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Forms and meanings of integration : a case study on mathematics and economic management science (EMS) in grade 7.

Marnewicke, Prevein Gregory

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University of Witwatersrand

School of Education

Faculty of Humanities

Forms and Meanings of Integration

A case study on Mathematics and Economic Management Science (EMS) in grade 7

A research report submitted towards the completion of the requirements of a Master of Education degree by Coursework and Research Report.

P. G. Marnewicke

Date: 22 December 2008

ABSTRACT

This study explored how mathematics teachers integrate mathematics with other learning areas and specifically Economic Management Science (EMS). I explored the understanding of teachers on the topic of integration and how they integrated mathematics concepts with selected EMS concepts from the South African curriculum for grade 7 learners.

The concepts selected in this study were: Salary, Interest, Graph, Ratio, Product and Expand. These concepts have both a mathematics and EMS dimension, and therefore potentially connected to both disciplines of mathematics and EMS. In the implementation of the study the teachers were asked to draw concept maps involving these concepts. Subsequently, I interviewed the teachers to document their experience of integrating these concepts in their teaching and planning for teaching of mathematics and EMS.

The analyses of the data collected demonstrated that integrated concepts can enhance or hinder learning in and across the two learning areas. The teachers integrated concepts unintentional and tacit. In addition teachers were more focused on integrating concepts belonging to a specified learning area and reflected on teaching and learning from a single domain. However in theory they argued for integration in and across the two learning areas. Therefore while two teachers aimed to integrate learning areas in theory, they were faced with different challenges in practice

DECLARATION

I; Prevein Gregory Marnewicke; declare that this work was done and submitted towards the completion of the requirements of a Master of Education degree by Coursework and Research Report without any aid or assistance from any party unless acknowledged. This study has never been produced, submitted or documented before.

Thank you

_____

P. G. Marnewicke 02 November 2009

DEDICATION

I dedicate this work to my two daughters Jada Smith (10) and Okzana Harvey (9); with all the love any human being and a proud father can give. I have taken time away from you to complete this study and hope that one day you will be able to appreciate and enjoy the fruit of my labour. I love you and may God bless you abundantly.

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KEY WORDS:

i. **Integration** (Relationship with in or between Learning Areas)

ii. **LA's** (Learning Areas: Previously known as Subjects)

iii. **Classification** (Boundaries between Subjects)

iv. **Framing** (Degree of input into the curriculum by Teachers or Learners)

v. **Recognition** (Identifying Concepts)

vi. **Realization** (Ability to interact with identified concepts)

CHAPTER 1: INTRODUCTION, BACKGROUND, RATIONALE AND AIM

1.1 Introduction (Rationale and Back ground)

Curriculum 2005 followed by the National Curriculum Statement emphasizes integration as one of its key concepts and principles, hence the study to explore the understanding of this notion of integration from policy to practice. There is an interesting background of this specific curriculum and the rationale behind. Hence, an imperative investigation into the implementation of integration in South African classrooms creates questions about the integration. In this chapter I am looking at the background of the curriculum and what the aim of this research study and the research questions that need answers about the integrated curriculum system.

1.2 Background

The South African education system took a paradigm shift from the old traditional curriculum of education to a new dispensation of an integrated curriculum. In the South African situation, we find ourselves operating and grappling to implement the new curriculum to the best of our knowledge, skill and abilities.

At this juncture I think it is important to, mention that teachers went for in service training for one week before the implementation of the new curriculum was made effective. When the curricular change from C2005 to the NCS came about teachers were called to in service training for another week to get training on how to implement the NCS. It is also imperative to realise that different provinces affected the training at different times and different service providers did training in different provinces. After these training workshops teachers were sent back to the classroom to implement and grappled with the new curriculum and integration between and within learning areas.

Even though it is almost a decade of grappling and interacting with, firstly curriculum 2005 (C2005) followed by a second revised and supposedly a more user friendly National Curriculum Statement (NCS). One of the key and central concepts of these two Outcome based education (OBE) curricula remains the issue of integration. The NCS document for Mathematics speak about short term integration and give examples of LA's (Learning Areas)that can be integrated. Interestingly, the NCS document is silent on LA's that can be integrated with Mathematics, but it does suggest any other combinations of integrated LA's are combinable. Hence, I am going to explore the integration of EMS with Mathematics.
The Policy also mentions the integration of concepts or themes between Learning Areas.

"The Learning Area content, concepts or themes are NOT the starting point when planning integration. However, they are important vehicles for achieving the outcomes and are to be considered as part of planning" (SA. DoE, RNCS Mathematics Policy document, 2003 pp.47)

The notion of integration mentioned in the quotation above guides me to explore the mathematical concepts and EMS (economic management science) concepts that I want to find in EMS and explore how it is implemented during teaching and planning to integrate with mathematics. The Mathematical Policy also mentions that it is an implication for planning to consider how well teachers know other learning areas in order to integrate and assess effectively. Therefore teachers are required to know the Learning Areas that they are integrating with. My study is therefore investigating the understanding and knowledge of teachers about the Learning Areas they teach and the Learning Areas that they integrate with.

Since we, the teachers and the implementers of the curriculum has been interacting with the notion of integration in and across Learning Areas (subjects) for almost a decade, it is tacit that we are required to have a fair degree of understanding what it means to integrate within Learning Areas (LA's) and across Learning Areas and that we interact with policy documents and research materials. The latter is also what the policy documents require from teachers. Learning Areas and the pedagogy are required to prepare the learners in order to contribute effectively to uplift the economic status of the country and teachers are given the task to ensure that these goals are clearly set out and met by learners.

In my study and quest, I want to explore the understanding that teachers have of what integration means. I set out to find clarity about the degree of understanding that teachers in the current South African situation have about the meaning of integration in the curriculum. How they implement that understanding in practice, within and specifically between Learning Areas (Subjects) since implementation of the new curriculum?

The link between Mathematics and EMS that pertain to the concepts can become confusing to the learners and teachers must clarify it so that learners develop a better understanding. Take the concept "product" as an example. At this level (grade 7) teachers need to re-emphasize that the answer to a multiplication operation (123- the multiplicand x 2- the multiplier = 246 – the product) will be identified or termed "the product" in word sums. The mathematics teacher needs also to clarify to learners that the same concept with the same spelling will have a different meaning when it is used in the learning area EMS. In EMS "the product" is referred to as the end result of articles (clothing, cars, electronic equipment, etc.) that was manufacture, assembled, constructed or created. The link would also be that it is used as the end result in both the learning areas after some operation that took place to come to the product.

As the study unfolds the other concepts that I have chosen have more or less a similar link or connection between the two learning areas and will be explained in later chapters of the study.

Within this study I aimed to elicit the types of integration that comes to the fore between Mathematics and Economic Management Sciences (EMS) at grade 7 level. The Mathematics Policy (2003) mentions that even though the LA's are learning programmes, it is possible for teachers to integrate in order to enrich teaching learning and assessment and I looked at how and why grade seven teachers see relationships between the two learning areas Mathematics and EMS.

I give a brief academic and professional background of the teachers that I worked with to present a better perspective of the respondents and their academic and educational credentials in order to qualify for participation in my study. The information about the teachers is the basis that was used to clearly discriminate why these two teachers were selected to participate in the study.

1.3 Rationale for the study

The shift from the traditional curriculum to the new curriculum (C2005) in 1998 brought with it novice situations in teaching. Learning Areas were introduced as integrated subjects relating and sharing time frames like EMS (Economic Management Science) and MLMMS (Mathematics Mathematical Literacy and Mathematical Science). During the revision of the curriculum and the formation of NCS the MLMMS resorted back to Mathematics and Mathematical literacy, but EMS remained. It is important to realise is that EMS was never taught in the levels below Standard Seven (Grade 9) or in Primary schools prior to 1998 in South African Schools. Teachers did not receive any formal training for teaching EMS prior to 1998. EMS at higher levels was taught as separate Subjects (LA's) as subjects like Economics, Business Economics, Commerce and Management systems and at high school level only.

EMS as a learning area is fairly new at the current grade seven level. It is already an integrated Learning Area (subject) consisting of different subjects (Economics, Leadership and management, Entrepreneurship) and financial knowledge. I therefore argue that EMS has open boundaries or blurred boundaries with weak classification (boundaries insulating learning areas) and weak framing (type of content selected by teachers or policy makers). The latter terms will be explained later in the Theoretical Framework. The assumption in this study is that educators teaching this subject need to be open to the issue of integrated teaching and integrating subjects in a predominantly integrated curriculum (Bernstein 1996).

1.4 The research Problem

Many questions come to mind when we look at integration between learning areas. The questions become even more when we look at the new curriculum and the implementation thereof. In my study I needed to phrase my questions in such a manner that I actually explore and find focused answers within the scope and purpose of my study, which is specifically based on integration between mathematics and economical management science and how these teacher interact with content and concepts across these two learning areas.

In order to integrate two disciplines, EMS and Mathematics, teachers need to have some kind of understanding of integration and the EMS teacher need to have some conceptual understanding of mathematics and in mathematics at a higher level then that of the learners in order to present the lesson with relative confidence. I am exploring the types of mathematics that comes to the fore in the understanding of integration by the EMS teachers and the understanding of integration of the mathematics teachers using mathematical concepts and EMS concepts derived from EMS.

The concepts are:

Graph, Ratio, Percentage, Salary, Product and Expand.

Using these concepts I explored to find answers to the questions I posed.

1.4.1 Research Questions:

- What relationships do grade seven Mathematics and EMS teachers make between selected concepts from EMS?
- What difference, if any, exists between relationships made by grade seven EMS teachers and those made by Mathematics teachers?

Answers to these questions will inform the enquiring minds of those interested in the issues in the curriculum and how the concept of integration is taking effect in certain classrooms in the country. I hope it will give some direction in the aim and the strategy of the curriculum and to strategies the strengthening of certain concepts within the curriculum.

1.5 Aims of the research study (Academic and Strategic)

1.5.1 Academic aim

This part of the study give reasons for exploration and investigation of what integration means and to understand what type of integration teachers are implementing in practice. The aim is to gain a deeper understanding of the different types of integrations that exist and to indicate to

teachers what type of understanding of integration they are implementing.There is a need to understand what an integrated curriculum mean to teachers and what it demands from the implementers (teachers) of such a curriculum. The national curriculum statement is currently being implemented. We need to explore the extent to which educators in practice grasp and understand what an integrated curriculum means

Historically mathematics has been a strong bound subject and now it needs to blur its boundaries and allow some integration with other subjects (Learning Areas). My study is based on what the policy says about integration and takes into cognizance that view brought to the fore by policy and investigating that view on what is happening and being implemented in the practice in the process of learning and teaching. An understanding of and insights into the demands that integration is placing on teachers in practice should be of invaluable worth to the teaching fraternity.

1.5.2 Strategic aim

It is important to indicate to curriculum policy makers and implementers how teachers understand integration between learning areas and how they implement it in practice. The aim is to give recommendations to the Department of Education (DoE) in terms of the ambiguity that might come to the fore with the different understandings of integration and the implementation thereof in practice. Policy makers and those in power can use this information in order to determine whether teachers need more in service training on integration and if teachers need in depth education or re- education in order to fully grasp this notion of integration and practical suggestion on how to implement the theory effectively in practice (pedagogy).

There is a need to engage with the debate on integration and what it means to teachers in the South African context. Engagement with key questions is needed: Where do we fit into the global understanding and interpretation of what an integrated curriculum is and what the integrated curriculum in mathematic requires. What can we learn about best practices of

integration by studying what teachers are doing in practise in relation to integration between disciplines of mathematics and EMS?

Questions in relation to this study and specifically to the ways that the two learning areas; mathematics and EMS; integrate with each other will always come to the fore when we engage with relevant literature and theories of learning. Relevant literature and theories of learning will also direct and focus the questions that come to the fore. In the following chapter I look at relevant literature that inform this study and the theory that frames the relevance of issues that comes to the fore for this study

CHAPTER 2: LITERATURE REVIEW AND THEORETICAL FRAME

2.1. Introduction

This chapter reviews the literature of authors who did research using concept mapping and interviews to understand how learners and students can relate concepts of mathematics to other learning areas. I focus on two main theories of learning and dissect the ideologies thereof with the link and relevance to the study.

In the discussion of literature, my aim is to look and find connections from literature of relevant authors which I found relevant to my study. I investigated the findings from other relevant literature and used it as a base and starting point from where I can further engage in to the study that I want to do. There are various literatures looking at integration of mathematics with other learning areas, but there is very little literature exploring the specific integration of mathematics with economic management science.This is important literature that relates to my study and guides my data analyses, informs my research design as well as my findings as I am using the tool of concept mapping and interviewing of learners for similar purposes.

Teaching and learning has always been driven by theories and hence research on educational practices is rich with theories. I am however going to base my study on only selected theories in order to analyse the data that I collected. The temptation for me is to use as many theories as possible. However, I am going to concentrate on two theories that are relatively grounded in the education field and are in agreement on some issues in the notions discussed in them and come to the fore in my study. The theories that my study focuses on come from Vygotsky (1978) and I build on it with notions from Bernstein (1982, 1996). These theories that I use to frame my study are some of the most fascinating theories to interact with in the theory of learning and have some of the most intriguing concepts and terminology to understand and interpret in the relevance of my study.

2.2 Relevant literature

Adler et al (2000) did a case study to see how mathematics students and teachers in practice can integrate mathematics within and across the disciplines. Adler at al (2000) found that mathematics teachers and students alike find it challenging to integrate mathematics with other learning areas. Taking the latter in consideration, I want to explore the finding of Adler and others (2000) on the premise that time frames have increased and to look at whether that status quo of their findings still remains. Possible changes could have evolved with time passing and the situation to integrate with more ease might be elicited. Davidson et al (1995) gives a breakdown of different types of integration that can help me understand what it means to integrate.

There are different types of integration and different methods (pedagogy) to implement and apply with the integrated curriculum as explained by Davidson (1995).
According to Davidson (1995) there are five types of integrations and these integrations are as follows:

-Discipline specific integration (between concept within a discipline, e.g. Geometry and Algebra in Mathematics. Using the theory of Pythagoras in a drawing of a right angle triangle to prove that $a^2 + b^2 = c^2$ (The sum of the two sides; adjacent and opposite sides depending on the position of theta (Θ); of the right angle triangle, squared is equal to the hypotenuse side of the triangle squared) which is also a perfect square formula in algebra. Product can also link with Expand when the expanded notation takes the format of 123 = (1x100) + (2x10) + (3x1). These concepts can be relationally understood at grade seven levels, if it is made clear to the learners with integration.
-Content integration (between two disciplines, e.g. Mathematics and EMS as explained earlier with the concept "product". Also the expanded notation in mathematics that is relating to the Place value of numbers in an amount with more then one digit (1230 = 1000 + 200 + 30 + 0) and expend in EMS referring to the increase of a business or an economic idea that grows with success and productivity. Expand is another concept in both learning areas where the same

concept have different meanings.. However, in EMS the same concept can be used in the same conceptual understanding of mathematical expanded notation to divide the total assets of a company (R 1230 = R 1000- Fixed Assets + R200 -Stock + R30 – Cash)

-Process integration (between disciplines and real life situation, when welders, builders and engineers use geometrical figures (triangles, squares and rectangles), operational measurements and tools to strengthen their frames.

-Methodological integration and (using a method from one discipline in another discipline, using calculations in geometry to work out area and circumferences on maps that was drawn at a certain, ratio and in scale)

-Thematic integration (using a theme to integrate two or more disciplines, using HIV as a theme for statistics in mathematics, to teach life skills in Life orientations, to show the growth or falling of the economy due to human resources in EMS or to broaden vocabulary in languages, as well as relevant content in all other LA's for a specific time frame in a learning period or term)

My study is related to content integration, which speaks to the integration between two learning areas, according to Davidson (1995). My study concentrate specifically on the integration of mathematics with economic management sciences and the concepts I use are also concepts from the EMS curriculum. The need to explore if teachers understand these different types of integration types evolves from the questions in the study. Like a ratio example from mathematics;

Divide R 500 in the ratio 2:3.

$2 + 3 = 5$

$\frac{R500}{5} = R100$

$2 \times R100 = R200$

$3 \times R\ 100 = R300$

EMS will use the ratio in some of the profit mark ups determining the selling price. Cost price R100; mark up 30%.

Selling price $\frac{130}{100} \times \frac{100}{1} = R\ 130.$

Mathematics use different types of graphs to determine variables; to illustrate information or data and data handling and EMS use different types of graphs to determine variable or fixed costs.

If the understanding of the different types of integration is grasped, then the need to explore how and which one or two or more of the different types of integration is implemented in practice. Not only is it imperative to explore the implementation of the type of integration in practice, but also the effectiveness and the efficiency that is it implemented with.

