimate goal is the neo-Bernsteinian approach through powerful knowledge as suggested by . In other words, the problems that the learners are encountered with should not be presented to learners without any theoretical framework where they would engage in empirical learning which Vygotskian

researchers has proven to be ineffective (Karpov & Bransford, 1995). The problem-solving should be theory-laden and in this way, the learners will learn general theories to addressing multiple yet similar problems.

The grade 8 Natural Sciences CAPS however cannot explicitly show evidence of this tension and readily approach the curriculum from a perspective of powerful knowledge. For example, the concept of the Solar System as presented in the CAPS documents only talks to the factual knowledge about the solar system and then goes onto recommend the construction of a model of the solar system. It does not go on to show how the disciplinary (undersocialised) and the interdisciplinary (oversocialised) knowledge can be integrated to develop a tension (powerful knowledge) as the ultimate neo-Bernsteinian curriculum approach suggested by Muller (2022).

What is the nature of the tension that exist between disciplinarity and interdisciplinarity in grade 8 natural sciences CAPS?

The term tension already tells us that the forces at each end of the rope are pulling in opposite directions. One of the ways of understanding the nature of this tension would be through looking at which force or end has got more pull over the other. Is the Natural Sciences Grade 8 CAPS more of a strongly classified, strongly framed, and undersocialized curriculum or weakly classified, weakly framed, and oversocialized curriculum?

The strict sequencing and emphasis on factual mastery that are found within the documents suggests the former while the investigations, problem-solving, and interdisciplinarity that exists within disciplinarity is suggesting the latter. Therefore, one can understand that there is fairly an equal pull from each end of the rope. That is there is a balance between interdisciplinarity and disciplinarity within the Natural Sciences Grade 8 CAPS.

Although the Natural Sciences CAPS shows evidence of both disciplinarity and interdisciplinarity, it however does not show by the standards of our framework or clearly from any other framework, how the two opposite forces may come to coexist together in the name of tension. The prescribed contents within the curriculum direct teachers to what should be talked about, but do not imply where to start crossing and maintaining boundaries so as to clarify the places and ranges of boundaries according to Niemela (2020). The mentioning of the factual and practical aspects in dichotomy in the policy statements indicates that the tension is not readily maintained and therefore CAPS need to be interpreted by the teachers so that they

can realise the tension. Thus, CAPS does not immediately realise a neo-Bernsteinian concept of powerful knowledge as suggested by Muller (2022) but still presents a dichotomised structure of the curriculum.

How do teachers understand this tension and implement their understandings in classrooms discourse?

Graham-Jolly (2002) suggests that the intended curriculum documented in the policy may not be exactly that which is enacted at schools, in classroom, and provides justification for this. This is due to the subjectivity that comes into play when teachers engage with the policy documents in order to understand them. For example Teacher C in the interview has responded positively; that the Natural Sciences Grade 8 CAPS really does allow opportunities for integration. Whereas teacher B has understood Natural Sciences Grade 8 CAPS to be so strictly sequenced that they are not allowed to cross subject boundaries.

Surprisingly, it was Teacher B who was able to cross boundaries and refer to the discipline of biology to help learners understand the concept of 'Seeing Light', although they had perceived the curriculum system as not so flexible and allowing towards that. On the other hand, Teacher C was not able to see the opportunity to cross boundaries are refer to Chemistry to help learners under how the planet Earth is able to sustain life even though they had a positive feeling that there are opportunities and allowance to cross interdisciplinary boundaries within CAPS. Teacher B was also a Life Sciences Teacher and therefore found it easier to refer to their area of expertise to explain the process of seeing light. Teacher C was another Life Sciences Teacher and the opportunity to cross boundaries into Chemistry to explain a geography /astronomy concept could not be realised since chemistry was not an area of his expertise. What might have enabled Teacher B to realise the opportunity for boundary crossing might however been the fact that they are also physical sciences teacher, and it might also have been a hindrance that Teacher C was not a geography specialist?

We may then begin to think that having expertise in multiple subjects may enable one to innately realise the opportunities for knowledge integration to an extent that they understand interdisciplinarity to be inevitable and existent within disciplinarity as Chettiparamb (2007) understands and maintains. On the other hand, when you don't have expertise in one of the concepts that you have to integrate especially when prescribed by curriculum policy, it might

be thought that your understanding of the relationship between disciplinarity and interdisciplinarity is not as Chettiparamb (2007) maintains but that the two are separate.

The neo-Bernsteinian idea of powerful knowledge however cannot be fully and readily achieved by the CAPS document. The policy statement does not explicitly show that the abstract factual or conceptual knowledge around Seeing Light or the Solar System stated in the document is not shown as to how it should be used to guide problem-solving around those concepts. In this way the policy presents both the polar opposite educational scenarios and the powerful knowledge educational scenario as suggested by Muller (2022) is not made readily available to the teachers.

The conditions under which the curriculum is enacted also affect the side of the tension that the teacher will lean towards when enacting the curriculum. Literally, all of the teachers studied could not fulfil the investigations that were required in the curriculum documents. Time is the no 1 factor that all the teacher have found to be a problem when it comes to having learners engage in investigative work. It is not that the Natural Sciences grade 8 CAPS document does not pose problems to learner to solve. This is not only believed by teacher in this study but even educators in the Eastern Cape that took part in Benjamin and Adu's (2019) study also felt the pressure of covering the prescribed content.

The concept of tension was however adopted in this study so as to understand how do both disciplinarity and interdisciplinarity co-exist within the curricular structures of the natural sciences grade 8. Not so many educators understands the co-existence as understood in our frameworks. Most understands that it is either we approach concepts and content from a disciplinary or interdisciplinary perspective. For example, In teaching the process of seeing light, teacher B has gone too deep into the eye and its parts and functions. Too deep that the lesson had appeared to be about the eye. They had crossed the boundaries that they lost the objectives of teaching the concepts as prescribed by the curriculum policy document. The boundary crossing is a good thing but the framework adopted in this study from Niemela (2020) suggests that the boundaries should also be clear and maintained

The logic that this study follows to develop this kind of understanding towards the idea of the tension is that the presence of both disciplinarity and interdisciplinarity within the curriculum will require that sometimes boundaries be crossed, and sometimes be maintained, and this is a complex process. This understanding was only evident in a lesson of a single teacher. Teacher

Das already reported above was requiring learners to think about the concepts at hand from either their everyday perspective or from a perspective of other scientific disciplines, and then later coming back to understanding them specifically from a perspective of the discipline or subject they are learning. In this way, the teacher is realising the tension as understood by the study.

