

# **CHAPTER 1: Contextual background of the study**

## **1.1 General introduction**

Curriculum reform is taking place in many countries across the world. Every country seems to be trying to make changes as it appears that each country is more or less unhappy with the curriculum it has today (Black and Atkin, 1996). In South Africa, when the new government took over in 1994, it also wasted no time in reforming all aspects of the educational system, including the curriculum (Aldous, 2004). Amongst other things, this reform has meant that schools make a shift from a firmly structured schedule of study, which was characterized by a strong discrimination between bodies of knowledge (Snyder, 2000), to an interdisciplinary approach of instruction. The newly adopted curriculum, generally known as Outcomes-Based Education (OBE), came up as an option for the traditional version of the curriculum.

The introduction of OBE has placed a pedagogical demand on teachers to adopt new styles of teaching, integrated teaching being one of them. The notion of integration has become synonymous with the new curriculum such that teachers are encouraged to organize their teaching in a way that promotes integration of one subject with another. The key thought behind this process is the belief that integration can foster stronger working relationships not only amongst educators, but also amongst subjects that are being taught. When teachers collaborate across disciplines, as Stepanek (2002) argues, they often gain new insights and new ways of approaching familiar subject matter. However, implementing the new curriculum has always been marked with challenges and criticisms, some of which being the concerns that:

- teachers are not adequately trained on new approaches;
- teachers are certified or licensed in specific disciplines and therefore, do not possess knowledge to integrate (Czerniak, Weber, Sandmann and Ahern, 1999);
- integration means different things to different teachers (Davison, Metheny and Miller, 1995).

From these concerns, there is a challenge on teachers to incorporate new pedagogy that centres on integration within and across disciplines. From this background, it becomes increasingly clear that there is also a challenge for Arts and Culture teachers to incorporate new pedagogical approaches that emphasize the need to integrate *Arts and Culture* and *mathematics*. As has already been indicated, most of the teachers were previously trained as subject specialists, and may not be in possession of knowledge to integrate across subjects (Czerniak et. al., 1999), and suddenly, as Adler, Graven and Pournara, (2000) put it:

... the teacher is expected to possess a broad general knowledge of matters unrelated to his or her subject and possibly also to be an expert in other subject areas. This is clearly seldom possible and might leave the teacher feeling powerless to cope with the new demands. (p. 6)

In view of the concerns such as the one cited above, one finds it difficult to imagine how a grade 9 Arts and Culture teacher, who is presumably not adequately trained in mathematics, will successfully incorporate mathematics in his or her subject (Arts and Culture), as might be demanded by the Arts and Culture new curriculum. This is extremely disturbing in view of the fact that there has been inadequate teacher training and preparation for integration (Berlin, 1994), it seems, most of the teachers lack the necessary confidence and courage to successfully enact the new curriculum in their classrooms. Therefore, in the wake of all these concerns and the misgivings that seem to characterize the implementation of the new curriculum, this study was mainly designed to establish how the Arts and Culture teachers deal with situations in which they are called upon to reflect on their mathematical knowledge during the course of their Arts and Culture lessons. Furthermore, this study also investigated the extent to which the notion of integrating Arts and Culture with mathematics is explicitly reflected within the new Arts and Culture curriculum documents.

## **1.2 Purpose and objectives of the study**

Most of the recent educational reforms and curriculum reconstructions have been geared towards encouraging integrated teaching and learning, within South African

classrooms. The desire to emphasize integration and to foster mathematical thinking in other disciplines is no longer a unique phenomenon (Coxford and House, 1995) in our teaching and learning experiences. Integration, as a fundamental feature of our new curriculum, was at the centre of this study, hence it provided the researcher with an empirical field within which the study was conducted. Collecting information on how grade 9 Arts and Culture teachers incorporated mathematics in their Arts and Culture lessons was of primary interest in this study.