Policy documentation of the department of Education (1997 and 2003) can also assist to clarify the understanding of integration in context of education in South Africa. According to the EMS policy document integration is a key principle of the RNCS grades R-9 (Schools) and that it requires the use of knowledge and skills from other Learning Areas, or from different parts of the same Learning Area, to carry out tasks and activities (Department of Education, 2002: 58) This statement or argument from the policy document of the department is in line with what Shulman (1986) argues in a paper that speaks to Pedagogical Content Knowledge (PCK).

Shulman (1986) mentions interesting ideas surrounding the pedagogical content knowledge (PCK) that educators need to have in order to teach effectively. Shulman (1986) argues that the professional teacher needs to be familiar with the curriculum and concepts that her students are learning and studying in the other subjects at the same time that they are studying with her. This knowledge, according to Shulman (1986), relates to the teachers ability to relate issues and topics that are simultaneously under discussion during the period of learning and teaching. The latter implies that educators need to understand other domains relevant to his/her own domain of teaching. It also implies that teachers need to effectively relate and explain to her/his students the related understanding and meaning of the content and how it links to, with and across other domains and learning areas as it is argued by Runesson (1999). The argument of Runesson (1999) in Assan (2008) is that; when teachers are studied in practice and they converse content to the learners, they display a point of reference to the content transferred. This capacity to represent freedom of distinction seems to be an implicit dimension of teachers' knowledge. This knowledge in practice can be described as "skilled content knowledge" and "pedagogical content knowledge" (Molander in Runesson, 1999) and in line with the notion of Shulman (1986). This

PCK of the teachers, in my study, need to be explored in order to elicit the relational understanding that the two teachers exposed in terms of the content of their learning areas in, across and with the other learning areas.

According to Assan (2008) a study conducted by Leveson (2003) on how academics practice their education approach with first year university accounting students found that what teachers view as pertinent student understanding for learning is robustly related to how they implement their practice. Educators who are adopting a teacher-focused approach seem to consider only subject knowledge to be relevant. In her study into the process of discovery of intra-individual variation in accounting teaching, Leveson (2003) mentioned that it is imperative to ask the correct question as well as for the teacher to be entirely obvious about what it is you are require from your subjects and your data.

As mentioned before, teachers have a task of paramount importance in terms of understanding and integrating learning areas. The aim of this research study is to explore the above mentioned statements in practice, the relation it threads with the relevant literature and how concept mapping add to the substance and form of the methodology.

Bolte (1999) did a study using concept mapping with three undergraduate mathematics course students and found that the students saw this method to enhance their mathematical knowledge in an enjoyable, but also effective manner. The result of Bolte's (1999) study brought to the fore the value of concept mapping followed by written essays. According to Wilcox (1998) concept mapping give more insight into the students understandings and the type of relationships they connect in and across domains. The concept maps supply valuable insight into the central ideas of the students and how these ideas are linked and connected. In order for teacher to engage with the concept map method, they have to understand the methodology of concept mapping. In this study the exploration is towards teachers and their engagement with concept mapping and a visual in dept sight into the understanding of the learners.

Using the concept map with the teachers gives the researcher a visual of the teachers understanding in relation to the two learning areas, mathematics and EMS (Williams (1998). It

also gives guidance to the educator in connection with future education and development in connection to the value of concept mapping for various activities and projects as well as visual presentations which supports the work of Hitchcock and Hughes (1995).

Hitchcock and Hughes (1995) states that we are living in a visually image saturated universe and that the use of artifacts and still photography is very underdeveloped. They also mention that visual data commands a different sort of gaze and a different sort of stance. My argument is that this is true also for concept mapping and hence this method is opening some exploration for me to undertake and add to the development thereof. I looked at the method of concept mapping and how teachers respond to this visual, inter - relational method of operation within concepts of learning areas and classrooms. Inter- relational concepts of learning areas are in line with the arguments of relational understanding of Skemp (1976).

Skemp (1976) argues against Instrumental Understanding (fixed, directed and determined by a static plan) and use the multiplicity of rules instead of the principle of general application to the given and current situation or problem to understand it relationally(flexible, sensible and contextual). When teachers are set in their teaching styles, they do not easily part from it hence this miss–match of the new curriculum and their old ways of teaching to be jettisoned, is not enough to sway them in adopting the new styles and theories of learning. If educators are teaching a text instrumentally that is meant for relational understanding then it will cause more damage then good. Instrumental teaching is better supplemented by a traditional syllabus. Learners will then at least learn proficiency of mathematical techniques that can be useful in other subjects (Skemp, 1976).

The argument of Skemp (1976) relate to the study, because it is implying that in order to understand with a higher sense of clarity, the understanding needs to be integrated and in coherence with other relevant understandings. To teach with integration is in line with what Skemp (1976) nominate as relational understanding, because of its open or blurred boundaries (weak classification) and weak framing referring to the input from students and teachers in accordance with Bernstein (1996). The concepts of Bernstein (1996) play an important theoretical framework role in my study.

2.3 Theoretical Frame work

2.3.1 Concepts of Bernstein

According to Bernstein (1982) formal schooling and education can be realized through a three message system: One the Curriculum: That which counts as valid knowledge (NCS). Two the Pedagogy: That which is seen as valid for transmission (OBE). Thirdly, Evaluation (Assessment): That which is valid for realization of knowledge of the taught (Learners). Bernstein (1982) mentions that time allocations which is called periods (time units) and whether it is optional or compulsory determine the status of the contents (LA's). The clear or blurred relationship between contents and the degree of boundary strength between content determine whether the status of the relationship is closed or open. Blurred relationship Bernstein (1982) nominates as open and a well insulated relationship he nominates as closed. The forms of transmission (Classification and Framing) is seen by Bernstein (1982) as social facts. Classification as used by Bernstein (1982) refers to the degree of boundary insulation and maintenance between contents. Strong classification refers to well and clear insulated boundary and weak classification refers to a blurred and open relationship. Classification speaks to the message system called curriculum not the classification of the content but the relationship between the contents and the boundary insulation. The two types of curriculum that Bernstein (1982) bring to the fore is a collection type where the contents stand in a close relationship to each other and the integrated type where the contents stand in an open and inviting relationship with each other. According to Bernstein (1982) there is underlying concepts to the collection type to create a specific type of educated person: The vocational man and the non vocational man.

Frame speaks to the message system called pedagogy and the way (context) in which the knowledge is transmitted and received. Frame speaks to the range of options available to the teachers and the taught (Learners) in reference to the selection, timing and pacing of the knowledge to be transmitted and received. Strong framing gives no or little options to the teachers and the learners and weak framing refers to a range of options available to the teacher

and the learners. Recognizing and identifying that these concepts speak to different message systems, hence they can function in isolation to each other.

Two types of curriculum codes come to the fore in Bernstein (1982): One is the collection code with a very strong classification and secondly the integrated code with a weak classification. The collection code with the relatively and degree of classification and framing can give rise to two types of collection codes within a curriculum: One the specialized field which is divided into a pure (e.g. economic field) or an impure (e. g. Mix field) which is most times challenged by the practicality of the time table and period issues. The collection code is striving towards the upkeep of the specialized and highly insulated contents codes that is linked to hierarchical ideas.

The second, integrated, code gives rise to two different types of the code. One is the teacher based integrated code. In this curriculum, this teacher who teach the same class all the subjects or learning areas and can integrate the relationship between the subjects and by own choice only. Secondly is the teacher based integrated curriculum. In this integrated curriculum, the teachers have to form a relationship among them and reach consensus about the subject or subjects.
In my view and in agreement with the claims from Bernstein (1982) the collection code has a tacit ideology hidden within the curriculum which is rigid to change and growth. It also brings about the hierarchical division of subject and contents with keeping subjects insulated with a strong classification. The collection creates a certain power over the message systems and protects that power by protecting the boundaries between contents. By not allowing relationships between concepts I deduce from these facts the old ideology of divide and concur. Mathematics has been associated with this ideology in the educational world and trying and wiggling not to allow integration into the subject sides us with the collection code and the ideologies that are attached to it.

An Integrated Curriculum on the other hand brings with it the capacity to reduce insulation and blurred boundaries. Bring contents and context together to a certain degree. The explicit ideologies of the integration code open contents weaken hierarchical structures thinking and promote interaction. Bringing together and finding common ground. Imperative to note is that the integration code does not completely do away with boundaries, but it weakens the power of

one over the other. Mathematics is not for the middle class or the elite few. If we allow for pacing, sequencing and timing as well as input from others, learners who were socialized into thinking they cannot do mathematics may take on the challenge and learn as much as they can and are interested in, about and within mathematics.

The notions of Bernstein (1982 and 1996) in connection with the two different types of curriculum come into consideration for the theory of learning that I use in order to explore the notion of integration. Bernstein's (1982) concepts of framing (teacher and learners input to the curriculum) and classification (boundaries blurring or strengthening between learning Areas) in addition with another notions from Bernstein (1996) that I apply into my study in the following understanding of recognition (when teachers connect or integrate concepts without insight) and realization (when teachers connect or integrate concepts with intent and insight) The curriculum in use (C2005, NCS) is an outcomes based curriculum and integration is an integral part of this curriculum. The following figures and framework is giving the idea of, and in line with what Bernstein (1996) refer to as integration curriculum.

Figure 2.1: **Three Message Systems of Bernstein's Theoretical Concepts**

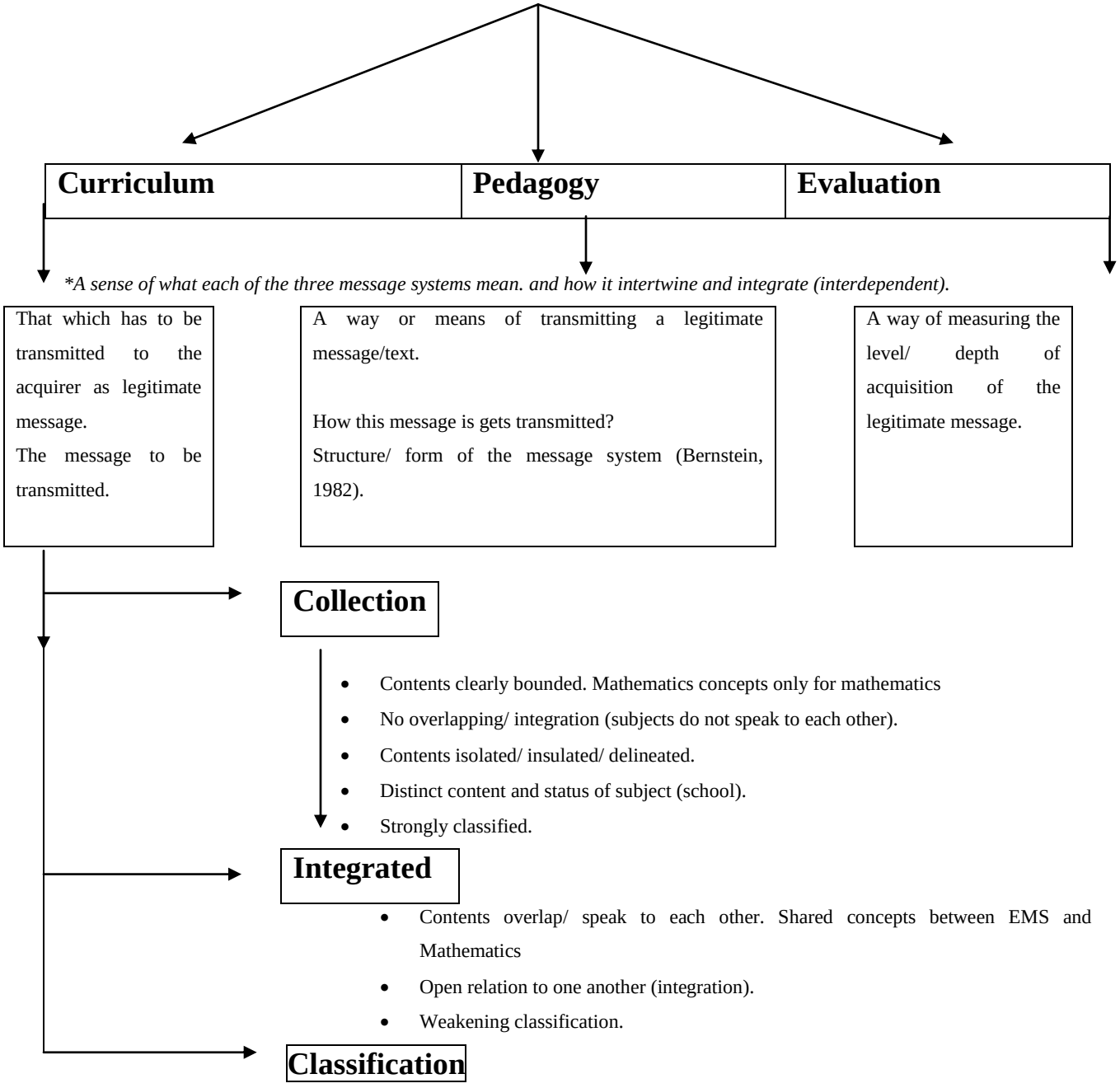
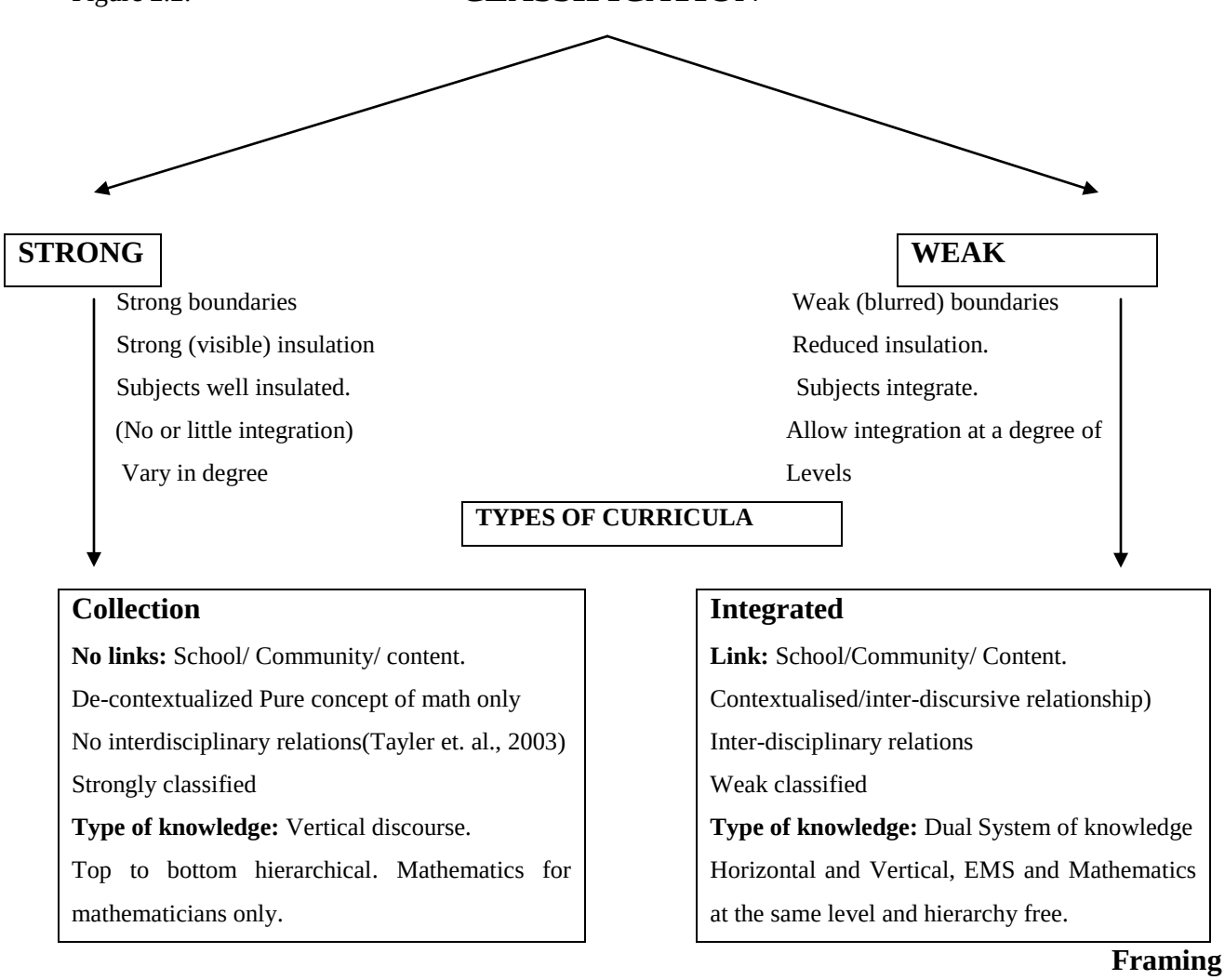