The whole idea around the understanding of the tension between two approaches to working with knowledge is in the interest of true learning that occurs when each is given a turn. When the curriculum is undersocialized; that is disciplinary boundaries are clarified and learners are not given freedom to think and talk about the knowledge at hand, they [learners] get to only take what they are given; that is store and memorise the content and concepts that they are given. Kirschner & Sweller (2006) understands this type of pedagogy as direct instruction, and it leads to rote learning. When it is too oversocialized the disciplinary boundaries are blurred and learners are given too much freedom to think about and explore the knowledge at hand, learners get to learn nothing for the concepts that represent their discussions or exploration do not get to be conceptualized.. Kirschner & Sweller (2006) understands this type of pedagogy as minimal guidance, and it leads to little to no learning. The idea around establishing a balance between these instructions is, in our study understood or at least enacted by 1 out of 5 educators.

What could be the conditions for boundary crossing and maintenance in grade 8 natural sciences CAPS and beyond?

Most, if not all of the barriers that are identified to be standing in the way of realising the elements of either or both disciplinarity and interdisciplinarity, and the tension between them can, or are already alluding us to the strategies that we may need to implement. For example, all the teachers in the study are aware of the prescriptive nature of CAPS and how this implies prohibition to crossing boundaries. The prescriptive nature of the curriculum policy documents is therefore automating the work of a teacher, and this is only causing them to realise only the disciplinary side of CAPS.

This prescriptive nature should therefore be downplayed such that teachers are not automated but autonomous and be allowed to design and manage learning in such a way that they can cross boundaries. If it is required that learners should be able to see the world as a system of connected phenomena and be able to integrate knowledge about this phenomena, this should start with the teacher. Automated teachers or any other worker may no longer be understood as

professional (Hargreaves, 2000). A more recent understanding of professionalism is instead that of an autonomous worker who has freedom to analyse and evaluate on the policies and requirements on their own (Hargreaves, 2000). If framing of educational knowledge is to be weakened for learners, teachers should be the first to receive this freedom to knowledge.

Autonomy and empowerment of the teacher however would require competence from those who they will be granted to. Hoadley (2010) takes us back to a point where teacher autonomy was allowed in C2005 and their lack of competence and expertise had not allowed them to embrace this autonomy and help learners learn. Teacher should therefore be assisted to develop these competences and expertise so that they are able to use and not abuse this autonomy. The idea of problem-solving is articulated as liberating by a plethora of researchers and scholars such as Freire (1970/1996), Gredler & Shield (2008) and Karpov & Bransford (1995), and teacher should be empowered to help learners develop such knowledge and skill. Villaroel (2018) suggests that the authenticity in the pedagogy of a teacher is evident when they are able to promote problem-solving within their teaching, and this is recommended below as a way to enabling the bridging of the gap between disciplinarity and interdisciplinarity within the learning of subjects such as the Natural Sciences grade 8. It should be emphasized however that the tension suggested in this study and/or the neo-Bernsteinian concept of powerful knowledge suggested by Muller (2022) will be made possible if the problem-solving is actually theory-laden and the boundary are neither only maintained nor crossed but both actions are done in the curriculum as Niemela (2020) maintains.

Ono & Ferreira (2010) have identified an initiative that had a good motive to helping teacher become more better realise the interdisciplinary aspect of the South African curriculum. The problem was with the approach to achieving this. Traditional workshop programs normally follow the direct instruction approach and autonomy cannot be taught in an automated manner. Rather, this study would suggest that the teacher development programs should re-orient the approach more towards learning how to learn (development of cognitive processes) than what to know (academic rationalism) (Eisner, 1985).

To reduce the prescriptive nature of the policy documents, the policy makers may also need to consider having framework policies that would guide teachers rather than instruct them. This would of course be effective when teachers are competent and skilled enough to interpret these frameworks. Thus, the process of teacher professional development as suggested above will have to precede the implementation of frameworks.

A more latent understanding of professionalism than that of autonomy however embraces individuals working together as maintained by Hargreaves (2000). This was one of the suggestions to interdisciplinary teaching and learning made by teacher C. they have suggested in order to cross boundaries, subject specialist teachers should work together so as to help one another understand content and concepts that they need to work with in their integration, but do not understand.

The issue of material resources has been reiterated more than enough in a lot of studies. It is however still needed that is pointed out in this study for it has certain implications for a better understanding and realisation of the tension between disciplinarity and interdisciplinarity within CAPS. Without resources to engage learners in experiential learning, schooling will be more about knowing than doing. The disciplinary side of the pull would now prevails over the interdisciplinary end of the spectrum. This issue should then still be addressed as it is important. The government still needs to take care of it and uniformly. However, the teacher's and learners' autonomy should also come into play when it comes to this matter too. They may have to improvise by getting their own resources. For example, to build the model of a solar system learners may think and/or be asked to be creative and recycle waste material that they can find in their communities.

The cases as understood from paradigms perspective may help us understand what it would mean to keep a uniform policy while teacher autonomy is still embraced. Rather than positively or radically perceiving the prescription of the policy documents, teachers need to be realist in their perspective such that they are creative in their pedagogy; in how they help learners understand what is prescribed.

Chapter 6: Conclusion, Limitations, And Recommendations

The study was aimed at determining the nature of the tension between disciplinarity and interdisciplinarity that could be found in the CAPS grade 8 Natural Sciences CAPS. To achieve this, the study follows a framework derived from two ideas by Young & Muller (2010): three educational scenarios, and Niemela (2020): places and ranges of boundaries, & boundary crossing-points. This framework was used to analyse the nature of the tension between disciplinarity and interdisciplinarity within the intended Natural Sciences CAPS document itself and then later how this compares to teachers' understanding and enactment within classrooms after interviews and lesson observations were made.

From the analysis, the study finds that the Natural Sciences CAPS does encourage and requires both the disciplinary and interdisciplinary ways of working with knowledge. The content as presented in the CAPS document and the textbook does refer to various concept at once in the midst of teaching certain concept(s). However, it becomes mostly the teacher's duty to determine how this process evolves simultaneously in classroom. Teachers D & E do mention how it is important for a teacher to realise the connections more than they are shown to them. If they (the teacher) are not knowledgeable or skilled enough, or is not deeply thinking about how to go about crossing and maintain boundaries between knowledge contents, the tension within their teaching becomes hard to realise. What ends up happening is the banking concept where the prescribed content that the curriculum prompts one to integrate and disintegrate concepts end up being called out and memorized as it is in the textbooks. In other words, the textbook content that encourages interdisciplinarity ends up solely being taught in a disciplinary way, and this was evident several lessons that were observed for this study.

When the connection is realised, one problem that follows and that which this study is concerned with is the extent to which the teacher can take it to discuss the integrated topics or concepts with weakened boundaries. The two topics taught in the five lessons and discussed from the CAPS document using the conceptual framework allude to us that it needs great awareness and strategy to figure out this extent. The teacher should be able to identify the core subject and that which is at the periphery.

The act of integrating concepts and/or crossing interdisciplinary boundaries is an exciting one and one can get lost in it. For example, teacher B has found themselves teaching a whole new topic of the eye whereas the core subject was seeing light. Identifying the core and periphery

subjects helps one figure out the range between the subjects. Identifying the range then helps the teacher think about whether or not the concepts at hand are sharing the same values and/or oriented towards the same goal. For example, seeing light is an optics physics phenomenon of concerned with the non-living world, whereas the eye is a biology concept concerned with the living world. When teaching the former, we therefore have to think about the range between the two concepts such that we are able to cross boundaries and be cautious to go back to the core concept to clarify the boundaries and not teach them as a single unit since they are not oriented towards the same objective. The reason why we need to cross and maintain boundaries under such circumstances is so that learners also not confuse the two concepts and by the end of the lesson be able to understand what the objective of the lesson is.

Sometimes the range may not be that wide that blurred boundaries are not problematic and this is the case when objectives or meaning of the two concepts being integrated are not that different. For example, the two concepts that teacher E was working with are both concerned with the non-living world. The teaching of how the sun produces its own energy is not separable with the idea of the nuclear reaction between hydrogen atoms. It therefore would not be as much problematic if the boundaries are not returned back to their original strength once they were weakened.

This is not to say that the teacher may leave the boundaries completely as weak. They would still need clarify them, just that to different extends in different cases. For example, the concept of axis in mathematics is meant to abstract the real world while in geography it is supposed to be more concrete. These are two different objectives although still concerned with the non-living world. This should imply a certain extent of boundary crossing and also maintenance considering the range and eventually the objectives of the two concepts.

Limitations

The study itself is attempting to understand a very complex phenomenon. Most existing study close to our topic are either around the idea of the disciplinarity, or that of interdisciplinarity. The idea of tension is left with little to no exploration within the literature came across. This idea is what I would like to refer to as a “fourth generation” that would be located within a realist paradigm which is yet to be fully understood. The majority of recent day scholarship and research is focused on the battle between modernist and postmodernist ideas and not how

they could be married or integrated. It then makes it difficult to come across a framework, or theory that would help us analyse this tension. The study would thus find itself most of the time exploring the idea of interdisciplinarity as the closest thing to the fourth generation idea of “the tension”. The study however remains conscious to remember that interdisciplinarity within the curriculum is not end goal, but the tension between disciplinarity and interdisciplinarity is.

Furthermore, understanding the intended curriculum may be an easy task for it is common across all the schools in South Africa (or at least those that are using it). It becomes a challenge to however understand the enacted curriculum because it differs through space and time; from class to class, and time to time due to many factors affecting that. We therefore have another limitation of establishing a fairly generalisable study because our study is qualitative and cannot study a large sample.

Curriculum Recommendations

From the above observations. This study would then recommend a more detailed Curriculum document that may also outline not only the concepts and topics that possible to integrate but also their objectives and the range at which they stand from one another. These should be a starting point to helping teachers think about the extent to which they can cross boundaries between various concepts, and how far back to they go to maintain the boundaries again. This is not to take away more of their autonomy but to empower them. Better yet, the curriculum policy may seek to design and provide frameworks to go about the process of crossing and maintaining disciplinary boundaries; that can help teacher do so in future.

The framework that was used to analyse the lessons of the teachers may guide towards developing a curriculum document that can help teachers realise the opportunities to work with concepts in this tensionism, and how to thoroughly do so. One of the most important aspects that the document policy may have to include in order to help teachers go about crossing and maintaining disciplinary boundaries may be the identification of the range between concepts that may be integrated. The documents may include details of how far apart the concepts are, and their orientations. This should help teachers see the extent to which have to (with their learners) cross the boundaries and the extent to which they have to return to maintaining them. This may not be seen as imposing on teacher autonomy but a point of transition between policy and implementation.

Pedagogy Recommendations

Since the study has found that the doing part of knowing - that is the practicality of learning is not satisfied, it therefore recommends that teacher pedagogy may accommodate this element in everyday teaching and learning. This accommodation would however only represent the pull from the interdisciplinary side of the tension. To ensure that the disciplinary side is also represented, the idea of crossing and maintaining boundaries should also be thought of in this process. The practical problem-solving that takes place in learning should not be left at the doing stage but should be thought of in terms of what theories go behind it.

To enable and promote this idea of practicality, while crossing and maintaining boundaries between various scholars such as Freire (1970/1996), Karpov & Bransford (1995), Gredler & Shields (2008), Villaroel et al (2018), and Villaroel (2020) suggested the concept problem-solving to be integrated into lessons. Even better, one of the general aims of the CAPS curriculum emphasises the promotion of this in learners (Department of Basic Education, 2011a). This concept and other ideas on how it may be integrated into lessons such as the ancillary use of language suggested by Hasan (2002) and the balance between direct instruction and minimal guidance as suggested by Kirschner & Sweller (2006) should be used in lessons and teachers should be trained on how to effectively apply these ideas to balance the tension between disciplinarity and interdisciplinarity. The study thus suggests that these ideas should be taught to teachers through professional development (PD) programs that are intended for realising the curriculum policy as analysed and suggested here.

There are other issues such as those of accountability that is of priority to the education department, which may be believed to be inconsistent with the kinds of pedagogies that this study is suggesting. However, the idea of authenticity within teaching and learning as understood by Villaroel et al (2018; 2020) again emphasises problem-solving as a pedagogical tool that can enable genuine learning and understanding of the knowledge within school subjects such as the grade 8 Natural Science within the CAPS, and ultimately a production of results that teachers can be gladly accountable for. Therefore, the PD programs should rather than focusing primarily on teaching teachers the content knowledge, open a bigger platform for teachers to learn authentic pedagogies that encourage problem-solving.

Areas of further research

The issue of the type of curriculum suggested here being inconsistent with accountability required by curriculum enforcement has multiple studies clarifying why problem-solving would actually be suited for producing results that teachers can be gladly accountable for. However, further research may still need to be done on how can we have or develop a curriculum that is more detailed and yet still promote teacher autonomy and versatility?

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Appendices

Interview Question

Ice Breaking Question

1. Can you please tell us about your journey as a teacher, when and where did it start?
2. What university did you attend?
 - f:** How confident do you feel the university had prepared you for teaching?
 - f:** Which aspects of teaching do you feel you did get equipped at the most/best and which do you feel you got equipped at the least/ worst?