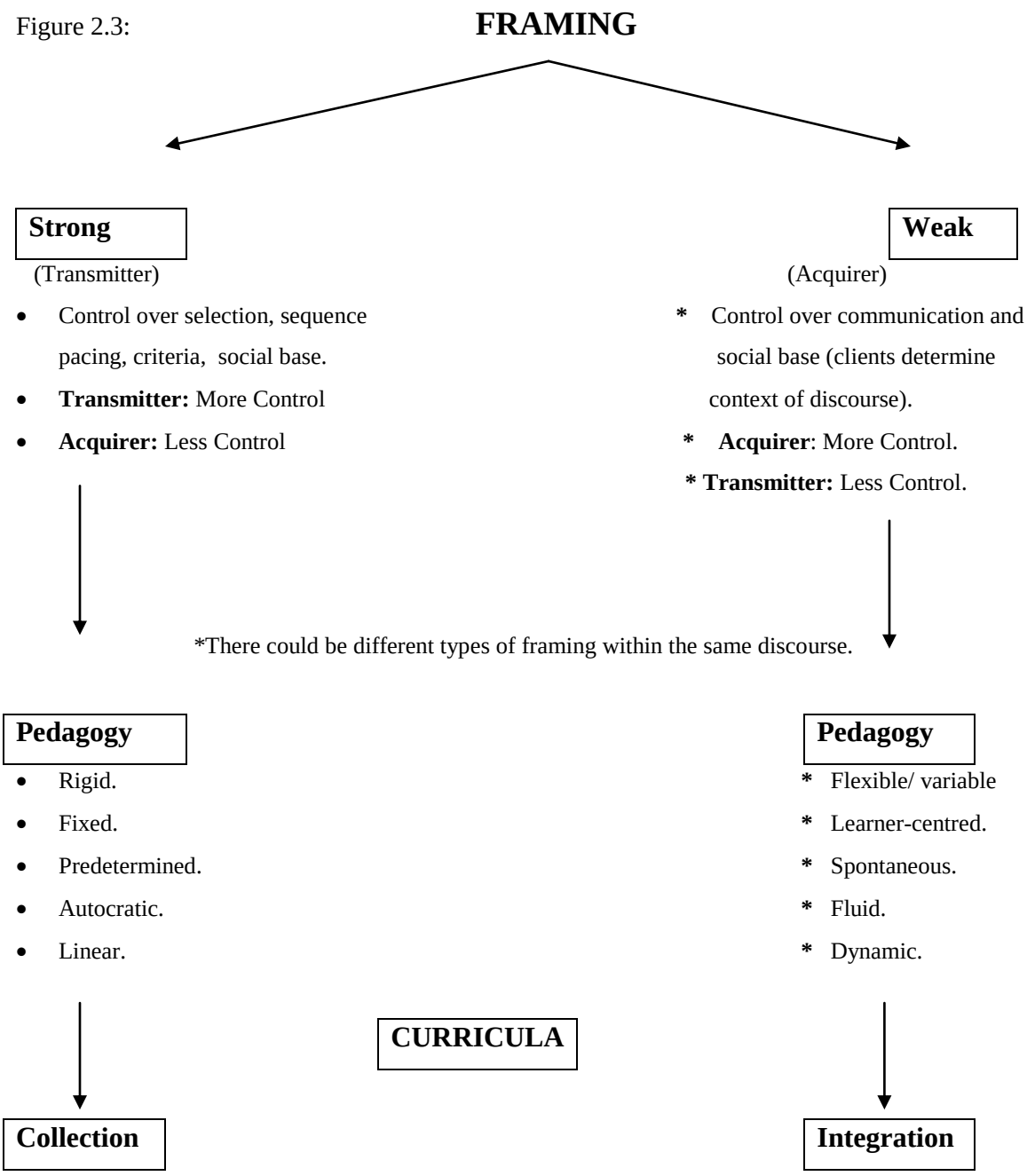
Figure 2.2:



- Form or structure of context in which knowledge is transmitted.
- Controls on communications in local and interaction able relations.
- It is about who controls what.
- The nature of the control over the selection of the communication, its sequencing and pacing; the criterion and the social base
- Explains and determine the structure of pedagogy.

The curriculum in use is leaning stronger in the direction of an integrated curriculum code and hence the concepts in use in this study need to be integrated and shared between EMS and Mathematics without hierarchy. The classification needs to be weak and the framing strong with learners input and relational understanding between the learning areas, as made explicit by the educators of the different learning areas as they plan collectively to integrate concepts.

Figure 2.3:



The idea is to identify if the teacher allows the two learning areas to interact and share the concepts (weak classification) that are chosen for this study or not (strong classifications). Also to see how strong or weak is the framing when the teachers allow the learners to explore the different concepts (strong framing) from the two different perspectives of the two learning areas,

Mathematics and EMS, or just whether the teachers use their own rigid ways of teaching (weak framing) without input from those who are getting educated.

2.3.2 The Recognition Rule (Bernstein, 1996)

- An intuitive rule that enables one to do the following in the pedagogic discourse of mathematics and EMS using the concepts mentioned previously:
- recognize the speciality of the context of the given concepts (Bernstein, 1996) and the ability to identify the demands of the situation and context of the concepts in and across the LA's.
- to communicate using the legitimate text (concepts) in context
- to produce a legitimate text, mathematical and in EMS using the concepts: product; salary; interest; graph; ratio and expand.
- Those that are engaged in a similar pedagogic discourse should share the same recognition rule for a pedagogic communication to be effective and productive. Communication should be possible even if participants come from different contextual backgrounds of mathematics or EMS.
- Recognition rule should be at the level of the acquirer, to allow the acquirer to be able to identify the distinguished features of the context.
- If classification is weakened, different contexts can overlap, and thus allow participants to share same recognition rule between the two disciplines of EMS and mathematics (share common pedagogic communication/ code).
- Classification can control recognition rule.

Strong Classification link with the Recognition Rule in one domain

Weakened Classification link with the Recognition Rule in more then one domain. The domain of EMS and mathematics and the concepts that inter relate.

2.3.3 The Realization Rule (Bernstein, 1996)

- The process we use to create meaning and legitimate text.
- Ability to produce a legitimate communication.
- Ability to produce or converse with the expected legitimate text.
- The ability to communicate and converse with the legitimate text that needs a code: Legitimate Pedagogic Code.
- Realization Rule relates and link with framing. and classification

In the case of this study the above mentioned statements for realization rule refers directly to the understanding, interpretation and transformation of the specific concepts: product; interest; salary; graph; ratio and expand in relation to the integration between the two specific legitimate texts of mathematics and EMS.

Weak framing implies that learners are part of the control of their learning; the process is learner-centred. This will allow and create an opportunity for learners to develop or acquire Realization Rule. Weak classification implies for realization rule across domains and the legitimate text of different context and situations that allows for the integration between the two learning areas at a deeper level of understanding and differentiation of the given concepts.

The socio-cultural constructivist theory of learning can feed my understanding of the notion of integration. In order for teacher and educators to integrate two or more learning areas they will have to communicate with each other. The communication will be academically and professionally. When this situation happens it is a social community of practice (Lave and Wenger, 1991) that starts inter acting with each other and will develop as the situation continues.

2.4 Socio- cultural constructivist theory

The notion from Vygotsky (1978) of socialist constructivist refer to a situation when teachers show the relationships between the two disciplines and why they see inter- relations in the co-existence of the two disciplines. The social interaction that come to the fore when teachers rely

on each other's disciplines in order to make the discipline that they are teaching more explicit and clear to their learners. How the teachers relate and interact cognitively between the concepts of the two different disciplines and how they use the concepts across the two disciplines in the quest to clarify the concepts in their discipline by using the relevance of the concepts from the other discipline.

Is the socialization of teachers (EMS and Mathematics) into the current curriculum practice evident and how the transformation process from the old socialized curriculum to the new is implemented in practice? The notion of scaffolding referring to the significant knowledgeable other who gives assistance and guidance to the student or learner can also be related to my study in the sense that in mathematics the mathematics teachers will lead the integration to other subjects with the teachers of other learning areas. When EMS needs to be integrated the EMS teacher will be the knowledgeable other taking the lead.

These theories will guide the data analyses. This relate back to Schulman's (1986) notion of knowledge and pedagogical content knowledge across domains, concepts (interest; product; graph; ratio; salary and expand), learning areas and disciplines (EMS and Mathematics). The zone of proximal development (ZPD) will then be determined by the concepts that need to be understood from the two learning areas proposing to be integrated at the time of learning and teaching thereof. In this case it is the area of mathematics and EMS (Vygotsky (1978).

The ZPD refers to the possible knowledge that the student can learn in a specific situation and time frame. The ZPD is also limited to the knowledge available to learn from the more knowledgeable other, but this is not the ceiling of learning for the student as s/he can move on to a new teacher with more knowledge and continue in this fashion Vygotsky (1978). Learners are also given an opportunity to explore the similarities and differences of the same concepts in context to the relevant learning area in use (EMS or Mathematics).

The latter fit into my study, because as mentioned earlier that the knowledge available from the different experts in order to guide each other from the different areas of legitimate text and context can inter change. It also brings to light that the old timer (master) and the newcomer in a

learning situation can be occupied by the same individual depending on the Learning Area, situation and context of the discourse at that given moment.(Lave and Wenger1993).

2.5 Situated theory

Lave and Wenger, (1993) is developed and in line with the socio- constructivist theory. I would like to relate this situated apprenticeship to learning and teaching in contemporary South African Education practices and the application thereof in teaching and how this notion link to socialization and socio cultural constructivist theory and to my study.

According to Lave and Wenger (1991) legitimate peripheral participation is when learners inevitably participate in communities of practitioners in order to acquire the skills and knowledge of that practice. In the acquisition of the skills and knowledge of the practice the learners will become a member and full participant or old-timer of the community in question. Every school has its own culture of learning and teaching, this is a practice where the practitioner determines the rules and regulations to guide and direct the norms and standards of the practice. This will influence the apprenticeship at the school. Hence, the teacher is seen as the master and the learners are seen as the apprentice.

In this study two teachers; one mathematics teacher and one EMS teacher; need to interact and interchange these two roles to assist each other. Meaning that the determining factor of who is master or new comer would be dependant on the expert in the learning area. When the concept is taken from mathematics the mathematics teacher will be the master and the other way around for the EMS concepts. In this study the concepts are taken from the EMS curriculum but shared by both learning areas and hence the anticipation of the integration, differences and similarities of the concepts to be elicited.

2.6 Conclusion

I have brought to the fore different literature dealing with issues relevant to my study. However, the literature does not speak specifically to the research that I am undertaking. This emphasizes the fact that my research is of ground breaking calibre. The discussion of integration of mathematics with other learning areas has been under the looking glass, but literature exploring the specific integration of mathematics with economic management science has not been dissected.

To add to the pioneering status of this study, is the method of exploration using concept mapping and interviews to understand how teachers can relate concepts of economical management science to mathematics is another highlight to the study. The theories of learning and teaching used to frame this study endow with it even more substance, form and initiation. This research study can elicit the possibility to use concept mapping in lower levels of education in South African classrooms. If significant evidence lend to the enhancement of concept mapping for learning in the lower level it would be a recommendation to make to policy makers.

Bernstein (1982) is clear about what the determination factors are to categorise the different curricula and the two categories of classification (Weak or Strong). There is no in between category for the Bernsteinian concept. My argument is that the schooling system in South Africa is more complicated for just weak or strong classification to be the only two categories for classification. Therefore I will come up with more input to be categorised for the South African situated context for classification in the education system. It is my view that the universe is not as easy, as weak or strong. There are categories between the two that needs to be researched and I want to explore that options to come up with an in between. There are many situations that have no clear resolution, but continuous management make it possible and, tolerable and doable. The world is not just black or white; there are definite flexible grey areas in between, depending at the degree thereof.

All the previously mentioned literature drive me to ask my research questions and my need to place this research study in order to find out if the integrated curriculum is tacitly implemented

and the level of content knowledge and pedagogic content knowledge that teachers understand of each others' learning areas. Is there a need to do refresher courses for teachers in order to understand integration at a global level and the different types of integration that exists in the field of education at another level and globally? The theories that I have highlighted to frame my study is the basis of an integrated curriculum and speak directly to the norms and standards that is suppose to underpin such a curriculum. The analyses of the data are strongly based on the theories and the concepts that come to the fore from these theories of practice in education. I have explained the terms and concepts and how it comes into consideration in relation to my study. I hope that the concepts and the terminology as I have related it to my study fascinate the reader as much as it intrigues me.

To give more clarity on the way that the theories will be interwoven in the study I explain the method that I will use to conduct the study in the following chapter.

CHAPTER 3: METHODOLOGY

3.1 Introduction

In this chapter I give an outline of the methods and procedures I embarked on in order to collect the data that I required in order to answer the research questions I posed in this study. I explain the methods that I used to select the samples of respondents and the context of the schools in South Africa where the respondents taught. I explain the relevance of the methods to my research and ethical considerations that I made in the research process.

3.2 Sampling and ethics

In order to obtain answers to my research questions I had to find willing teachers to participate in my study. The physical area that I identified for my study has eighteen Primary Schools and seven Secondary Schools. It is an area that formed part of the previously disadvantaged communities and used to be called a "coloured area". It is situated in the Gauteng Province, in the South of Johannesburg about twenty kilometres from the central business area of Johannesburg. I intended to work with two schools. The reason why I selected the two schools for my study was because of the background of the grade seven EMS and Mathematics teachers and the years of experience they had in teaching these learning areas. Another reason for my choice was because the teachers that I identified were also students at institutions of higher learning. They intended to improve their teaching qualifications and were part of the paradigm shift in the teaching profession.

I approached the school principals and the grade seven Mathematics and EMS teachers at the school where I am teaching. They agreed to volunteer as respondents in my study. I also approached the grade seven Mathematics and EMS teachers at another school about three kilometres away from my school. The teachers in my study were completely informed of the aims and intentions of the study. The above mentioned arguments is in line with what Cohen and

Manion (1994) relate as specifically selected cases on the intention of the researchers as they embark on the search to identify a sample that is satisfactory to specific aims of their research

> In purposive sampling, researchers handpick the cases to be included in the sample on the basis of their judgment of their typicality. In this way, they build up a sample that is satisfactory to their specific needs (Cohen and Manion, 1994: 89)

For purposes of getting a clear understanding and piloting at the first school, I did the same study at these two different schools with grade seven EMS and Mathematics teachers. In order for me to gain some perspective to the validity and reliability of my study, I used the first school as a pilot study. The pilot study guided me to test my methodological tools (Concept maps, Interviews and data recording device) and to refine my research design. Piloting guided me to not use video recording due to ethical difficulties that may arise. The pilot also brought to the fore that I need to first explain concept mapping to my respondents, because they only had a idea of concept mapping and needed more clarity about the concept mapping idea. It also assisted me to make my appointments with the respondents for after school time as the noise levels during school hours interfered with the sound quality of the recordings. Some of my interview questions I had to rearticulate in order to get more direct and clear answers from my respondents.

I identified EMS concepts from the EMS Syllabus and policy documents (DoE, 2002) that, in my view, would be connected to some mathematical concepts which the teachers have to understand and grasp in order to do integration between mathematics and EMS in their teaching. These concepts as mentioned before were: *Graph, Ratio, Percentage, Salary, Product and Expand.* I did the pilot study with the respondents at my school and got data that I could use to get results and interpretations. I did an interview with the Mathematics teacher and the EMS teacher could not attend her interview due to illness. However, I obtained sufficient information to enable me to reflect and attempt to answer my research questions.

The Mathematics teacher had been teaching Mathematics for fourteen years. Given his background, it can be said that the Mathematics teachers had experienced the traditional curriculum in mathematics and had gone through a paradigm shift that was brought about with

the introduction of the new curriculum (C2005 and NCS). The Mathematics' teacher was also improving his teaching qualification at an institution of higher learning where he did an honors program in educational management.

The EMS teacher had been a teaching for ten years. Her first two years she taught at a private school, teaching Economics and Business Economics and another year she was in Daverton at a Primary school where she taught EMS for the intermediate phase. She holds a Masters degree in educational management and was a PhD student in financial management at a university in the North West province of South Africa. The EMS teacher like the mathematics teacher had been part of the transition from the traditional education system to the new educational system.

When I interacted with the respondents for the first time I was interested in finding out how they would interact with the analytical tools (Concept Maps and Interviews) of the research study. I introduced and explained concepts mapping to the teachers and then ask them to draw an example concept map pertaining to the relationships of position and hierarchy at their school's staffing situation and the relationships and links that exist within their school's staffing. I specified to the teacher that there is not any set structure for them to draw a concept map. They had freedom to draw the maps as they preferred. I gave the teachers the exercise (worksheet appendix E) that required them to draw links between the given six concepts and to label the links in order to explain the relationship between the selected concepts.

I needed to get some insightful answers from the teachers and based on the descriptive and interpretive value of the study including the validity thereof I used follow up tape recorded interviews to get the degree of understanding of the teachers intentions after the implemented and completed worksheets. The interview was done verbally with thoroughly thought through semi structured interview questions, designed especially to get to the mathematics that came to light within the EMS concepts and to get to the knowledge of the teacher about integration between EMS and mathematics (Attached find the semi structured interview sheet as appendix F).

Even though teachers agreed to participate in my study I applied to get permission from authorities to do the research study in their institutions and followed the ethical path to be fair and just to my respondents and to protect their integrity and rights. Respondents were also informed that they may withdraw from the study at any given time if they wish to do so and that they will not be receiving any form of remuneration or incentives for participating in the study. According to Opie 2004 research comes into people's lives that are the focus in various ways and involves them into activities that take up their time. They provide researchers with information and privileged knowledge about them that gives the researchers power over them. My assumption was that because the respondents in my study were also students and did research projects of their own, it made them more receptive to participating in my research project.

Setati 2005 argues that there are hierarchical Powers and individual power at play when doing research at schools that can deny researchers access to school. These capital 'P' powers are relating to authorities in education like Principals and the Department of Education. I applied and informed the Gauteng (South African) department of Education for ethics clearance, to the District Office of Johannesburg Central region and to the Ethics committee of the university where I am improving my qualifications. All these institutions gave me clearance to conduct my research at the institutions that I identified. As mentioned earlier there is also the power relations with the small 'p' relating to the teachers, learners and their parents that can veto the researchers. I also applied for approval and clearance from all relevant stake holders (School Management and relevant Teachers) within my study to be granted as permission to do the case study and to include them in the study. The focus will be primarily on the teachers because they are the designated implementers of the policy and they were all older then 30 years of age.

I revealed my plan to follow my Master's degree with a PhD directly after the completion of the Master's and I therefore asked all my subjects for permission to store the data collected in a safe and secure environment in order for me to use it at a later stage to further analyse and utilize for my studies and for journal and other publications whilest protecting their identity in keeping them anonymous. The evidence will be destroyed by fire after five years. The latter will happen only with the complete and full consent of all relevant stake holders at the relevant time and situation. After everything all evidence will be destroyed by combustion. Anonymity will stay at

the order of the day unless this privilege has been waived and signed for by all or some respondents. Lastly and most important I informed all my respondents that the data collected from them and the environment of the holistic study, will be treated with respect, fairness and dignity. No one will be harmed, and all stake holders will be protected throughout the study. I also gave my word to the respondents that I will give feedback to the all relevant stakeholders and input to the respondents on best practises and areas for development in accordance to my study after completion. This is to build relationships with respondents and to do away with scepticism that can create reluctance for schools to allow researchers back into the site at later occasions and this is exactly in line with the argument of Setati 2005.

All qualitative research is labelled to be unable to claim complete disconnection and having no or very little bias (Walker, 1995) and therefore most of the time claiming a personal insight of hermeneutic value. Hence I did data collection at two different schools therefore entering the unknown at the second school. I hoped that this way I gave my study some form of non bias and credibility. In this particular situation I entered the domain as a confused outsider as mentioned by Reid (1996) and looked at the given discourse from the point of view of an outsider. Going through the same process of data collection with all the respondents and the fact that the respondents are neutral and objective in the study suggest in some way that the research holds some form of validity and reliability.

Maxwell (1992) put critical importance on the descriptive, interpretive and theoretical validity of qualitative research. Integrating the issue of validity within and into this study, I explain the relation of the three most imperative types of validity according to Maxwell (1992) to this study.

The interviews that were tape recorded came from the concept maps as created by the respondents. These concept maps are reflected in the original format as created by respondents. I listened to the recordings repeatedly and directly transcribed it according to the words of the interviewees. I transcribed the direct use of language and the grammar as it was used by the interviewees. Where grammatical errors occurred within the transcripts, it is because I did not want to ratify the errors in order to reflect the direct transcripts of the recordings as uttered by the interviewees. In accordance with Maxwell (1992) the degree of accuracy of the recording while

observing and recording the respondents and whether the researcher interpreted or attached connotation to the data can be determined from the latter process that I mentioned. The attachment of transcripts and the scanned original concept maps can attest the argument as I bring it forward.

Interpretive validity is clearly evident in the research based upon the respondent's inputs, concepts and reflected in their own words. This is reflected as inserts directly quoted from the transcripts and in the language and own words of the interviewees.

The theoretical validity, as argued by Maxwell (1992), is concurred by the fact that the research community have interacted with the construct of theory that I bring to the fore. As mentioned in the theoretical frame I bring the constructs of social, situated and Bernsteinian constructs. After the data collection and the interviews and transcribed tape recordings I analysed the data using the framework that I based on the Bernstein a concepts of classification. Classification in this study was used in the same way that Bernstein (1982) describes the insulation between the two learning areas. When the integration was blurred, open, flowing and easy I described it to be weak classification, because it allowed interaction between the two Learning Areas. In the opposite situation when the integration is not allowed and the insulation between the two Learning Areas is not flowing, strong insulated and close, I referred to the interaction between the two Learning Areas as strongly classified.

However, Bernstein (1982) does not give any option to describe a middle ground between these two options, so I bring in another category of referring to the classification between the two learning areas to be fair. In this study Fair classification will be equivalent to teachers recognizing the integration that can or should take place between the Learning Areas but does not apply it. The data was also looked at from the point of view where teachers just recognize the integration and where teachers realize the integration. In the realization of the integration the teacher implements the integration between the two Learning areas and hence referred to as strong realization and recognition. When the integration is just recognized and not implemented the realization and recognition are referred to as weak.

3.3 Conclusion

I have outlined and explained the methods and ethical considerations I used to collect my data and the reasoning behind my ethics. I also explained the orientation of the research area and the sampling for data collection. I hope that there is visible method that comes to the fore in my madness. I have created and explained the validity and reliability in this study in order to create reasonable trustworthiness.

I used the above mentioned concepts and concept maps to draw tables and to interpret the tables accordingly. I drew tables to analyse the integration that took place between the concepts and tables to indicate the integration between the two Learning Areas. I also draw information from the transcripts of the interviews to elicit certain key aspects that came as results from the data collected.

The methodology indicated was piloted and aligned to serve the purpose and focus of this study and will guide the following chapters in terms of the focussed view of the observations intended by the study.

CHAPTER 4: DATA PRESENTATION AND ANALYSES

4.1 Introduction

In this chapter I used related literature as a guide and a typological starting point in order to organize the data that I have collected via created concept maps, tape recorded interviews and the transcribed interviews with the respondents. I organized the data in table form to highlight the different ways in which the teachers employed integration, initially between the given concepts taken from the EMS curriculum statement and thereafter between the two learning areas, Mathematic and Economic management Sciences. The raw data that the tables are derived from is captured in Appendix A, after the references, for verification purposes. It is imperative to re-iterate that even though the six concepts is taken from the EMS curriculum, the same concepts is also mathematical terms and regularly used in the mathematical discourse.

As I discuss the data collected I will refer to specific utterances from the transcribed interviews and insert quotations from the transcribed interviews at certain points in the discussion. The transcripts that compiled from the interviews is attached to this document as Appendix A and the reader are referred to interact with the transcripts as it will elicit a clearer understanding of the data that I analyse for the purpose of this study and as mentioned earlier to add validity and reliability to the tables that is created within this chapter. The concept maps that the respondents drew are presented in the raw form to indicate exactly the manner in which both teachers presented their thoughts on paper followed by the analyses thereof.

4.2 Interpretations of concept maps and interviews

The literature have indicated that the concept maps was going to be limited to key linking words or phrases, which can be confusing or misinterpreted, it was necessary to follow it up with the tape recorded and transcribed interviews. The latter was also confirmed during the pilot study and clear typological categories were elicited. The categories of weak (W), strong (S) and fair

(F) are specific and different in each category. In classification it is in line with the definitions and explanations as given by Bernstein (1996) with the addition of fair. Using the concepts from the related literature and specifically the concepts provide from Bernstein (1982 & 1996) I categorized the tables accordingly. The categories will identify the Classification, Recognition and Realization between concepts and the learning areas. While organizing the data I distinguished between weak (W) and strong (S) classification and used the same categories for recognition and realization. According to my knowledge these categories was only used for classification and framing by Bernstein (1996) and related literature.

I found that it was difficult to clearly place some of the data as either weak or strong and came up with a term in order to place all data collected, hence the category fair (F) came to light. The categories in the tables two and three will also speak to the knowledge of the teachers about the other's learning areas in connection to these specific concepts in relation to Classification (boundary insulated strength between learning Areas). Weak classification implies that the insulated boundaries between the learning areas are blurred to allow integration, strong classification implies that the boundaries between learning areas are insulated and not blurred to allow for integration between learning areas and concepts. Fair classification implies that the insulation of boundaries is selective in the choice or degree of allowing integration between the learning areas and concepts.

In the instance of recognition, weak will imply no knowledge about the concept or learning areas and how to integrate it, Strong recognition will imply a high degree of knowledge about the concept or learning areas and how to integrate it and fair recognition implies that the concept or learning area is known but the knowledge about how to integrate is not explicit.

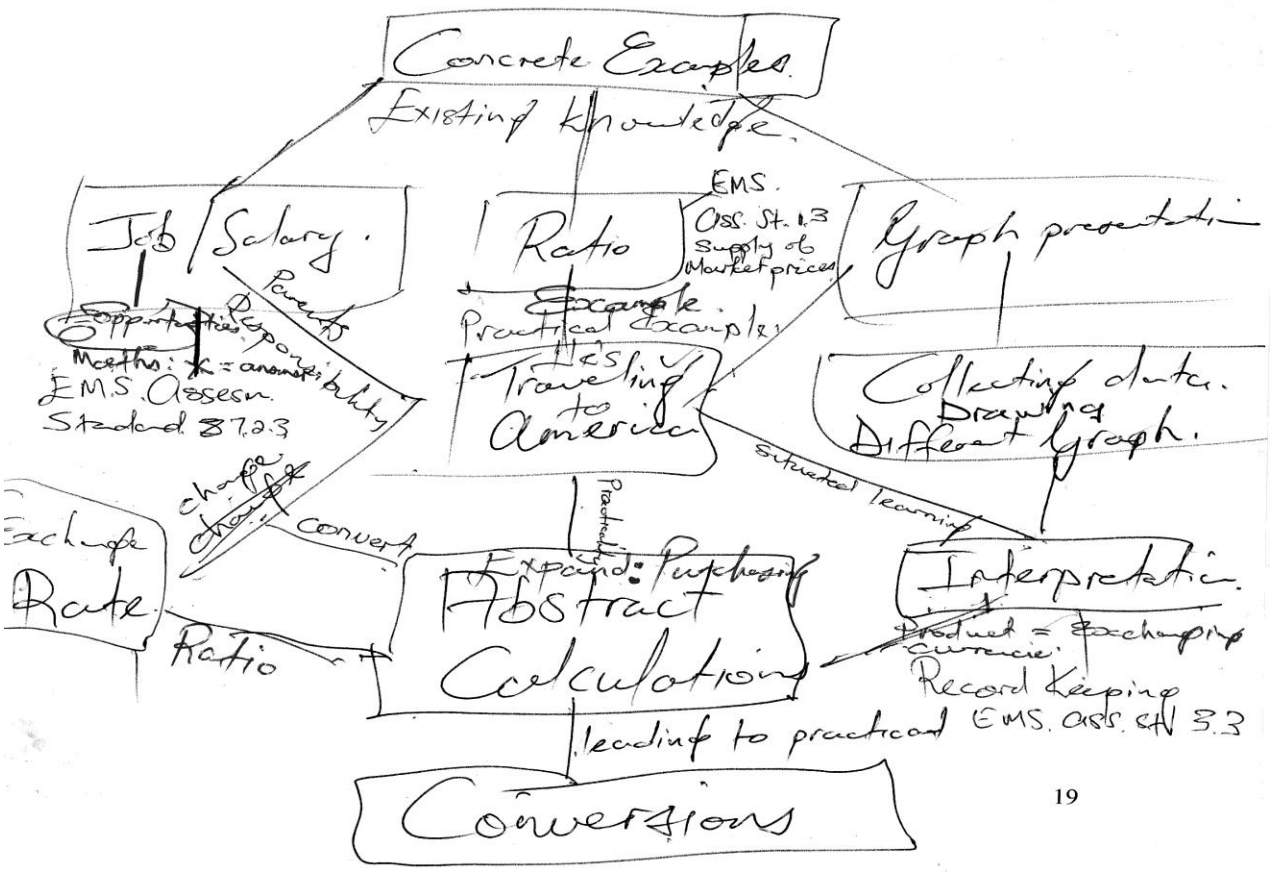
Strong realization implies that the knowledge base of the concept is at a high degree and can be explicitly explained, as well as the integration between concepts and learning areas. This implication is therefore in line with what Shulman (1986) refers to as a high degree of applied Pedagogic content knowledge within and across domains. Weak realization is when the degree of knowledge in terms of the integration of concepts and knowledge is at a low level and the explanation thereof is incomplete or vague. In the instance of fair realization the respondents

show that they can identify a link between concepts and learning areas, but is unable to explicitly explain the relationships.

Taking the use of the concept maps in consideration, both the EMS and Mathematics teachers revealed that the concept map was "challenging and tricky". The concept maps, however was followed up with interviews for clarity and information purposes. It is important to notice and to elicit that a meager line between two concepts indicates that there are some relational link between the two concepts. Single word explanations or simple descriptive words attached to the linking lines indicate an understanding of the relational link and a conceptual understanding between the two or more concepts joined by the line.

Mr. M argued that there are challenges within the concept map that can lead to different conclusions.

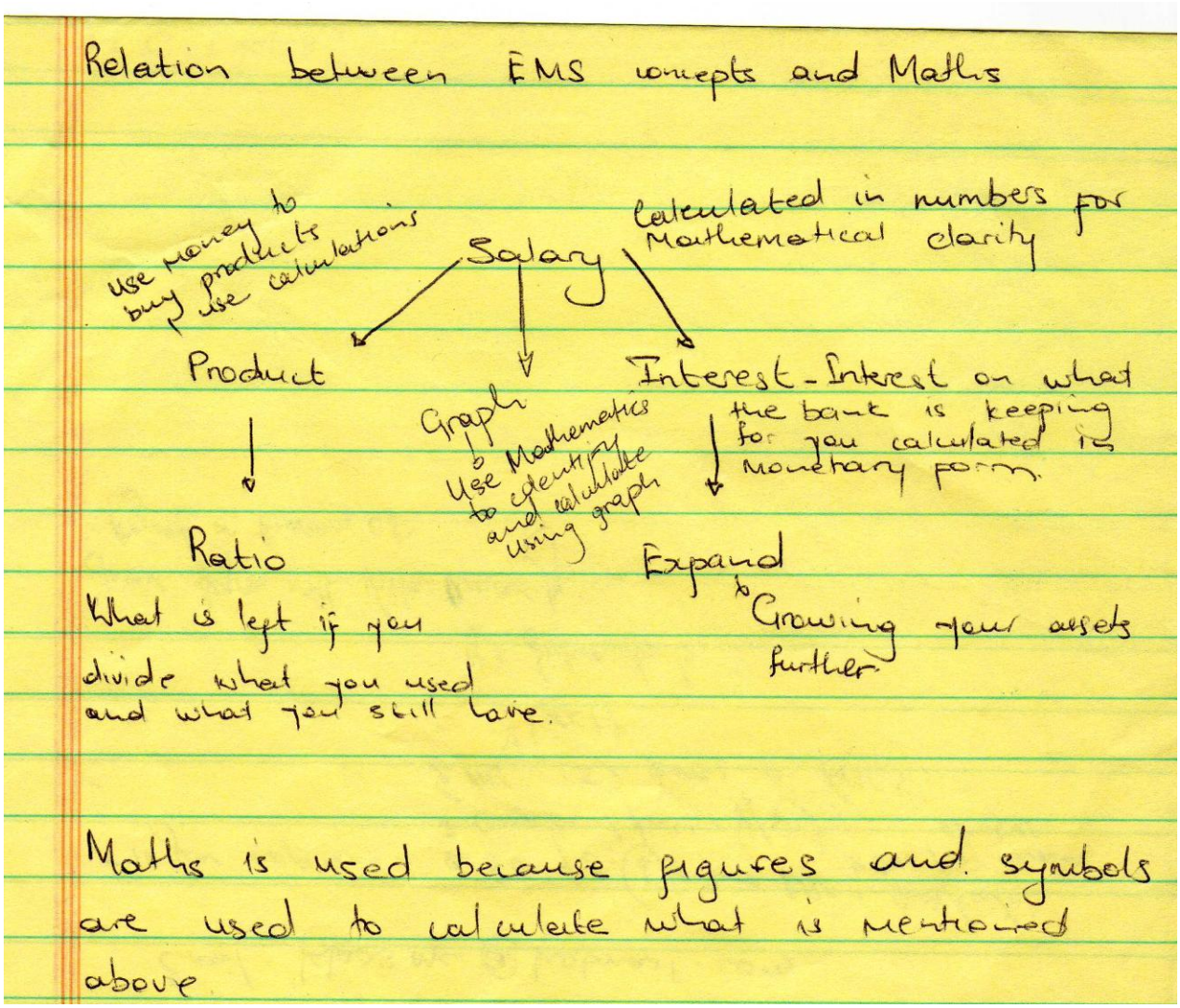
Figure 4.1: Concept Map of the Mathematics Teacher (Teacher M)



Mr. M being the mathematics teacher did not use any basic symbols (+, -, ×, ÷) from the mathematics curriculum to identify or relate the concepts between the two learning areas. Instead he related the concepts to Assessment Standards in the mathematics curriculum statement. Looking at the map it can not be related to a mathematics teacher, unless it is made clear by more information or descriptions from the interview.