Interview Questions

1. What do you think or understand of the prescriptive vs. flexible nature of CAPS?
 - f:** Is it absolutely prescriptive or flexible?
 - f:** If partly, is it predominantly prescriptive or flexible?
2. What aspects within the policy do you think allude to either prescriptiveness or flexibility?
 - f:** Is it the sequencing, time, pedagogies, or boundaries between contents?
 - f:** And how?
3. Let's talk about the boundaries between contents. As an NS teacher, how strong do you think these boundaries are between contents within the subject?
 - f:** What about among NS and other subjects?
 - f:** Can you please elaborate more or give an example.
4. Is it a good thing that the boundaries are strong (if understood to be strong) or weak (if understood to be weak)?
 - f:** How is it or could be a good thing? i.e., what are the advantages of having the subject boundaries in that nature? (To teaching and learning)
5. What could be the dangers (disadvantages) of having these boundaries in the that way (either weak or strong: how they are understood by the teacher)?
6. How do you think CAPS helps you exploit those advantages and alleviate those challenges?
7. What strategies do you possess or think are needed to exploit the advantages or alleviate those challenges?

Lesson observations and Interviews

Lesson 1/teacher A

Teacher: So after galaxies we can have solar systems. Within galaxies we have billions and billions of solar systems. Now solar systems is the one that we want to talk about. And then one of the galaxies, In our galaxy, we have the “Milky Way”. The solar system (meaning galaxy) that the earth is positioned is the milky way. Now by definition, solar system we said is the sun, planets, and other objects moving around. So now actually we are going to talk about the sun as the center of the solar system.

Now our sun is at the center, right? Do you understand now. And around the sun we have the orbits of the nine planet, do you know those.

Learners: Yes.

Teacher: Can you name them.

(the learners compete to name the planets and the teacher asks them to raise their hands)

Alright learner X is going to give us the planets

Learner: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, And Pluto.

Learners: Yoooh! Pluto is no longer a planet.

(the teacher ignores that part and moves onto talking about the planets)

Teacher: Ey Ey EY! He listed them. Now those are kinds of planets. Now the planets are orbiting the earth, I mean the sun sorry Now what is a planet. A planet is a rounded body travelling around the star in a clear circular path or motion. A planet is a rounded body of what? of rocky material travelling around the star in a clear circular path or motion.

So now a sun. Our sun is considered to be a star. So now most planets are orbiting around the sun. So the earth is positioned in a clear position to say now it is conducive for us to have oxygen, and, and, and, right? So now that is why we have life on earth. Because it is not far from mercury, It is between mercury and what?

Interview 1/teacher 1

Interviewer: So, the main idea is to understand what think about the prescriptive vs flexible nature or the CAPS curriculum? As a teacher who teachers under this curriculum, what do you think about that?

Interviewee: About how prescriptive it is?

Interviewer: Yes, about that?

Interviewee: Personally, I feel like CAPS is very strict. But I can't say is a bad thing. I mean there needs to be one thing that people follow if at the end of the day success or failure is going to be measured the same across the country.

Interviewer: Makes sense, so what is it about CAPS that you can say is prescriptive?

Interviewee: So we obviously have to teach the specified and same topic for specific grade and also do the same assessment tasks.

Interviewer: Does matter how you sequence the topics and pace the lessons?

Interviewee: To a certain extent yes it does matter. You can't teach a term 4 topic in term 1 when you are not done with a term 1 or 2 topic because the topics are going to be assessed first. When it comes to the teaching pace. I don't think CAPS is that strict because most of the time, you may be ahead of the syllabus. So I think it is only strict in a sense that you cannot be slower than what it says. But most definitely you can be ahead and that what the advisors mostly promote.

Interviewer: Let's talk about the boundaries between contents. As an NS teacher, how strong do you think these boundaries are between contents within the subject?

Interviewee: Uhm, so what are these boundaries?

Interviewer: Alright, so NS as a subject right, so how do you see the contents of this subject in relation to one another? Do they relate? And what does that mean. While at that, what about NS and other subjects?

Interviewee: Oh yeah. I see. I think there are points of connection between these subjects yeah. Especially because NS is combination of subjects that learners will choose from later in grade 10.

Interviewer: And how do you work around with that?

Interviewee: Uhm I think we can't dwell much on that especially when we consider how strict the syllabus is. the fact that they curriculum advisors encourage us to be ahead of the syllabus makes no time for connecting concepts.

Lesson 2/teacher B

Teacher: Alright. We are going to start with an eye as an object that enables us to see light

Teacher: Parts on an eye. What is this part? Points to the chart at the front.

Learner: raises their hands:

Teacher: Yes.

Learner: Cornea.

Teacher: Cornea. What is the function of the cornea?

Learners: to protect the eye.

Teacher: to protect the eye, the next part?

Learner: is a pupil

Teacher: what is the function of a pupil?

Learners: to control the amount of light entering the eye.

Teacher: Yes. What is the third part now?

Learners: Mumble the answer

Teacher: Alright. Let's move as a class now. What is the third part?

Learners: Retina.

Teachers: What is the function of a retina?

Learners: Argues around the answer.
Teacher: Alright. Shush. It is where images are formed. What is the last part.
Learner: Optic nerve
Teacher: What is the function?
Learners: Inaudible

Interview 2/Teacher 2

Interviewer: Okay so what do you understand about the prescriptiveness vs flexibility within the CAPS curriculum

Interviewee: Err, what do you mean by that? I don't understand your question.

Interviewer: Okay, in other words, how strict is CAPS?

Interviewee: Okay now I get you. Yah, CAPS is obviously a very strict curriculum. There is a lot of rules on how should a teacher do things. I for example, I am teaching teaching iphysics. When it comes to chemistry. I have to start with the rate of reactions before the chemical equilibrium. But I personally feel like I need to start with chemical equilibrium. And if I do that, I might in hot waters with people from the district you know. We as teacher, we are the puppets of the system and these facilitators are like polices of the curriculum and the ATP.

Interviewer: Let's talk about the boundaries between contents. As an NS teacher, how strong do you think these boundaries are between contents within the subject?

Interviewee: I think NS is a combination of other subjects. We have Life Sciences, we have physics, we have igeography. So. it's already a good starting point to break interdisciplinary boundaries.

Interviewer: Can you see boundary weakening between NS and other subjects in the senior phase maybe?

Interviewee: Yah, so the geography in NS should come from the social sciences in order to be age appropriate.