Mrs. K said that the word within the concept map can be linked without any direction or purpose. Mrs. K mentions that symbols and figure are used in mathematics, but she does not draw any relevant symbols or figure from the mathematics curriculum.

Figure 4.2: Concept map of the EMS teacher (Teacher K)



Both concept maps from the respective teachers indicate that the teachers see a link between the concepts and a link between the two learning areas. However the degree of the links that that see is at the level of recognition and the realization fall short (Bernstein, 1978)

Mrs. K. saw the concept map as easier then writing a test, because you can give many meanings to one concept and Mr. M. is in agreement with the latter. In his view the concept map can be followed to and through different channels. Mr. M feels that when given a concept map exercise it will have to be limited and Mrs. K. Feels that the learners should first internalize the concepts and only thereafter will the concept map method be an enhancement to the process of learning.

Mrs. K actually mentions that the concept map will be a better form of assessment in the case where learners are conversant of the concepts and the meanings thereof.

> Interviewer: So, Let say hypothetically, they know the concepts. You have explained it and now you want to do an assessment. You have explained to them concept mapping. Will you use it? Do you think they will enjoy it more then a test?
> Mrs. K: Yes, Yes. Then they will. If I am sure they know what the concepts are, then it will be easier for me as an educator to keep track and find out who, exactly and how much they (the learners) know and who does not understand and to what degree.

Mr. M felt that after the concrete stage of learning, the learners can then be introduced to concept mapping. His view is that concept Mapping is to broad for the learners and it needs to be directed and guided to obtain what the teacher wants to achieve with the learners.

> Interviewer: Let's see. Do you think you would use a concept map in your class room as form of assessment?
> Mr. M: I would to a certain extent, yes. I think it needs to be limited. As I have explained to you earlier it is broad. Forming concepts and to use it as a form of a class test. I think especially with the, taking the learners abilities into consideration. So I think when using this you need to strategise it, as to what it is that you want to achieve.

Mr. M prefers that the manner in which the concept map is used should be guided by formation in order to get a certain and predetermined outcome.

Both Teachers recognized that integration is supposed to take place between learning areas. This is an indication of content integration between two disciplines, and in this study between Mathematics and Economic Management Sciences. Mrs. K explained that the learning areas are related in term of outcomes from different learning areas. She mentions an interwoven link between learning area outcomes that brings my understanding that she sees it as some kind of learning proficiency that needs to be obtained or reached.

> Interviewer: Ok. What does integration in the NCS mean to you?
> Mrs. K: I would say where we somehow inter link and intertwine the Learning Areas, where they somehow come to a certain Line and say this learning outcome of this learning area can go with this learning outcome of this learning area. That is how I understand integration.

According to Mr. M., integration is a system that shows the learner the importance of concepts that cut across a variety of learning areas. He argues that integrating concepts of different learning areas elicit the importance of the concepts in the sphere of all the learning areas and hence making it clearer for the learner and the degree of understanding of the concept relatable to all other learning areas.

4.3 Categories of the data and interviews

In order to categorize the data on integration between the learning areas, mathematics and Economic Management Science, within the scope of this study I drew table one to indicate how the two learning areas are seen to integrate by the two teachers. I included the view of the teachers in recognizing that the learning areas must integrate and the realization of, and implementing the integration between the two learning areas.

Interviewer: What does integration in the NCS mean to you or how do you understand integration?

Mr .M: I believe, and I'm positive in saying this. I Believe, That having clear systems in place make the learners see that what you are doing is not only important just for one specific learning area. Can I make use of an example? What happened was the learners were doing HIV and AIDS.

They were asked how many people, to go get, gather information of how many people had HIV/AIDS. Now I think for me as a math teacher to integrate it with the Life Orientation lesson will be adequate because what I have seen is they were easily able to relate to how it functions in all learning areas.

Mr. M: Is ironically in favour of integration, but mentions later that there are some concepts that is pure mathematics and cannot be integrated with other learning areas.

Table 4.1: The integration classification between the learning areas

Learning Areas	**Classification**	**Recognition**	**Realization**
Mathematics	F	S	W
E M S	W	S	F

Teacher K display a strong recognition for the conceptual understanding of integration as captured during the interview and displayed at columns 163 and 164 of the transcripts in Appendix A and in relation to the curriculum of South Africa at the lower level classes.

Interviewer: Ok. What does integration in the NCS mean to you?

Mrs K: I would say where we, somehow inter link and intertwine the Learning Areas, where they somehow come to a certain Line and say this learning outcome of this learning area can go with this learning outcome of this learning area. That is how I understand integration.

The EMS teacher does not see any reason why there should not be integration taking place between the EMS and other learning areas.

The teacher even suggested means and ways to integrate the learning areas on a level of planning and preparation. Her suggestion is that the planning should happen in an integrated way and the mathematics teacher also mentions that the planning plays an important role.

The attitude from both teachers is receptive to teach integrated style, but at the moment they both admitted that they are not implementing the curriculum completely with integration between learning areas. Therefore the table show that the recognition about integration between the concepts of the learning areas to be strong. The relation and links that they draw between the learning areas are on paper and does not come to life in practice. Therefore the table show that the realization between the concepts of the learning areas and how they are implemented to be weak or fair.

According to Mr. M if there is any integration taking place between the Learning Areas in his class room it is happening unconsciously, cause he is not planning or teaching to make integration one of the key and explicit factors during his lessons. Mr. M recognize that integration at his institution between the two learning areas only takes place on paper and that mathematic does not necessary have to integrate with other learning areas cause it has certain "things" that cannot correlate with other learning areas.

The degree of integration that takes place from the mathematics teacher's perspective is that certain concepts in grade seven specifically that does not correlate with the context of other learning areas.

> Mr. M: Sir. What I am saying is. It depends on how your department functions, because. Doing that as it is supposed to, because it is important for children to look at the broader picture. In that, this learning area is not more important then, that learning area. So, but what I have picked up is that when we have our context, it is the same and yes there are some Learning Areas that functions right across the board. However the implementation of this new curriculum and them stating that grade seven, especially grade seven, it is not necessary for the maths department to function within the context of the school ,because it is believed that there are certain things that

you cannot correlate to the context of within other Learning Areas. But, with regard to our school I would say, yes, you can see from the planning, because children bring homework or they get homework and it is related to one specific topic.

Hence, my analyses that the classification is not weak, neither is it strong and that place it in the category of being fair. Mr. M recognize that integration is suppose to take place between learning areas, but admit that he is not implementing the integration purposefully. Hence, my deduction that the recognition of integration between the learning areas by Mr. m to be strongly insulated and classified. It becomes confusing because in the next sentence Mr. says that there are thematic integration (Davidson, 1995) taking place because learners home work from different learning areas are linked with one topic as the themes. He recognized that the concept given are shared by the two learning areas, but argue that it is not made explicit to the learners how these concepts link in relation to the two learning areas. Mr. M makes explicit the fact that he is not making clear to the learners how concepts integrate and a form of tacit integration might be at the order of the day.

The EMS teacher (Mrs. K) recognizes and integrates the learning areas as far as she can, but implicitly so. She has a positive outlook on the integration of the learning areas and a high degree of understanding about the concepts and how they integrate between the two learning areas. The classification between the learning areas taken from the view of Mrs. K is therefore weak with a strong recognition and a fair realization, because her integration is implicit and not with intend.

According to table 2 , that follows, there is still some strong classification from the mathematics teacher(Mr. M) in the admittance that mathematics do no allow for integration with other learning areas when it come to certain Assessment standards in the mathematics and EMS curriculum.

Table 4.2: Mathematics teachers' understanding of the concepts in Economics Management Science context

Concepts	Classification	Recognition	Realization
Salary	F	S	S
Product	S	F	S
Interest	W	S	F
Graph	F	W	W
Ratio	W	F	W
Expand	F	W	W

Mr. M see product initially only as something to be purchased in EMS terms. His explanation of Graph is very vague and far from the mathematical understanding of the concept "Graph", according to him it is the way or how you go about planning. He does not indicate any mathematical dept in terms of horizontal and vertical axis Y and X. He does not mention any other mathematical graphs related to parabola, coordinates or equations or trigonometry. He initially understand the meaning of the concept "interest" in the English language sense and only after clarification he explains it according to the EMS understanding, as the charges on an account . He does not make any reference of calculations or mathematical procedures in order to explain and work out the interest of numbers according to percentages or anything about compound interest and simple interest.

Interviewer: Ok, Graph?

Mr. M: Is how you go about planning

Interviewer: "Ratio?"

Mr. M: Well, the rate at which it goes.

The explanation given is limited to one domain and not very explicit. At Ratio Mr. M brings to the fore another concept of "Rate" which takes us back to his (stuck) realistic context of reality about the learners of his school that went to America. He is very clear about the values of money and how the exchange rate works between the different currencies (Rand to Dollar) but does not explicitly use this reality to explain ratio and the division of the two quantities as it compares and how the ratio of the two quantities change daily.

. Mr. M see expand in EMS terms as opportunities. Looking at the concept map and the follow up explanation that Mr. M gives for expand during the interview as captured in Appendix A, column 61 and 62, my understanding of this opportunity that Mr. M speaks about is one to make money from or an opportunity to expand a business.

Interviewer:	Yes, I think maybe you need to give me the mathematical explanation of expand and the one you just gave me. Is what? It is more a? How will you explain expand in the Maths class.
Mr. M:	Well, that I would say how it can be used. Normally, if you look at the word expand it will go with challenges, right. Which means you will now need to define the word expand in a mathematical term where the learners is now able to see that, excuse me, this how I can determine what ever it is I want to do. Like an example, the children wanted to buy themselves products in America. They came back. Now what I have done was. I said how many dollars you paid for it. So immediately I said ok, this is your opportunity. You paid 120 dollars for your I-pot. The rate in South Africa is like 6 to 6.95. So that is an opportunity for that child to see, hey, is it comparing the prices when visiting other countries.

There is no mention of multiplying out brackets or the distributive law. At primary level it speaks to the expansion of numbers in an amount to indicate the place value of that number as it id multiplied by the unit. Although my argument is that Mr. M is relating to the EMS understanding and explanation of "expand" it needs to emphasise that Mr. M. is actually implicitly integrating mathematics and EMS. He himself is also not aware of the fact that he is integrating the concept from mathematics to EMS. It is however imperative to be aware that the specific language of mathematics and the terminology that make it explicit is not coming very strong to the fore from Mr. M.

The expectation that Mr. M. as a mathematics teacher to pick up on mathematical terms and concept as soon as it is mentioned bring to the fore that Mr. M. appears to be misinterpreting the concept mathematically, but understanding it in EMS terms.

In this situation the expectation was to get the mathematical explanation from Mr. M. and he did not explicitly explain it and therefore the table shows Mr. M. understanding of the concept "expand" as weak realization. The Ems teacher on the other hand shows a significant difference.

Interviewer	Ok, product?
Mrs K.:	Product is when you multiply something by something. In maths that is a product. When you multiply a number by a number you get a product.

The EMS (Mrs. K) teacher presented a high degree of understanding of the mathematical understanding of the given concepts. The EMS teacher even brought in to the interview mathematical terminology and explained the understanding of the terms very well and the table below show the confirmation thereof.

Table 4.3: Economic Management Science teacher's understands of the concepts in mathematics context

Concepts	**Classification**	**Recognition**	**Realization**
Salary	W	S	S
Product	W	S	S
Interest	W	F	F
Graph	W	S	S
Ratio	W	S	S
Expand	W	S	S

Hence the recognition and realization o the EMS teacher is strong and well structured. Mrs. K. encouraged the integration between learning areas and therefore the observation is that the boundaries (classification) between the learning areas and concepts are weak. Mrs. K has a fairly strong understanding of the mathematical concepts; this might spring from the fact that she is also teaching mathematics to a lower grade. Mrs. K linked the concepts to each other and also to real life situations.

Interviewer: Now we are going to look at certain concepts that you linked. Ok let's start on top here. Salary. You linked salary to, let go this side.
Mrs. K: If I do not with draw money or if I keep it there for a specific time frame, then I know I will get interest on that.

The EMS teacher (Mrs. K) linked salary to math and to purchase of products in the EMS context and to real life situations. Mrs. K mentioned that certain mathematical concepts become confusing (ratio). She brings a clear picture to the fore of her understanding of mathematical terms and brings other relevant concepts in with ratio, like division and also mentions that there is a borrowing of concepts between learning areas. Mrs. K. explains the concept of expand in mathematics in terms of the place value of numbers and the unit values of the numbers according to the place it is situated within the amount. This type of explanations was implicitly not represented by the mathematics teachers. Mrs. K. is tacitly exposing integration when she mentions borrowing of concepts from one discipline (Mathematics) to another (EMS).

Interviewer: Ok, the graph?
Mrs. K: The graph I still think it is the mathematical term that we use to divine or draw to explain what we have. We can use graphs. Like, we would borrow the graphs from the mathematics, but use then effectively in the economics to be able to look at the bigger picture.

According to Mrs. K certain concepts are shared between different learning areas and the learning areas borrow the concepts across and within the context of the learning areas as it becomes necessary. This is an indication that the EMS teacher is blurring the boundaries between learning areas.

Mrs. K argues that if the same teacher teachers both learning areas to the same grade it confuses the learners. My deduction from this statement is that the learners associate a learning area with a person (teacher) and if that person is associated with more then one learning area it becomes confusing to them. I deduced from the interview with Mrs. K that the reason why she has a better understanding of mathematical concepts is because she is also teaching mathematics to a lower

grade. Hence, the fact that she noticed the confusion of the learner in receiving teaching of different learning areas from the same teacher.

> Interviewer: So do you think that the fact that the two learning areas are sharing the concepts it confuses the children?
> Mrs. K: I would say the confusion would be when the same educator teaches them both the learning Areas, because they see the educators saying product in maths as times and go to EMS and say product and say a different thing. Otherwise I do not think they get confused, I do not think so.

In order to make clear the comparison of the classification, recognition and realization and the boundary strength between the learning areas and the concepts I used to analyze the relationships that the two teacher draw in their concept maps and interviews, I drew table four. This table makes it easier for you, the reader to draw comparisons at a glaze of the similarities and differences of the integration and the boundary strength between the learning areas and the used concepts. The following table derived from the complete transcribed interviews (appendix A) and the two concept maps (figure 1 and figure 2) in chapter 4.1 of the two teachers.

Table4.4: The integration between learning areas and concepts of the teachers and the relationship between the two Learning Areas

Concepts	**Classification**		**Recognition**		**Realization**	
L A's	**Math**	**EMS**	**Math**	**EMS**	**Math**	**EMS**
Salary	W	W	S	S	S	S
Product	W	W	S	S	S	S
Interest	W	W	S	S	W	S
Graph	W	W	S	S	F	S
Ratio	W	W	S	S	W	F
Expand	W	W	W	S	W	S

It is interesting to highlight from table four that the EMS teachers has a stronger realization and recognition of all the concepts, while both of the teachers are showing weak classification. The

latter indicates that integration is favored but not practically implemented in practice. It might be due to the fact that the concept was taken from the EMS curriculum or it might be because the EMS teacher is integrating relationally across the learning areas and therefore have a clearer grasp and understanding that is relational sound. The latter therefore implies that relational understanding with weak boundaries and a stronger framing with flexible input from other domains lead to a higher degree of understanding.

Even though this study was not focused on to determine the level of understanding of the teachers content knowledge, it was interesting to find that; in line with the argument the Shulman (1985) bring to the fore in terms of the content knowledge that teachers need to understand; the content knowledge of teachers need to be studied, both within and across the relevant learning areas that they are teaching

4.4 Conclusion

I have indicated certain key elements that come to the fore in the dissecting of the data collected. I have used inserts that was taken from the transcripts that the respondents uttered and data that was organized according to related literature and theories of construct to inform the arguments and interpretations that is elicited.