Lesson 3/teacher C

Extract E: from lesson 3 by teacher C

Let us turn to page ...52

Teacher: Now who can tell us guys, just one person...what is this

Learners: It's a galaxy

Teacher: It's a galaxy? Alright. Now what is the name of this galaxy?

Learners: Milky way

Teacher: Alright shap. Now how many planets did we have before?

Learners: Nine

Teacher: Now which planet is no longer considered?

Learners: Pluto

Teacher: How many planets do we have now?

Learners: Eight

Extract F: from lesson 3 by teacher C

Teacher: So out of all these 8 planets, only one planet is able to maintain life, which is Earth angithi?

Learners: Yes.

Learner: Sir, even mars nayo bathi it can maintain life?

Teacher: Okay, now, it is not scientifically proven. So we will have to say no for now. Now we have the first four, they are called what? Terrestrial planets. It is the ones where you can have some land on neh? And the remain 4: your Jupiter, your Saturn. Neptune, and Uranus are called what? Your gas giants neh? Now in the gas in the gas giants guys? There is no land neh, no land. Nothing at all, so if you would go to Jupiter, it's mostly gases and water neh? Shap.

One learner raises their hand.

Teacher: Alright. Question Louder..

Learner: Sir do we live inside earth or outside, coz...(inaudible)

Teacher: Alright, here is a very good question...bathi: do we live inside earth, or on Earth

Learners: On (some) outside (others)

Interview 3 Extract:

Interviewer: Okay, let us get to the interview questions. What do you think or understand of the prescriptive vs. flexible nature of CAPS? In other words, is it absolutely prescriptive or flexible? Or partly maybe?

Interviewee: Uhm, the curriculum on its own is obviously a prescribing book, yeah, telling teachers what to teach, when to teach it, and how to. So this should tell us that that our CAPS is more prescriptive than anything.

Interviewer: Are you able to perhaps see anything flexible about CAPS maybe?

Interviewee: Yes the what and the when of everything...that I can say they are completely prescriptive. However, when it comes to the how part, I think the teacher is allowed some freedom. So I think is where the CAPS is partly flexible.

Interviewer: Alright, I think you have already answered my next question. So would you agree with me to say that the pedagogy aspect of CAPS alludes to flexibility while the contents and sequencing are strictly prescribed?

Interviewee: Yes, exactly, yess..

Interviewer: Okay, let's talk about the boundaries between contents. As an NS teacher, how strong do you think these boundaries are between contents within the subject?

Interviewee: Uhm, can you please repeat the question, maybe put it in another way.

Interviewer: Alright, so NS as a subject, what do you think is the relationship between it and the contents of other subjects, and not just only with other subjects, but also the relationship between the contents within NS.

Interviewee: Alright, now I get your question now. Yes definitely, these subjects interlink. There are certain topics within the Natural sciences that are interlinked with one another. Sometimes you find yourself teaching a topic like respiration that would require you to include chemical equations, which is chemistry.

Interviewer: What about other subjects? Because, chemical equations and photosynthesis are topics within the NS syllabus right?

Interviewee: Yes, there are some points where we also need to make connections with geography, maths, and also recall some history of things.

Interviewer: Can you please elaborate more or give an example.

Interviewee: Uhm, just the fact that the learners need to learn chemical equations and balance them is a maths skill, equations are mathematics, and also, the topic I was teaching of solar system, uhm planet earth and beyond is a geography content.

Interviewer: So is it a good or bad thing that the subjects are interlinked like this?

Interviewee: Yes definitely. In varsity, we learnt that learners learn better when teachers provide many ways of understanding. Yeah, we need to explain to learners from different ways of seeing the same thing. And using other subjects help with that you know.

Interviewer: Oh that's actually good. So can you think of any dangers or disadvantages of interlinking contents from multiple subjects?

Interviewee: Uhm, yes. The problem starts when you do not know the content that you are trying to bring into your subject. You won't be able to make the links and sometimes even confuse the learners.

...

Interviewer: What skills do you possess to deal with these challenges or exploit these advantages?

Interviewee: Uhm, Collaboration. I think it's a great idea to sometimes call anyone who is more knowledgeable on the topic you are trying to fetch to come and explain it better to learners. Even if they don't come to your class but go to them for clarification on that topic so that you understand it better.

Interviewer: How does that happen in NS?

Interviewee: Yes great question. So NS mostly combine physics, chemistry, and life sciences. With the example of photosynthesis, I majored with life sciences, my chemistry is not that good, so I would call or go to a science teacher to clarify the photosynthesis chemical equation so yeah, we need collaboration.

Lesson 4/teacher D

Extract G from lesson 4 by teacher D

Teacher: Question 2, what is axis?
 Learner: Axis? (yes). Axis is... (the teacher interrupts the learner)
 Teacher: Hhayi! Don't tell me the definition, I just want you to tell me roughly what axis is.
 Learner: Is when the planets are... (the teacher interrupts the learner again)
 Teacher: Hhayi! Don't tell me about the planets... (to another learner) Yes mtanam
 Learner: North pole and south pole
 Teacher: Yes u Zamile, u za nayo, u za nayo. Athi north pole and south pole. I just want to draw them to show you why I say uza nayo. (draws a quadrant on the board).
 Teacher: Angithi in Mathematics you do graphs?
 Learners: Yes. We have started yesterday.
 Teacher: Good. What are these lines?
 Learners: (argue around the answer... and get to agree on axis) Axis.
 Teacher: Can you name them?
 Learners: x-axis and y-axis.
 Teacher: claps hands for the learners. Then what is the definition of axis?
 Learner: Imaginary straight lines.
 Teacher: Yes. Straight lines angithi, imaginary straight lines. Alright, the next one. Atmosphere. Before you tell me anything, what do you think?
 Learners: Air, moya,
 Teacher: Moya!? Alright, let us turn this into natural sciences. Moya in Natural Sciences?
 Learners: Air, oxygen, atmosphere, gases.
 Teacher: Gases. Gases angithi? Yes. In the atmosphere, there are gases angithi? So atmosphere is the layer of gases surrounding the earth.
 Teacher: the next one. What is rotation?
 Learner: Is when planets are rotating.
 Teacher: Hhayi! Before you talk about the planets, what is rotation roughly?
 Learners: Spining.
 Teacher: Spining angithi?
 Learners: Yes.
 Teacher: So what is the answer there?
 Learners: E!
 Teacher: continues to reprimand one of the misbehaving learners.
 Teacher: Orbit? Hay orbit mina angi'yazi, yin'iorbit?
 Learners: the part...(inaudible)

Interview

Interviewer: Okay now. Ever since you started teaching you have been with CAPS and not any other curriculum before, what do you think about it? Is it too strict or flexible?
 Interviewee: You know I have been expecting that question. This have been a topic since university days. At first yes. When I started teaching I always felt like the curriculum is too strict. And especially because of the time, so you have to follow what it says and do nothing more. For example, you would have the normal teaching and learning run for 10 weeks in a term according

to the ATP. But then the exams would start may in week 7. So you already feel like there is no room for a breather and you have to take care of business.