I have indicated analyses deduced from the concept maps and the followed up interviews. The indicating reasons and explanations for certain understandings that will inform the findings of this study and the generalization that can be made as the study draws to a close in order to answer the critical questions.Change in our approach towards teaching is bound to have a great influence in both realization and recognition rules for teachers and learners. It is important to note that shifts from strongly classified collection codes to more flexible and weakly classified collection codes can create ambiguity that leaves the recognition and realization rules intangible. In the following chapter I aim to answer the critical questions that were raised by this study and based on the data analyses that dissecting of the interviews and concept maps.

CHAPTER 5: FINDINGS, RECOMMENDATIONS AND CONCLUSION

5.1 Introduction

This section explains the findings that came to the fore as we dissect the responses that came from the concept maps and the interviews of the two respondents during the analyses of the data presented in Appendix A and from the concept maps reflected in chapter 4 (4.1). According to the data analyses it is evident that certain views come strongly to the fore. As a result I come to the following findings in the two case studies independently and collectively. It also strive to answer the research questions posed as the answer result to these research questions

5.2 Findings

5.2.1 Answer s to question one.

1 What relationships do grade seven Mathematics and EMS teachers make between selected concepts from EMS?

The relationships that the teachers make between the concepts are fair. They recognize the relationships, but they do not realize the relationship and links between the two learning areas. The relational links between the two learning areas and concepts are not explicitly made clear by both teachers. If the relationships are explained, it is done tacitly and not implicitly. Both teachers mention thematic integration that is observed in the planning and homework of different learning areas, but it does not explicitly come to the fore. Therefore the relationship and integration that the teachers in this study make is superficial and without clarity.

Both teachers are recognizing that integration in teaching and teaching methods should be applied. Teachers are aware of the integrated relationship that exists between the two learning areas, Mathematics and Economic Management Science. Both teachers agree that the concepts between the two learning areas are common and have similar or completely different meanings. The recognition in the implementation of the integrated manner of teaching is not explicit enough. Both teachers admit that they do not teach their learners in the integrated method of teaching. It appears from the interview and the concept maps, that there is some form of integration taking place, but it is tacit, unintentional and unconsciously done to make learners aware of similarities or differences that occurs between these two learning areas. Hence, learners might find it confusing when they interact with the same concepts in the different contexts of the two different learning areas.

Planning was mentioned by both teachers. They argue that if the planning process takes place in an integrated fashion, collectively and co-operatively it will add and make a significant improvement to develop the integrated curriculum. The planning process in an integrated way, require from educators to plan collectively and in this process it takes away certain powers of authority from certain learning areas and the teachers in control of those learning area. Hence, there is a problem of certain educators to collectively plan and prepare themes, lessons and time frames. The latter definitely contribute to the reluctance of the new integrated curriculum to become more substantially implemented. Thematic integration were pushed with the older curriculum 2005 when themes were given to the teachers by the departmental officials to do collective planning around. Some of the themes were based on Personal development, HIV Aid, Environment and so on, but teachers in certain learning areas complained that they cannot align the content of the learning areas to the themes.

The two teachers in this study do not plan together (Process integration) or collectively (thematically) within a discipline (Discipline specifically) or across (Content integration) any other discipline even though they are stationed at the same institution(methodological integration). The whole situation creates a strong play of power relations and segregation of learning areas.

Deduced from the study as a whole there is very little situations created to integrate or to plan for integration in or across the learning areas, EMS and mathematics. Mr. m mentions a lot of a trip taken to America which can be labeled as process integration of linking the content to real life situations Mrs.. K. links the two learning areas with content integration, because she refers to the similarities or differences of the concepts between the two learning areas. The latter makes Mrs. K. look like the teacher that integrates in line with the study, because the study is directed to look for content integration because of the concepts between two Learning Areas.

5.2.2Answers to question two

2 What difference, if any, exists between relationships made by grade seven EMS teachers and those made by Mathematics teachers?

Even though the integration is more tacit then implicit, there is a clear difference between the styles of integration noticeable from the EMS teacher in contrast to that of the Mathematics teacher. The mathematics teacher in this study is more process integration and methodological integration orientated, while the EMS teacher is more Thematic and content integration orientated. The degree of fair relational link of the EMS teacher is weak with less insulation of boundaries between the learning areas and concepts from EMS then that of the mathematics teacher. The difference that exists between the relationship made by the EMS teacher and the mathematics teacher is significant. The classification of the EMS teacher is weak and the classification of the mathematics teacher is strong.

The difference is clear enough to elicit that the mathematics teacher is not relating concepts with the necessary efficiency or effectively. The EMS teacher on the other hand is making an effort to try and relate the content knowledge of concepts between the learning areas and between the concepts. The EMS teacher is more aware of the concepts in her learning area and in the mathematics that is elicited in these concepts. The mathematics teacher on the other hand is not showing the necessary content knowledge in his learning area and appears to be confused by the concepts.

The mathematics teacher is concentrated in one domain, that of mathematics and makes excuses for the reluctance not to move in and across to other learning areas. That implies that the mathematics teacher links mathematics with the dominance it once was associated with. The latter proofs against what the curriculum demands according to the curriculum statement of the department of education. However, the mathematics teacher mentions that departmental officials gave the endorsement to him not to make effective and efficient effort to integrate certain mathematics concepts with other learning areas.

Mathematics teachers are not letting go of the power and power relations created by boundaries between learning areas, because they are hanging on to the prestige and superiority attached to mathematics from the old apartheid era curriculum. They are not making time to learn about other learning areas and where they can slot in and integrate mathematics with the different and other learning areas. The department is still giving power to certain learning areas as is evident in the time allocations to the different learning areas and mathematics are reigning supreme, because of more time and emphasis given to the learning area in the NCS policy and by the agreement that certain concepts within mathematics that can not be correlated to other learning areas and getting the acceptance from departmental officials when dealing with this statement.

Literature and theories mention previously in this study is arguing for relational and integrated education that can lead to better understanding of student and the mathematics teacher recognize the value thereof, but does not realize the importance of the implementation. That makes the recognition and realization strongly bound and the classification of the mathematics teacher strongly bound. Hence an overall fair integration instead of a curricular desired weak bounded integration.

As mentioned by the mathematics teacher that it might be that he implements integration unconsciously and this could be related to what Runesson (1999) in Assan (2008) mentions as a tacit dimension of the implementation of teaching in action that can be linked to pedagogic content knowledge.

The EMS teacher (Mrs. K) has a fair understanding of the mathematical concepts and how they integrate with other learning areas. She understands well how these concepts integrate with her learning area and whether she is teaching the integrated way or not. She would like to teach in a related manner if the time allocation allows for her to do so.

The EMS teacher is well aware of the concepts and the meaning and understanding of these concepts in a mathematical context. The pedagogical content knowledge of he EMS teacher in terms of mathematics is at a high degree level. The EMS teacher seems to be moving between domains and integrating fairly and with weak boundaries of insulation.

This latter might be influenced by the dual teaching that is done by the EMS teacher. However the EMS teacher is predominantly an EMS education specialist. According to the EMS teacher, the very same aspect of dual learning area teaching, like the situation of the EMS teacher that also teach mathematics to the lower grades, leads to some confusion for the learners. According to the EMS teachers the learners associate a learning Area to an individual and if the individual teachers more then one learning area it creates integrated confusion of concepts and a problem for clear differentiation of the concepts according to learning area specification. In my view the latter can be turned oppositely and made clear by the individual who is teaching two or more learning areas, because the individual have more control in the clarification of concepts according to the learning area specification and differentiation.

My argument and in line with the theories and literature mentioned in this study that, clear conceptual differentiation and explanation of similarities to learners will lead to, relational, integrated, and realized and domain situated understanding. The teacher shows a fair understanding of the concept and how these concepts can be integrated across the two learning areas, but the integration is not implicitly applied in practice during lessons. The opportunities that present for integration in order to give learners a clear understanding of the similarities or differences that exists between the two learning areas are not capitalized on when the situation present therefore.

5.3 Recommendations

There are some recommendations that I want to make o teachers, policy makers and researchers. These recommendations I make in the light and hope that this study have opened new debate on the matter of integration in the curriculum and the classification and framing of learning areas. The view is that there are limitations to this study and some suggestions to look at closing the gap left by this study.

5.3.1 Recommendations to teachers

It is becoming a serious concern that the gap between the intended integration type curriculum and the implemented curriculum is widening. Teachers seem to be not implementing the intended integration type curriculum, whether deliberately or tacit. The teachers in this study need to inter act with each other and the learning area concepts of different domains.

The situated theory as explained by Lave and Wenger (1991) teachers are situated in a specific learning area. The specific content of that learning area is specialized and the teacher is supposedly the expert, but relating exciting knowledge to relevant situations in other learning areas. Skemp (1976) is also refereeing to relational understanding as a better and more beneficial understanding of concepts. Controls and evaluation processes needs to be adjusted to fit in with the integrated style curriculum of learning and teaching, instead of looking for the completion of the syllabus. The emphasis should be on quality of teaching and understanding instead of the quantity that can be covered in a given set or time frame.

The foundation of strong understanding of concepts and the application of the same concepts in and across learning areas in order to emphasize the difference and or similarities of the same concepts in different disciplines, domains and learning areas are created in the lower levels of teaching. Flexible, integrated and relational teaching can prove to be more efficient and effective if it is explicitly and implicitly implemented. Teachers in this study need to read across domains and in and within other learning areas. Weaken the boundaries of classification and strengthen

the framing between colleagues and the sequencing and of content. Plan collectively and enhance the relational differences and similarity that need to be elicited to learners with intend and effect. The teachers in this study need to improve their content knowledge in terms of the others 'Learning areas. Improvement of across domains content knowledge will increase the level and degree of integration across and within heir learning areas.

5.3.2 Recommendation to policy makers

Resistance to embrace curriculum change by some of the teachers is a factor for concern and integration is a key concept of the national curriculum statement.. This, to a greater extent, delays and derails the process of implementation. According to Bernstein (1996) there is within an integrated curriculum situations where teachers interact to select the content and pedagogy to relate to the taught. Inline with the later and also in agreement with the socio constructivist theory of inter action and scaffolding from Vygotsky (1978), I recommend and suggest that planning takes the format of grade or phase groupings, course groupings and in an integration style. Encourage and suggest collective and thematic planning and the implementation of the principle of integration. Blur the boundaries between learning areas.

Train all teachers in order to emphasize that all the learning areas are important and that one is not superior to the other. It is hoped that those who propose changes to the curriculum will continuously try to interact with teachers so as to ensure that the transition ultimately becomes a success. This might be difficult as our whole country is emphasizing the importance and shortage of mathematics and Science teachers and this situation jettison the balance that is suppose to come with the new curriculum. Give thorough workshops to teachers on the different types of integration that can be used and the clarity the importance to know the difference. Look for links to intertwine concepts and to eliminate confusion of learners.

Encourage teachers to use more visual, flexible and bubbly methods of teaching in order to make learning and teaching more fun and exciting. Concept mapping, with proper follow up interviews, can be both a pedagogic tool and an assessment tool if used effectively and

efficiently. This tool can be used in all learning areas and it can as a tool enhance integration in, between and across learning areas.

5.3.3 Recommendations to researchers

To researchers that would like to follow up or do a similar study, I suggest that the method of class room observation be done and video recorded in order to view whether teachers are doing what they imply to be doing. In this regard it will also be clearer to analyze if the integration is not happening in action, the degree of integration and the type of integration that teachers are eliciting during practice in action. In this manner the data can bring to the fore exactly what teachers are doing in the classroom during implementation? A class room observation can then be followed up with concept mapping and interviews to triangulate the study.

In this study the EMS teachers is teaching both leaning areas at the same level and she mentioned that it could lead to the confusion of the learners' understanding of related concepts. The ideal situation would be to only allow one teacher per learning area, but it is not the status quo or what is taking place in the practical reality. The alternative would be to make sure that the dual learning area teacher is content and pedagogically clear about the implication of the concepts shared that has the same meaning or differ from the meaning of the other learning area. In this instance it is necessary to clarify and emphasize the conceptual similarity or difference within and across learning areas to the learners.

It appears that most research studies are focused on the higher levels of education in South Africa. At that level the most damage is done and remedial intervention is necessary. If more research within the level of primary schools in South Africa is activated, it will enhance the degree of quality education needed at the higher levels. I hope that this study provoke deeper need for similar studies at lower level of education.

5.4 Conclusion

This section concludes certain findings from the data collected and analyzed, specifically for this situation and other situations similar to the situations of the case study. It however cannot generally assume that all situations in the education department, schools and teachers will reflect the same findings. These findings might be relevant and generalized to similar situations in the South African context of educational practice.

The relationship that grade seven Mathematics and EMS teachers make between concepts from EMS and related to mathematics is superficial and exclude in dept explanation. If there is a link, it is just mentioned for note and it is not made clear to the learners how the concepts integrate with other learning areas. In some instances it is not even done consciously. It might be elicited as incidental and just brushed over.

The EMS teacher is more aware of the integration potential then the mathematics teacher. The mathematics teacher is more focused on the mathematics in his learning area and does not give recognition to the fundamental value of the other learning areas.

Teachers in practice need to equip themselves with pedagogic content knowledge and inter act with the curriculum statement in order to speak from a perspective of knowledge in relation to integration. Teachers need to explore the types of integration and even elicit more types of integration that get elicited during practice of learning and teaching. This will add o the bank of types of integration in practice. I have highlighted a few findings of practices and a lot more can be found by fellow researchers, teachers and policy makers.

Teachers are trying to integrate and, in some instances, integrating (unconsciously) without planning to do so. However, it is clear that the teachers in the case study do not have a clear, but limited understanding of what it means to integrate. Teachers are not aware of the type of integration that they are suppose to use or even what type of integration they are using when they do integrate.

The type of links and relationships that the teachers in this study drew between concepts of the two learning areas mathematics and EMS is based on the understanding they have of the other learning area. If the teacher has a limited understanding of the other learning area it makes the link and the blurring of insulation between the learning areas difficult. The latter then automatically leads to the strong insulation that exists between concepts, in and across learning areas. If teachers have a clear understanding of the others learning area the link and relationship is blurred. This means that the integration is good and the classification is weak. The concept recognition and realization is strong, understandable and clear.

Teachers in this study need to expose learners to the fact that the same concepts are shared between different learning areas and that it might have the same or a different meaning. The meaning of the concept will depend on the context, learning areas and discipline that it is used in. The EMS teacher is more open and susceptible to integration and tries her best to accommodate the opportunities to integrate, she even tries to make positive suggestions to integrate, whereas the mathematics teacher comes up with reasons why mathematics cannot integrate at certain level and how it is expectable and encouraged by officials and policy makers not to integrate mathematics with other learning areas.

As mentioned it is however imperative to understand that it cannot be over generalized as the norm and standard in all South African classroom practices, because the study only focuses its scope on two grade seven teachers. The teachers in this study had to draw a concept map once and I did a followed up interview. There was a second time of looking at the concept maps during the interview sessions, but it was done with a specific time and frame. This is a clear indication for the room that is created for further study in similar fields of study.

'The national curriculum statement could be creating a new set of recognition rules unfamiliar to both teachers and learners'. This change in both recognition and realization rules also imply that teachers have to move away from being subject (Learning Area) specialists to generic educators, but this move is likely to come up with heavy implementation and financial demands.

Whatever the socio economic situation, the boundaries that the curriculum present and the method of pedagogy, we as educators and implementers of the curriculum need to empower ourselves with knowledge. Therefore, we need to recognize, realize and understand the gap created by strong bounded insulation and pledge to integrate across the learning areas and the concepts within the learning areas.

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Appendix A

Transcripts of interviews

The transcripts of he interviews with both the EMS and the Mathematics teachers is a direct form of the spoken word as it was uttered by the respondents and grammatical errors occur at places, but is left uncorrected for the purpose of true reflection of the recorded interviews.

Interview with subject one: (mathematics teacher).

1	Interviewer	Mr. M. Please give us a background of your academic and professional history
2	Mr. M	Well. My name is J. M. I have been teaching for the past 15 years. I started of teaching History and Geography, but within my second year of teaching I was introduced to Maths and ever since that day I have been only teaching Maths.
3	Interviewer	So you have been teaching Maths for about 14 years now
4	Mr. M	That is correct. I have been teaching maths for 14 years
5	Interviewer	I think "meneer"(sir) what is important is the fact that you have been teaching Maths in the old system and when we went over into the new system you changed over with it , into the new dispensation or new paradigm of teaching the RNCS or the OBE style. Ok. The Last time I asked you to draw me this concept map. I'm going to ask you a few questions on that and you can just respond to me as to how do you find it.
6		
7		
8	Interviewer	How did you find the concept mapping exercise?
9	Mr. M	Well. I think it has been bit of challenging, yes. Challenging in the sense that, you know one does. We don't always analyse to get the big picture. What we normally do is we look at things and then we want to approach it. However having a concept map made me realize that there are different challenges within it.