Interviewer: And now, what do you think about it?

Interviewee: So, yes it still remains what it is, but my perspective of it changes as I find better ways of taking care of business. I think can now work with the seven weeks better and pace my topic in ways that the seven weeks is more than enough, and allow myself to do more than what I am required.

Interviewer: What do you mean by doing more than required?

Interviewer: I'm talking about revision or even going onto the next terms work. Yeah things like that

Interviewer: Okay, so what is your take on the flexibility of CAPS when it comes to making connections between concepts from within your subject NS, and perhaps with other subject too?

Interviewee: I think that happens naturally. Or maybe it is because I am a maths teacher. Or perhaps it developed over time. But a teacher has to see these connections more than they are always shown to them.

Interviewer: What examples can you give within the NS and between NS and other subjects

Interviewee: Uhm Yoh! So I think language is a great point of view to see these connections. For example, axis is a word that means different things in different subjects. So if you can find the commonality between these different meanings, it can learners understand and be more curious.

Interviewer: Alright you already mentioned that making such connections help learners understand. Can you elaborate on that?

Interviewee: I think it makes sense when you.. when you know a certain word and it comes up with another special definition. It makes more sense what it generally means

Lesson 5/Teacher E

Extract from Lesson 5 by Teacher E

(For the most part, the whole lesson was shared in IsiZulu and therefore had to be translated completely to English)

Teacher: Okay. Now tell me, What did you learn yesterday about the sun?

Learners: That the sun is a star

Teacher: The sun is a star right?

Learners: Yes.

Teacher: For those who did not know, the sun is a star like all the other stars that we see at night. Now the question is: why do we see the sun like this (illustrating big with hands), and other stars like this (illustrating small with index and thumb)?

Learner: It is because they are far from us Sir.

Teacher: Very, very good. So the sun is the closest star to our planet earth.

Teacher: Now here comes a question. Why is it that we see our star as round shaped, but other stars as typical star shapes we know from our childhood?

Now, have you ever seen that an apollo, when you see it from close range it looks normal and round, but at a distance they take a star shape?

Learners: Yes

Teacher: that is the case with other stars

Learner: why is it that we can see other stars during the day?

Teacher: that's a very good question. Alright, have you seen that if you light a torch of your phone during the day from afar, we cannot even recognise its light?

Learners: Yes.

Teacher: That is the case with the sun; since it is so close, it outshine the radiation produced by all other stars that are far away during the day. We can only see these stars when the sun is hidden from us at night.

Extract from Lesson 5 by Teache E

Teacher: Alright, Yes Banele

Learner: (inaudible)

Teacher: I will respond to that question when we are talking about Planet Earth. Now we are still learning about The Sun

Teacher: Yes Siphokazi

Learner: Inaudible

Teacher: yes the energy changes, As time goes on, nuclear reactions in the sun continues, and the hydrogen get used up, so the sun is also getting smaller. It is estimated that the sun is about five billion years old, and it is left with five billion more years. I will teach you what will happen to the sun when it [the sun] comes to an end, I think next year.

Teacher: Yes Banele

Learner: So since the sun is about five billion years old, this means that there were no planets and earth before?

Teacher: Yes. Other planets were not there. But I will respond to you as to how planets where formed in term 4.

Learner: (Inaudible)

Teacher: Indaba ka Elon Musk and planet Mars. But were are not talking about the planets now. We will talk about Elon Musk and Project X when we are talking about the planets.

Extract: From lesson 5 by teacher E

Teacher: So the sun is the hottest at its core, with temperatures of 15 million degrees Celsius. 15 million...you seem not to understand how much is 15

million. For water to boil, it should be at 100 degrees Celsius. What do you think will happen to the water at 15 million degrees Celsius?

Learners: It would be finished.

Teacher: It would be finished right? Yes Siphokazi.

Learner: So how were they able to measure the temperature at the core?

Teacher: So you cannot get to the core because the sun is too far and too hot. So even if you travel at a very high speed to the sun, you will get burnt and vanish into air without getting there. So, scientists study the nature and behaviour of objects. They are aware that the sun is made of the element called hydrogen, So considering the mass of the sun and that the hydrogen atoms react with another to form a new element called helium, this reaction is also known as nuclear reaction. So they [scientists] are able to use this knowledge to figure out the energy consumption at the core and how much heat will be produced at the core.

Interview

Interviewer: Alright, so a lot of teachers have complained around the current CAPS curriculum saying it is so strict. What do you think about that?

Interviewee: Yah Thobs check, yes it is strict. But I mean, it is a central common thing, so it has to be specified and given to everyone.

Interviewer: So you think its abosutely strict?

Interviewee: Yes. If something is put on paper and mandated, it is a prescription and we should all follow it. In this way, it is then prescriptive.

Interviewer: You mention the word prescriptive. What exactly is so prescriptive about the curriculum? Especially the Natural Sciences Grade 8?

Interviewee: Me Thobs, I was speaking from a more general perspective that a curriculum is a strict prescription since is written down and mandated on everyone. But if you want specific things I can say, knowledge; the content that you have to teach, the sequence, and time frames, like we have the ATP and it summarises all of that.

Interviewer: Okay, let 's talk about the content knowledge as you have mentioned. What do you think the relationship between NS and multiple contents from other subjects? Are they related, and does CAPS allow or help you to make those relationships?

Interviewee: Yes there are relationships. But I don't think it's common that you see it in your CAPS although we use the ATP most of the time that you should check out or make relationships with other contents. So I think it is the teacher work to be on the lookout for such connections.

Interviewer: Why should they be on the lookout for these connections?

Interviewee: It makes explaining more effective, yes it makes explaining more effective, and in turn learners will understand better.

Interviewer: Okay, let me not assume that it is a good thing that the CAPS itself does not really show and promote any connection between subjects. What do you think about that? Is it a good or bad thing.

Interviewee: I can't say it is a bad thing. Teachers should be on the lookout for ways to explain things to their learners. And if it means it should be through getting ideas from other subjects, then it should be that way. Even from outside the school if possible.

Interviewer: What strategies do you think you have, or teachers should have to be able to find such connections you are talking about?