10	Interviewer	So. Do you think the concept map method is the same as writing a test?
11	Mr. M	No, I will, I will not think so.
12	Interviewer	Ok. What makes it different?
13	Mr. M	Writing a test, you being driven to one answer whereas when following a concept map It leads you to different channels which you can follow.
14	Interviewer	Let's see. Do you think you would use a concept map in your class room as form of assessment?
15	Mr. M	I would to a certain extent, yes. I think it needs to be limited. As I have explained to you earlier it is brought. Forming concepts. And to use it as a form of a class test. I think especially with the, taking the learners abilities into consideration. So I think when using this you need to strategise it, as to what it is that you want to achieve.
16	Interviewer	Now. Just a follow up on that question. If you have a concept map or the idea, how will you use it as a class test?
17	Mr. M	As I have stated on my drawing. You need to move from the concrete to the abstract. Which will imply that in making the learners aware of what is happenins around them, and then exploring it from there so when formulating your test the learners can, are able move from where they are to where they can develop. I think in that way they are more able to realize how the test should be formed or what their standards are or their assessment.
18	Interviewer	What does integration in the NCS mean to you or how do you understand integration
19	Mr. M	I believe, and I'm positive in saying this. I Believe, That having clear systems in place make the learners see that what you are

		doing is not only important just for one specific learning area. Can I make use of an example? What happened was the learners were doing HIV and AIDS. They were asked how many people, to go get, gather information of how many people had HIV/AIDS. Now I think for me as a math teacher to integrate it with the Life Orientation lesson will be adequate because what I have seen is they were easily able to relate to how it functions in all learning areas.
20	Interviewer	Now sir we going to go to your concept map. Right and remember the concepts that we use was: Salary, Product, and Interest. Graph, Ratio and Expand. Now, I see here you have linked salary with, what is this now?. Is it ratio?
21	Mr. M	That will be exchange and ratio, exchange rate.
22	Interviewer	OK. Exchange rate. So salary here is linked with?
23	Mr. M	Exchange rate
24	Interviewer	Now ratio, where did you link it. Where is the concepts , show me the concepts here "Meneer".
25	Mr. M	The concepts here (Pointing out the concepts)
26	Interviewer	I see Ratio
27	Mr. M	Right
28	Interviewer	I see Graph
29	Mr. M	Right
30	Interviewer	I see, what is this?
31	Mr. M	That is an interpretation of a graph
32	Interviewer	OK, but how many concepts did you use here, because there is 1, 2, 3, 4, 5, 6?
33	Mr. M	Right, how I would, looking at this. How I would include it in my math lesson. We are planning, we are planning. The

		learners will be allowed, there were I say travelling to America. This is now where the learners will start, but however as the EMS, what they do is. They relate to job and salary. Which parents need to do.. So, you will not be able to travel to America, if you not have your parents or maybe your sponsors or whatever you have, does not have a job. However when you do this, you need to take into consideration the interest.
34	Interviewer	The interest of what?
35	Mr. M	The interest of, which will…. You need to determine.
36	Interviewer	Ok. You need to determine the intrest that you need to take into consideration.
37	Mr. M	Right
38	Interviewer	Of what?
39	Mr. M	Of your expenses
40	Interviewer	Your expenses when you do?
41	Mr. M	You're planning to travel.
42	Interviewer	Ok, so I take it this travelling here is linked to ratio and it is linked to that graph there?
43	Mr. M	Right and it is linked to job.
44	Interviewer	And it is linked to job, which you have put into one column with salary?
45	Mr. M	Right, you are. Sir.
46	Interviewer	You can write there, if you want to add stuff, meneer (sir).
47	Interviewer	Now graph here is linked to ratio, so I am trying to understand how it links. Why are you linking it that way? Here you say ratio then you link it to travelling to America then you link it back to graph
48	Mr. M	If you could nicely see there it is said; supply of market prices. Now when you need to plan your travelling, especially

		when you travel to foreign countries you need to know what the ratio and the rate is of that specific country, in order you to do planning as to how much your final expenditure will cost
49	Interviewer	OK, so that is how it links to expenditure?
50	Mr. M	Right now, the graph having it here will now allow the parents; here it says there are different types of graphs. What I plan on doing with this graph presentation is; that the parents need to compare. One thing that I try to bring across to the children is not that your money becomes less, because those people have different rates and ratios which they work with, which will make your money more or less equal to. The fact is that you need to plan accordingly.
51	Interviewer	Then there is an exchange rate here that is linked to job and salary?
52	Mr. M	As I have explained earlier. It is important for people. I am just taking an example of what happened in the school now is. The parent, the child was elected to go to America. The parent saw that it was 1600 and some odd dollars. However when they converted it, they picked up, but no. this is then close to 16 , 17 Thousand rand. Which resulted in the child not going. Now bringing that to there attention now I think it is very important.
53	Interviewer	Ok. So that is basically what you wrote down here, which is?
54	Mr. M	The conversion.
55	Interviewer	OK.
54		Making use of abstract calculations. In that, people sit with the concept that if I raise 10 thousand I can go with 10 thousand to America
55	Interviewer	OK. Meneer(sir) I am going to give you this red pen and I am

		going to ask you to put in the other concepts which you did not use. Ja (yes) just put them you think they should belong.
56	Mr. M	Ok, well. I believe the expended notation will definitely with the abstract calculation. Where the learner is able to now associate himself with the process of the map.
57	Interviewer	Ok.
58	Mr. M	So I will put expended, here.
59	Interviewer	Ok, but it is not expended, it is expand.
60	Mr. M	Expand, which means , further or , I don't know the meaning of expand…
61	Interviewer	Yes, I think maybe you need to give me the mathematical explanation of expand and the one you just gave me. Is what? It is more a? How will you explain expand in the Maths class.
62	Mr. M	Well, that I would say how it can be used. Normally, if you look at the word expand it will go with challenges, right. Which means you will now need to define the word expand in a mathematical term where the learners is now able to see that, excuse me, this how I can determine what ever it is I want to do. Like an example, the children wanted to buy themselves products in America. They came back. Now what I have done was. I said how many dollars you paid for it. So immediately I said ok, this is your opportunity. You paid 120 dollars for your I-pot. The rate in South Africa is like 6 to 6.95. So that is an opportunity for that child to see, hey, is it comparing the prices when visiting other countries.
63	Interviewer	Interesting. Right "meneer" (sir) now, let's see did you put all of them on now?
64	Mr. M	I have expand, I have ratio, you want me to….
65	Interviewer	Ok ratio is in, what about? You have graph, you have expand, and you have salary. What about product?

66	Mr. M	The product. That would nicely link into EMS, in that I am saying you need a job.
67	Interviewer	OK
68	Mr. M	Right. So, with this job there are different opportunities.
69	Interviewer	Ok. How does it link to product?
70	Mr. M	Right. So when having a product, you need to have started something.
71	Interviewer	Ok
72	Mr. M	Are you with me.
73	Interviewer	Yes, carry on
74	Mr. M	In this case here, linking it with the EMS I would say what you purchase is your product.
75	Interviewer	Ok, That is the EMS explanation.
75	Mr. M	That is the EMS explanation
77	Interviewer	If you are speaking in the Maths class about product?
78	Mr. M	Well the immediate reaction from the children will be that I need to multiply.
79	Interviewer	Ok.
80	Mr. M	That is in a maths term. I need to multiply
81	Interviewer	To get a?
82	Mr. M	An answer. However. I would, especially looking at this lesson, the product of my planning. My abstract calculation. I do not know if it is right if I. no. I'll put it here with my interpretation.
83	Interviewer	Ok, your interpretation of?
84	Mr. M	The amount of money I would need. Here I will take into consideration, that your travelling. It goes from. If you are travelling to America you need to divide your product with there rate , but when you come from America with money you are going to multiply the money that you bring , in order

		for you to exchange it for Rands, or into our currency.
85	Interviewer	So, I am going to ask you to. If you have to give me plain mathematical answer for these concepts. Just Maths. Nothing else. No real life situations. No EMS, just Maths. How are going to respond to it. If we talk about salary, what would be your mathematical reasoning of salary?
86	Mr. M	Accumulation.
87	Interviewer	Of?
89	Mr. M	What you earn.
90	Interviewer	Ok, accumulation of what you earn. All right, product.?
91	Mr. M	Multiplying, on what you earn, can earn, you want me to….?
92	Interviewer	We are talking about plain maths, nothing else?
93	Mr.M	Multiplying
94	Interviewer	Multiplying , in getting to your?
95	Mr. M	No, ya, ya. Your product is what you multiply to your earnings, per working days.
96	Interviewer	Ya, but, a ok. Intrest?
97	Mr. M	It is charges
98	Interviewer	Ok, Graph?.
99	Mr. M	A, I normally refer to it as a synopses, that is basically what it is, a synopsis of information in non numerical terms. I won't say non numerical terms. I have the word sir. A shorter ..
100	Interviewer	Graphic
101	Mr. M	A shorter explanation
102	Interviewer	Ratio?
103	Mr. M	Exchange
104	Interviewer	And Expand
105	Mr. M	I would say a,,,,
106	Interviewer	Plain maths, nothing else, Expand?
	Mr. M	Add

107		
108	Interviewer	Add?
109	Mr. M	I would say add, sir
110	Interviewer	All right, so sir if I ask you now to give me EMS explanations of those. No, no, no, just your EMS explanation of. What do you think salary will be in EMS terms. Look we now you are a maths teacher, but I am just putting you out there now.
111	Mr. M	Well, salary I would say is what you earn.
112	Interviewer	Ok, on a?
113	Mr. M	On a yearly, monthly, weekly, daily basis.
114	Interviewer	All right, Product?
115	Mr. M	A, the product for me will be…
116	Interviewer	And we are talking EMS now
117	Mr. M	It will be what you intend purchasing, I think. I would like to think it is that.
118	Interviewer	Ok, intrest?
119	Mr. M	It is more are you willing or do you want to.
120	Interviewer	Ok.
121	Mr. M	That is interest in an English sense yes
122	Interviewer	Yes, but we are talking EMS sense, and you know EMS has to do with? So what will intrest be?
123	Mr. M	Oh! Your charges to your account, yes. In that as well , yes. Your charges to your account
124	Interviewer	Ok, Graph?
125	Mr. M	Is how you go about planning
126	Interviewer	Ratio?
127	Mr. M	Well, the rate at which it goes.
	Interviewer	Ok, and then expand.

128		
129	Mr. M	The opportunities for you.
130	Interviewer	Ok. Meneer (sir). Question. Do you think? Look you have explained to me now, America and the conversions. Do you think you teach like that everyday?
131	Mr. M	I would say no, sir.
132	Interviewer	So, do think integration is taking place between learning areas at your school?
133	Mr. M	I would say it is, on paper yes. It takes place.
134	Interviewer	Ok, but now in the lesson?
135	Mr. M	Yes, no, no, no. you see the question is it towards…
136	Interviewer	I am asking the question. You, actually the question is about your school. So, you will not know what is happening in other people's classes. So I am speaking about you. Firstly, I asked do you teach that way. You said no. Now I am asking do you think teachers in their classes are teaching their concepts with an integrated way?
137	Mr. M socialist	Sir. What I am saying is. It depends on how your department functions, because. Doing that as it is supposed to be. Cause it is important for children to look at the broader picture. In that this learning Area is not more important then that Learning Area. So, but what I have picked up is that when we have our context, it is the same and yes there are some Learning Areas that functions right across the board. However the implementation of this new curriculum and them stating that grade seven, especially grade seven, it is not necessary for the maths department to function within the context of the school ,because it is believe that there are certain things that you cannot correlate to the context of

		within other Learning Areas. But, with regard to our school I would say, yes, you can see from the planning, because children bring homework or they get homework and it is related to one specific topic..
138	Interviewer	Do you think that you are integrating Mathematics and EMS concepts regularly in your Learning Area, which is Mathematics?
139	Mr. M	Sir , I think one of the problems we are experiencing is we do not have knowledge with regard to the Assessment Standaards of EMS and Mathematics. I might do it, yes, but that might be unconsciously. Then again I need to say that their context. I try as much as I can to bring it in line with the EMS in that they do calculations like percentages and things like that, but that is what we need to strive for. However, I do think that looking at the planning we can implement it , yes.
140	Interviewer	Ok, last question sir and I just thought about this one: do you think EMS and Mathematics are sharing these concepts that we just spoke about.
141	Mr. M	Yes, yes. I really do. In that, learners are not given the opportunities. Learners are not being explained like salary as an example. They are the concept that salary is what you earn, but they do not know how to calculate it.
142	Interviewer	Sir. I like the answer sir. Do you think these concepts that we spoke about? These six concepts: Salary, product, intrest, graph, ration and expand. They are shared by hese two learning areas. Maths and EMS? They come in both of them
143	Mr. M	Yes, yes, yes, yes.
144	Interviewer	Do you think it will help the children, or it can confuse them?
145	Mr. M	As I have stated earlier sir, it is important that when you do

		your planning, you need to make learners aware how it is integrated into what they are doing in the next grade,
146	Interviewer	Are you doing that?
147	Mr. M	No, sir.
148	Interviewer	Sometimes unconsciously.
149	Mr. M	Yes , sir.
150	Interviewer	Mr. M. I think I am going to stop here. We might continue at a later stage, but thenk you sir for your time Highly appreciated.

Interview with subject two (EMS teacher)

1 151	Interviewer	Maybe you can just give us a quick background of yourself professional as well as academic?
2 152	Mrs K.	I have been a teacher for ten years now. My first two years I taught at a private school in Benoni. I was doing economics and Business Economics and another year I was in Davidton at a Primary school and I was doing EMS for the intermediate phase. The whole phase and academically I have a Masters degree in management, educational management. I am currently in my PHD doing financial management with the University of North West.
3 153	Interviewer	Ok. Madam we are going to be speaking to the concept map that you drew. Right. Firstly, I want to ask how did you find the concept mapping exercise?
4 154	Mrs K.	I found it very. I did not actually know where to start , cause I saw all the words and I know what I wanted to say about them, but I felt that maybe this should go with that and that should go

		with that. So it was a bit of a tricky situation.
5 155	Interviewer	Ok, Do you think the concept map method is the same as writing a test.?
6 156	Mrs K.	No it is not. I think with the concept map is much easier, because you can give so many meanings to one concept. And it does not necessarily mean when you explain this, this way; it is wrong. It is just how you connect the dots. So I think it is much simpler then writing a test.
7 157	Interviewer	Will you use concept mapping in your classroom as a form of assessment?
8 158	Mrs K.	I don't think now I will
9 159	Interviewer	Why?
10 160	Mrs K.	Because, I think the kids need to internalise the words and know the explanations. Then it is easier. You know the grades that are. When they are at this lower grade they are still battling with the language, they still battling with the concepts so it is easier for much higher grades. I would suggest, yes, this is good, but for the kids you must explain every other word and they might know what they want to say, but because it is put in this way they will be a bit confuse. So for now I will not use it.
11 161	Interviewer	So, Let say hypothetically, They know the concepts. You have explained it and now you want to do an assessment. You have explained to them concept mapping. Will you use it? Do you think they will enjoy it more then a test?
12 162	Mrs K.	Yes, Yes. Then they will. If I am sure they know what the concepts are, then it will be easier for me as an educator to keep tract and find out who exactly and how much they know and who does not understand and to what degree.

13 163	Interviewer	Ok. What does integration in the NCS mean to you?
14 164	Mrs K.	I would say where we, somehow inter link and intertwine the Learning Areas, where they somehow come to a certain Line and say this learning outcome of this learning area can go with this learning outcome of this learning area. That is how I understand integration.
15 165	Interviewer	Ok. Do you, when you teach. Do you. Ok. No. before we go there. Did you link all the concepts? Lets look at your concept map. You linked salary, there is interest. Expand is there, ratio is there, product is there, graph is there. Ok. I see you put graph in the middle . I there a reason for that?
16 166	Mrs K.	Yes, because with a. When you use graphs is when you want to see how the picture of what ever. So I thought if I have everything else. All the calculations, all the, like I said, like I said the interest and expand. The graph will sort of explain this. You know when you draw a graph and maybe you talking interest and salary. You know the interest will sort of impact on your salary to this degree or it will go down or what ever. So, That is why I put he graph there.
17 167	Interviewer	Ok. So all your concepts are linked?
18 168	Mrs K.	Ya (Yes)
19 169	Interviewer	Now we are going to look at certain concepts that you linked. Ok lets start on top here. Salary. You linked salary to, let go this side.
20 170	Mrs K.	If I do not with draw money or if I keep it there for a specific time frame, then I know I will get interest on that.
21	Interviewer	Then you went on to expand? You linked interest with expand?

171		
22 172	Mrs K.	Uhm. Yes. You are looking forward to some things. You want to have interest on the money you put in to the bank that is when you will expand on, what ever, your assets. You get more money in the bank , because of your interest you are expanding your capital
23 173	Interviewer	Now. Expand you did not link to anything? So I suggest lets go. Is there a reason why you did not link it anywhere else?
24 174	Mrs K.	No
25 175	Interviewer	Then you linked salary to product?
26 176	Mrs K.	Yes. We use money to buy goods and services. So when we use money we buy products and product is linked to the amount of money we will be able to buy for. So salary is. The products that we buy are mostly related to the salary that we earn. I will buy certain stuff, because I earn a certain amount of money an this will go here like the other way
27 177	Interviewer	Ok, and then product is linked to ratio?
28 178	Mrs K.	I said what is left if you divide what you used and what you still have. When you look at the kind of. Ok , here is my salary and here are the things that I want to buy, but based on this and based on the product. I can make sure that I get the stuff that I need. I will b able to get the proportion of the things that I want, because it is what is left if you divide what you used and what you still have. You are looking at your salary, you looking at kind of stuff that you want. Sometimes you do not need to use your money to buy stuff over and over and over again. No, you still have from the last month or the month before and this will

		be able to help you deal with the current salary that you have, because if you know what is still there and what you must still have then it gives you the ratio of the whole.
29 179	Interviewer	Ok. Madam, I think, what I am going to ask you now is. The concepts that we have, they are taken from the EMS curriculum. I want you to, just shortly, describe or define each of them. Lets start with salary again. In EMS terms how will you describe or define salary?
30 180	Mrs K.	It is the amount of money you receive for doing work over a period of a month.
31 181	Interviewer	Ok, and interest?
32 182	Mrs K.	Interest is the capital you get when you put your money in the bank.
33 183	Interviewer	Ok, expand?
34 184	Mrs K.	Expand is when you grow your assets.
35 185	Interviewer	Ok, product?
36 186	Mrs K.	The product is goods and services. Its good produce for the consumption for consumers.
37 187	Interviewer	Ok, and ratio?
38 188	Mrs K.	Ratio is the dividend of a… mmm
39 189	Interviewer	You can explain it in simple terms. It is fine.
40 190	Mrs K	Ratio is what you get when you take what you had and divide with what you must still have to get what you actually need.

		That how simple, otherwise the dividend and stuff will confuse me more. (Laughter)
41 191	Interviewer	Ok, the graph?
42 192	Mrs K.	The graph I still think it is the mathematical term that we use to divine or draw to explain what we have. We can use graphs. Like we would borrow the graphs from the mathematics, but use then effectively in the economics to be able to look at the bigger picture.
43 193	Interviewer	Ok, that is the EMS explanations. Now I am going to ask you to give me Mathematical explanations. (Laughter) Ok, let's start with salary?
44 194	Interviewer	Salary.
45 195	Interviewer	If you have to think mathematically.
46 196	Mrs K.	Salary is the amount of money hat you get. Yes getting paid.
47 197	Interviewer	Ok, Interest?
48 198	Mrs K.	Interest is what you have more on what you put in the bank
39 199	Interviewer	Expand?
50 200	Mrs K.	Expand. Expanded notation. Is when you grow the things and make them bigger?
51 201	Interviewer	All right, where do think they will use expend in mathematics. Like you have mentioned now expanded notation?
52 202	Mrs K.	When they use a one of those hundreds and tens and stuff and stuff. When you want to see 450. It is four zero zero + five zero

		+ zero. So that is an expanded notation.(Laughter)
53 203	Interviewer	Ok, product?
54 204	Mrs K.	Product is when you multiply something by something. In maths that is a product. When you multiply a number by a number you get a product.
55 205	Interviewer	Ratio?
56 206	Mrs K.	When you divide stuff. Ratio. Maths. Yes. The dividend, you know that word it is when you divide a number by a number you get a ratio.
57 207	Interviewer	All right, and then graph?
58 208	Mrs K.	Yes, Graphs. Aaa, eish. Graph in Maths is when you interpret the numbers. If you want to see how many of this and that on a graph you can, you know, sort of draw a picture and say in relation to this, this is ..
59 209	Interviewer	Ok. You wrote a nice sentence here at he bottom. Do you mind ready it for me?
60 210	Mrs K.	I say math is used because figures and symbols are used to calculate what is mentioned above.
61 211	Interviewer	Now, do you think integration is taking place on a daily basis at your school?
62 212	Mrs K.	No, I do not think so.
63 213	Interviewer	Why?
64 214	Mrs K.	Much as I do Maths and EMS. Sometimes stuff that I do in EMS at a particular point is not related to stuff that I do in maths at a particular time. It looks like loose, loose things and it is very

		confusing when you are an educator, because it is loose particles of stuff. You have to grapple here and there. It is not stuff that is integrated and sometimes we do not plan sitting down as the whole phase, so that every body follow what everybody is doing. The maths department will sit there and do there maths stuff, the EMS will sit there. We do not like sit together and say: This is what we want to do as the phase. How do we use your maths? Maybe maths will take (Learning Outcomes) LO 1 (Assessment standard)AS 1, but LO1 AS1 of maths goes with LO4, AS3 of EMS. Why don't we do the same LO? That LO in particular in the same quarter so that we can be able to integrate. I do not se that happening more often.
65 215	Interviewer	Do you think that you are integrating mathematics and EMS concepts regularly in your learning Area?
66 216	Mrs K.	Not Really
67 217	Interviewer	Why?
68 218		Because, some of the terms need to be explained very thorough. The kids must actually internalise the whole meaning before you even use the same meaning in another concept, because it changes the tone when it moves to another section.. So I battle with getting them to understand the terms in EMS. So it becomes difficult to go to maths and use the same, because I still have to go and explain again in a maths tone. You know and become difficult
69 219	Interviewer	So, madam. Last question. These EMS terminology or concepts, do you agree that they also appear in mathematics.
70 220	Mrs K.	Yes

71 221	Interviewer	Do you think they have the same meaning?
72 222	Mrs K.	No, (laughter) other them figures. No.
73 223	Interviewer	So, EMS these concepts have another meaning?
74 224	Mrs K.	They have another meaning. Yes
75 225	Interviewer	And in Maths they have?
76 226	Mrs K.	Lets take the product example. In maths when I say product: I know it is a multiple of stuff, and in EMS when I say product I know it is a production of goods or service or something. You know. It is entirely different. That is why I said in that question before. You know, it is difficult to change over like that, because kids still take a product as times (Multiplication). As I go to EMS and I say product they still want to times and then it is a good or service or a production of something.
77 227	Interviewer	So do you think that the fact that the two learning area are sharing the concepts it confuses the children?
78 228	Mrs K.	I would say the confusion would be when the same educator teaches them both the learning Areas, because they see the educators saying product in maths as times and go to EMS and say product and say a different thing. Otherwise I do not think they get confuse, I do not think so.
79 229	Interviewer	So do you think I you make it clear to them that this product that I am talking about in EMS has got a different meaning in mathematics it will eliminate the….?
80 230	Mrs K.	It levels the ground they will know exactly how to go about. Yes

81 231	Interviewer	Madam K. Thenk you very much, Madam. I think we have come to the end of this interview. Thenks once again for participating and it have been interesting.

Appendix B



UMnyango WezeMfundo
Department of Education

Lefapha la Thuto
Departement van Onderwys

Enquiries Shadrack Phele

(011) 355 0285

15 June 2007

Mr Marnewicke P.G.
24 Vanguard Street
Edenpark
Alberton
1458

Dear Mr Marnewicke P.G.

APPROVAL TO CONDUCT ACADEMIC RESEARCH

The Gauteng Department of Education hereby grants permission to conduct research in its institutions as per application.

Topic of research: "Forms and meanings of integration: A case study on Mathematics and Economic Management Science (EMS) in grade seven."

Degree: Master of Education

Name of university: University of the Witwatersrand

Upon completion of the research project the researcher is obliged to furnish the Department with copy of the research report (electronic or hard copy).

Wish you success in your academic pursuit.

Sincerely,

pp Shadrack Phele

Albert Chanee
Divisional Manager
Education Financing, Planning and Monitoring.

Office of the Divisional Manager Education Financing, Planning and Monitoring
Room 1501, 111 Commissioner Street, Johannesburg, 2001 P.O.Box 7710, Johannesburg, 2000
Tel: (011) 355-0729 Fax: (011) 355-0670 E-mail: albertc@gpg.gov.za
Reference: 2005efpm

Appendix C

UMnyango WezeMfundo
Department of Education

Lefapha la Thuto
Departement van Onderwys

Enquiries: Kobela Lekota

Tel: (011) 983-2308

To : **The Principal**
E.W Hobbs Primary

From : **Sipho Mkhulise**
Acting District-Director

Date : **07 November 2007**

Subject : **Permission to conduct research at the school**

The above-matter has reference:

This communiqué serves to grant permission for Mr P.G Marnewicke to conduct a research at the school from 13-14 November 2007. The office hopes that he will be given the necessary support in executing his functions with the institution.

Any enquiries can be forwarded to my office on the telephone number stated above.

Yours in Service

Sipho Mkhulise
Acting District-Director
JHB Central District

Office of The District Director: Johannesburg Central District
Soweto College of Education, Corner Modjadji & Old Potchefstroom Road, Soweto,
P.O. Box 900064 Bertsham, 2013
Tel: (011) 983-2308 Fax: (011) 933-3429

Appendix D

Wits School of Education

27 St Andrews Road, Parktown, Johannesburg, 2193 • Private Bag 3, Wits 2050, South Africa
Tel: +27 11 717-3007 • Fax: +27 11 717-3009 • E-mail: enquiries@educ.wits.ac.za • Website: www.wits.ac.za

STUDENT NUMBER: 0420700X
Protocol: 2007ECE107

27 Mar. 08

Mr. PG Marnewicke
24 Vanguard Street
EDEN PARK
ALBERTON
1458

Dear Mr. Marnewicke

Application for Ethics Clearance

I have pleasure of advising you that the Ethics Committee in Education of the Faculty of Humanities, acting on behalf of the Senate has agreed to approve your application for ethics clearance submitted for your proposal entitled:

Forms and meanings of integration: A case study on Mathematics and Economic management Sciences in Grade Seven

Recommendation:

Ethics clearance is granted

Yours sincerely

M Mabeta

Matsie Mabeta
Wits School of Education

Cc Supervisor Prof Willy Mwakapenda (via email)

Appendix E

The University of Wit waters Rand School of Education
MEd. Research Project: Concept Mapping: Integration ofMathematics and EMS Worksheet 2007

The following key concepts are taken from the Economic and Management Science curriculum for grade seven learners.

The concepts:

Salary, Product, Interest, Graph, Ratio and Expand.

Use the above mentioned concepts and draw a concept map to illustrate the* relationships and links between the concepts and the integration you see between these EMS concepts and Mathematical concepts. *Use labels in the form of descriptive wording with you links to indicate the integrated relationship you see between the concepts.

Appendix F

The University of Wit waters Rand School of Education
MEd. Research Project: Concept Mapping:
Integration ofMathematics and EMS Worksheet

Semi-Structured Interview Questions (Most of the following questions are subject to change after piloting has been done and open ended questions and answers are totally dependent on the response from the samples)

1. How did you find the concept mapping exercise?

2. Do you think the concept map method is the same as writing a test?

3. Will you use concept mapping in your classroom as a form of assessment?

4. What does integration in the NCS mean to you?

5. Did you link all the concepts in the worksheet?

6. Why did you link certain concepts? (Depending on the concepts linked on the actual concept map)

7. Why did you use this word to link concept A to Concept B (Depending on the actual wording used to describe or label the links between the actual concepts)

8. Do you think that there is integration taking place on a daily basis between Learning Areas at your School?

9. Do you think you are integrating Mathematics and EMS concepts regularly in your Learning Area (Mathematics or EMS)?

Appendix G

The University of Wit waters Rand
School of Education
Masters in Education
Research Project: Concept Mapping

Dear Sir or Madam

To whom it may concern

I, Prevein G. Marnewicke, am enrolled at the University of Wit waters Rand, South Africa as a Master in Education(Mathematics) student in the second year part time. As a section of my studies I am doing a research study under the supervision of Dr. Willy Mwakapenda.

I request your permission, the permission of your mathematics head of department and your grade 7 EMS and Mathematics Educators in my research.

My research will be aiming to explore teacher understanding of key mathematical concepts in the EMS curriculum. This study is imperative because it explores the teachers' ability to draw links and relationships between mathematical concepts and EMS concepts and why. I shall also need the permission of the head of department for mathematics at your school and the relevant teachers. I shall interview the teachers about the concept maps that they drew. The interviews will take about 30 minutes each and will be tape recorded and video taped for record purposes. This research project will last about two days with three hours needed for every day.

This study is directed to develop mathematics teachers in their task of teaching and to understanding how they understand the given concepts. All the data collected will be kept confidential and used for research purposes only. No names or personal details will be revealed in my research project. The results of the research may be reported in future conferences or journal papers, but the school and the participants will remain strictly anonymous. At the end of the research I will make a summary of the findings, available to the school.

I would be pleased if the school could agree to participate in this research project. If the school agree to participate they will have the right to withdraw at any time. If the cease in participation by the school occurs the data and information of the school will not be used and destroyed by fire. I anticipate that the experience gained from participating in this research project will enjoyable and beneficial to the relevant teachers and the school.

For additional informant, please contact the research supervisor at Wits University.
Willy Mwakapenda Phone: (011) 717-3410 email:mwakapendaw@Educ.wits.ac.za

Yours in education

_____

Mr. P. G. Marnewicke: *0834094706 preveinmar @yahoo.com Date: 11 June 2007*

Appendix H

The University of Wit waters Rand
School of Education
Masters in Education
Research Project: Concept Mapping

Dear Sir or Madam

I request your permission as a grade 7 EMS and Mathematics Educators in my research.

I, Prevein G. Marnewicke, am enrolled at the University of Wit waters Rand, South Africa as a Master in Education(Mathematics) student in the second year part time. As a section of my studies I am doing a research study under the supervision of Dr. Willy Mwakapenda.

My research will be aiming to explore teacher understanding of key mathematical concepts in the EMS curriculum. This study is imperative because it explores the teachers' ability to draw links and relationships between mathematical concepts and EMS concepts and why. I shall interview you about the concept maps that you drew. The interviews will take about 30 minutes each and will be tape recorded and video taped for record purposes. This research project will last about two days with three hours needed for every day.

This study is directed to develop mathematics teachers in their task of teaching and to understanding how they understand the given concepts. All the data collected will be kept confidential and used for research purposes only. No names or personal details will be revealed in my research project. The results of the research may be reported in future conferences or journal papers, but the school and the participants will remain strictly anonymous. If clipping of the interview have to be viewed at any event your faces will be covered so it cannot be seen. At the end of the research I will make a summary of the findings, available to the school and to you on request.

I would be pleased if the school could agree to participate in this research project. If the school agree to participate they will have the right to withdraw at any time. If the cease in participation by you occurs the data and your information will not be used and destroyed by fire. I anticipate that the experience gained from participating in this research project will enjoyable and beneficial to you as a teacher and the school.

If you are interested to participate in my study Please complete and sign the attached consent form.

For additional informant, please contact my research supervisor at Wits University.
Willy Mwakapenda Phone: (011) 717-3410 email:mwakapendaw@Educ.wits.ac.za

Yours in education

_____

Mr. P. G. Marnewicke: *0834094706 preveinmar @yahoo.com Date:11June 2007*

Appendix I

The University of Wit waters Rand
School of Education
Masters in Education
Research Project: Concept Mapping

Consent form

I, _____, hereby give my consent to be part of
(Name and surname in full)
the research study to be conducted by Prevein. G. Marnewicke to explore meanings and forms of integration in the understanding of key mathematical concepts in EMS in S.A. schools. I understand that the research is to find new ways to improve teaching and learning.

I acknowledge that:

1. The aims and methods have been explained to me
2. The benefits and the possible hazards of the research have been explained to me.
3. I understand that the results of the study will be used for research purposes and may be reported in scientific or academic journals.
4. Interviews will be video taped and recoded
5. Individual results will not be released to any person or institution except at my request and on my authorisation
6. All identities will remain anonymous.
7. I am free to withdraw consent given for the study at any time during the study and in this event participation will cease and information obtained will not be used.

_____ _____
Signature of participant/SMT head *Date*

_____ _____
Signature of a Witness *Date*

Circle the appropriate term and sign next to it for video and audio recording consent:

I agree to be video recorded: Yes No Signature _____

I agree to be tape recorded: Yes No Signature: _____