Interviewee: Mmmmmh (thinking). I don't think there is a strategy. I can't really say the psychology part of it. But I think it is just natural of the mind to try and find alternative ways to explain things especially when the person you try to explain these things to doesn't understand. So things like, like analogies, examples and trying to simply just come naturally.

Participant Information Sheet (PIS): For Parents and Learners

Dear Sir / Madam

My name is Kgothatso Thobejane. I am a Masters student in the Curriculum division at the University of the Witwatersrand, Johannesburg. My supervisor is Dr. Alfred Masinire. I am conducting a research study about understanding the nature of CAPS. The study title is: The Tension Between Disciplinarity and Interdisciplinarity in Curriculum Assessment Policy Statement (CAPS): A Content Analysis of a Topic and Teaching in Grade 8 Natural Sciences.

I am inviting you to allow your child to take part in a lesson observation. If you decide to allow them to take part, their participation in this research study will last an hour. The observation will take place at the school they attend during the period chosen by their teacher.

With your permission, I would like to audio record the lesson. This data will be stored in a password secured computer for 5 years and deleted after those years. Only the researcher will have access to the data.

During the research activity, no personal information about your child will be asked.

The lesson observation will be confidential and anonymous. When I share the results of the research study, I will not include your child's name nor anything else that could identify them. With your permission, other researchers may use the data collected from this research study, but your child's name and any personal information will not be used or passed on.

If you decide to allow your child to take part in the research study, it should be because you want them to volunteer. They do not have to take part. You can stop them from being in the study at any time. They will not get any direct benefits if you allow them to join the research study. You nor you child will not lose any services, benefits or rights you would normally have if you decide not to join. Taking part in the research study will not cost you anything. You or your child will not be paid for being in this research study.

The risks for this research study are no more than what happens in everyday life.

This research study will be written up as a research report and may continue to be published. The report may be available on the university library website. If you would like to receive a summary of this report, I will be happy to send it to you.

If you have any questions during or afterwards about this research study, feel free to contact me or my supervisor on the details listed below. If you have any concerns or complaints about the ethical procedures of this research study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrecnon.medical@wits.ac.za

Yours sincerely,
Kgothatso Thobejane

Researcher:
Kgothatso Setjakadume Thobejane, 1994511@students.wits.ac.za , 079 281 0057

Supervisor:

Dr. Alfred Masinire, Alfred.masinire@wits.ac.za , 011 717 3056

Participant Information Sheet (PIS): For the Principal and SGB

Dear Sir / Madam

My name is Kgothatso Thobejane. I am a Masters student in the Curriculum division at the University of the Witwatersrand, Johannesburg. My supervisor is Dr. Alfred Masinire. I am conducting a research study about understanding the nature of CAPS. The study title is: The Tension Between Disciplinarity and Interdisciplinarity in Curriculum Assessment Policy Statement (CAPS): A Content Analysis of a Topic and Teaching in Grade 8 Natural Sciences.

I am inviting your school to take part in a lesson observation. If you decide to allow them to take part, their participation in this research study will last an hour. The observation will take place at the school they attend during the period chosen by their teacher.

With your permission, I would like to audio record the lesson. This data will be stored in a password secured computer for 5 years and deleted after those years. Only the researcher will have access to the data.

During the research activity, no personal information about your child will be asked.

The lesson observation will be confidential and anonymous. When I share the results of the research study, I will not include your child's name nor anything else that could identify them. With your permission, other researchers may use the data collected from this research study, but your child's name and any personal information will not be used or passed on.

If your school decides to take part in the research study, it should be because you want to volunteer. Your school do not have to take part. You can stop from being in the study at any time. Your school will not get any direct benefits if you join the research study. You will not lose any services, benefits or rights you would normally have if you decide not to join. Taking part in the research study will not cost you anything. Your will not be paid for being in this research study.

The risks for this research study are no more than what happens in everyday life.

This research study will be written up as a research report and may continue to be published. The report may be available on the university library website. If you would like to receive a summary of this report, I will be happy to send it to you.

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Supervisor:
Dr. Alfred Masinire, Alfred.masinire@wits.ac.za , 011 717 3056

Participant Information Sheet (PIS): Teacher.

Dear Sir / Madam

My name is Kgothatso Thobejane. I am a Masters student in the Curriculum division at the University of the Witwatersrand, Johannesburg. My supervisor is Dr. Alfred Masinire. I am conducting a research study about CAPS understanding. The study title is: The Tension Between Disciplinarity and Interdisciplinarity in Curriculum Assessment Policy Statement (CAPS): A Content Analysis of a Topic and Teaching in Grade 8 Natural Sciences.

I am inviting you to take part in an interview & lesson observation. If you decide to take part, your participation in this research study will last about a day. The interview will take place at the school you work at the time of your choice.

With your permission, I would like to audio/video record the interview & lesson observation. This data will be stored in a password secured computer for 5 years and deleted after those years. Only the researcher will have access to the data.

During the research activity, I will need to ask for some personal information about you, including your own perceptions about the CAPS curriculum, the nature of your subject, your university qualifications etc.

The interview & lesson observation will be confidential and anonymous. When I share the results of the research study, I will not include your name or anything else that could identify you. With your permission, other researchers may use the data collected from this research study, but your name and any personal information will not be used or passed on.

If you decide to take part in the research study, it should be because you want to volunteer. You do not have to take part. You can stop being in the study at any time. You do not have to answer any questions if you do not want to. You will not get any direct benefits if you choose to join the research study. You will not lose any services, benefits or rights you would normally have if you decide not to join. Taking part in the research study will not cost you anything. You will not be paid for being in this research study.

The risks for this research study are no more than what happens in everyday life. OR Some of the questions asked may make you feel sad or upset. If this happens, I will stop the interview and/or the lesson observation and continue another time. If you need some support or counselling services following the interview& lesson observation, these are available free of charge.

This research study will be written up as a research report and may continue to be published. The report may be available on the university library website. If you would like to receive a summary of this report, I will be happy to send it to you.

If you have any questions during or afterwards about this research study, feel free to contact me or my supervisor on the details listed below. If you have any concerns or complaints about the ethical procedures of this research study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za.

Yours sincerely,
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Researcher:

Kgothatso Setjakadume Thobejane, 1994511@students.wits.ac.za , 079 281 0057

Supervisor:

Dr. Alfred Masinire, Alfred.masinire@wits.ac.za , 011 717 3056

Consent Form: Parents

Title of project: The Tension Between disciplinarity and Interdisciplinarity in Curriculum Assessment Policy Statement (CAPS): A Content Analysis of a Topic and Teaching in Grade 8 Natural Sciences.

Name of researcher: KGOTHATSO SETJAKADUME THOBEJANE

I,, allow my child to participate in this research project.

I agree to the following:

(Please circle the relevant options below)

The research study was explained to me. I understand what this study is about.	YES	NO
--	-----	----

I understand that my child will volunteer to take part in the study	YES	NO
---	-----	----

I agree that the interview/focus group/other activity may be audio recorded.	YES	NO
--	-----	----

I agree that direct quotations from the observation may be used by the researcher in their research report.	YES	NO
---	-----	----

I agree that participation will remain anonymous (names will not be used by the researcher in their research report).	YES	NO
---	-----	----

I agree that other researchers may use the information provided in the interview (depending on their own ethics clearance being	YES	NO
---	-----	----

obtained) but names and any personal information will not be used
or passed on.

..... (name of participant's parent)

..... (signature)

..... (date)

..... (signature)

..... (name of researcher/person seeking consent)

..... (date)

Consent Form: Teachers

Title of project: The Tension Between disciplinarity and Interdisciplinarity in Curriculum Assessment Policy Statement (CAPS): A Content Analysis of a Topic and Teaching in Grade 8 Natural Sciences.

Name of researcher: KGOTHATSO SETJAKADUME THOBEJANE

I,, agree to participate in this research project.

I agree to the following:

(Please circle the relevant options below)

The research study was explained to me. I understand what this study is about.	YES	NO
--	-----	----

I understand that I can volunteer to take part in the study	YES	NO
---	-----	----

I agree that the interview/focus group/other activity may be audio recorded.	YES	NO
--	-----	----

I agree that direct quotations from my interview/focus group/other activity may be used by the researcher in their research report.	YES	NO
---	-----	----

I agree that my participation will remain anonymous (my name will not be used by the researcher in their research report.	YES	NO
---	-----	----

I agree that other researchers may use the information I provide in my interview (depending on their own ethics clearance being obtained) but my name and any personal information will not be used or passed on.	YES	NO
---	-----	----

..... (signature)

..... (name of participant)

..... (date)

..... (signature)

..... (name of researcher/person seeking consent)

..... (date)

Consent Form: The Principal & School Governing Body

Title of project: The Tension Between disciplinarity and Interdisciplinarity in Curriculum Assessment Policy Statement (CAPS): A Content Analysis of a Topic and Teaching in Grade 8 Natural Sciences.

Name of researcher: KGO THATSO SETJAKADUME THOBEJANE

I,, agree to have the school I lead to participate in this research project.

I agree to the following:

(Please circle the relevant options below)

The research study was explained to me. I understand what this study is about.	YES	NO
I understand that the school I lead can volunteer to take part in the study	YES	NO
I agree that the interview/focus group/other activity may be audio recorded.	YES	NO
I agree that direct quotations from my interview/focus group/other activity may be used by the researcher in their research report.	YES	NO
I agree that the participation of children and educators will remain anonymous (my name will not be used by the researcher in their research report.	YES	NO
I agree that other researchers may use the information my child acquired during the study (depending on their own ethics clearance being obtained) but the names of participants and any personal information will not be used or passed on.	YES	NO

..... (name of Principal)

..... (signature)

..... (date)

..... (name of SGB Chairperson)

..... (signature)

..... (date)

Classroom Observation Protocol

Part 1: Background Information

Observer(s)					Start time	
Date					End time	
Duration					Topic/concept	
School Name					District	
Teacher's Name					Subject	
Number of pupils	Boys	Girls	Total	Average age		
Aims of the lesson						

Observation Notes

The observation will be made solely on the teaching decisions and strategies that the teachers make and use.

Places and range of boundaries	What do you see	What do you think
1. How far apart are the concept		
Boundary Crossing Points	What do you see	What do you think

1. Correlation		
2. Core Subject		
3. Connective subjects, courses, and units		
4. Optionality		
5. Cross curricular integration		

Classification & Framing

	--	-	0	+	++
Classification					
Framing					
Overall Comments					

Three scenarios of Educational Outcomes

Which educational scenario (undersocialized curriculum/oversocialized curriculum/powerful knowledge) do you see prevalent	
--	--



SCHOOL OF EDUCATION ETHICS COMMITTEE

CONSTITUTED UNDER THE UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)

CLEARANCE CERTIFICATE

PROTOCOL NUMBER: H2023ECE076M

PROJECT TITLE

The Tension Between disciplinarity and Interdisciplinarity in Curriculum Assessment Policy Statement (CAPS): A Content Analysis of a Topic and Teaching in Grade 8 Natural Sciences.

INVESTIGATOR

Thobejane Kgothatso Setjakadume

SCHOOL/DEPARTMENT OF INVESTIGATOR

WSoE

DATE CONSIDERED

10 July 2023

DECISION OF THE COMMITTEE

Approved unconditionally

RISK LEVEL

Minimal Risk

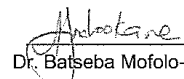
EXPIRY DATE

Date of submission of the Research Report

ISSUE DATE OF CERTIFICATE

1 November 2023

CHAIRPERSON

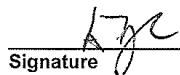

Dr. Batseba Mofolo-Mbokane

cc: Dr. Alfred Masinire

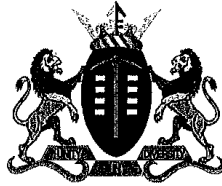
DECLARATION OF INVESTIGATOR

To be completed in duplicate and **ONE COPY** returned to the Chairperson of the School/Department ethics committee.

I fully understand the conditions under which I am authorized to carry out the abovementioned research and I guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee.


Signature

Date 02 / 11 / 2023



GAUTENG PROVINCE

Department: Education
REPUBLIC OF SOUTH AFRICA

8/4/4/1/2

GDE RESEARCH APPROVAL LETTER

Date:	24 August 2023
Validity of Research Approval:	08 February 2023– 30 September 2023 2023/380
Name of Researcher:	Thobejane KS
Address of Researcher:	32 Makarapa Street Ditobeleng Driekop
Telephone Number:	0792810057
Email address:	1949511@students.wits.ac.za
Research Topic:	The tension between disciplinary and interdisciplinary in Curriculum Assessment Policy Statement (CAPS)
Name of University:	University of the Witwatersrand
Type of qualification	Master of Education
Number and type of schools:	2 Secondary Schools
District/s/HO	Gauteng East Ekurhuleni North

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

The following conditions apply to *GDE* research. The researcher may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:

1

Making education a societal priority

Office of the Director: Education Research and Knowledge Management

7th Floor, 17 Simmonds Street, Johannesburg, 2001

Tel: (011) 355 0488

Email: Faith.Tshabalala@gauteng.gov.za

Website: www.education.gpg.gov.za