Exploring ways in which Arts and Culture teachers incorporated mathematics in their lessons, and the extent to which grade 9 Arts and Culture curriculum documents explicitly reflected on the integration of Arts and Culture and mathematics, were the underlying objectives of this study. However, as time progressed it became increasingly evident that this study would also implicitly inherit the following research goals and objectives. For instance, the researcher ended up with a desire to use this study as a tool to highlight some of the pedagogical challenges that teachers face as they try to wrestle with the notion of integration in their classroom practice. To a certain extent, the researcher also believed that this study would provide a yardstick measure to ascertain how far the implementation process of integrated teaching has progressed. The researcher also shared the sentiment that this study would be a needed catalyst to heighten awareness of the continued existing gap between the idealized curriculum (Ogunniyi, 1988) and the enacted one. The researcher also believed that this study would be in a position to present its findings as empirical evidence to support the call to capacitate teachers in terms of knowledge and strategies to deal with new challenges. There is a general perception that teachers need to be trained on new pedagogical approaches; they need to be retrained in order to change their pedagogical identities. Finally, this study aimed to highlight some of the benefits of integrated teaching and learning.

To achieve these goals the researcher interacted with two grade 9 Arts and Culture teachers and one grade 9 mathematics teacher in order to gain access to their views and understanding of integration and its implementation, and their levels of readiness towards implementing this new teaching innovation was also evaluated. It was important to involve teachers in this research because they have been placed as main

role players in the enactment of the new curriculum. Hereunder, the researcher has also tried to explain the objectives for conducting this study; for selecting Arts and Culture and also for involving teachers in the research.

### **1.2.1 Why this study**

Most of the literature surveyed seemed to assume a position that there is still very little research conducted and documented on integration (Berlin and White, 1994; Hurley, 2001). Other researchers, such as Czerniak et. al., (1999), highlight the problem of the 'lack of definition for integration that can be used as a basis for designing, carrying out, and interpreting results of research' (p. 422). This has contributed, adversely, in not providing a space for related research work to be conducted. The researcher felt it would be rewarding to conduct a study within the context of this background, that is, conducting a study within an area of research that has not been significantly explored. This realization made the researcher to believe strongly that the study would have a potential to make a meaningful contribution and also influence future related studies.

Integration, as Adler et. al., (2000) acknowledge, is a driving principle of OBE. It plays a central role within the new curriculum, it is the fundamental feature of the new curriculum and hence, a determinant for its success. This makes it extremely imperative for curriculum designers to monitor the process of curriculum implementation, and what teachers are actually doing in their respective classrooms. Following this route will provide us with a yardstick for evaluating the success of the new curriculum implementation process. This study has attempted to make such a contribution in terms of monitoring the challenges that teachers, particularly Arts and Culture teachers, face as they enact the new curriculum in their classrooms.

### **1.2.2 Why Arts and Culture**

Most of the literature seems to place much emphasis on exploring integration between mathematics and science (Davison et. al., 1995; Huntley, 1999; Hurley, 2001; Lyublinskaya, 2006), with very little attention of such documented reports on integration between mathematics and other subjects, such as Arts and Culture. This means that we have only been receiving one side of the picture; hence this study has

attempted to explore the other side of the picture, that is, to investigate how mathematics is incorporated into other subjects, apart from science.

The new curriculum encourages integration across all subjects. Arts and Culture, as a learning field, presents numerous possibilities for such an integrated teaching approach. As students are encouraged to demonstrate their drawing and artistic skills and perform various dance movements, the possibility of mathematics coming alive during these lessons is inevitable. Drawings and art will entail the utilization of mathematical instruments and measuring equipments, and an appreciation of geometry as a mathematics field. The same can be said with the articulation of dances, which is likely to involve movements and postures that could be executed at certain angles. Music, as Graumann (2005) acknowledges, provides a good opportunity for application-oriented practice of fractions. Therefore, there are quite a number of instances in which mathematical concepts are likely to be a subject of discussion in an Arts and Culture lesson.

### **1.2.3 Why teachers**

The issue of teacher training has always been a contentious one. There is a general perception that teachers are not ready to implement the new curriculum. This becomes more disturbing in view of the fact that teachers are positioned to be the implementers of the new curriculum. They are expected to forge connections not only within their subjects but also across other subjects. Possibly, an Arts and Culture teacher is now expected to incorporate mathematical concepts into his or her subject, as suggested by the following grade 8 Arts and Culture Learning Outcome 1 (LO1) and its subsequent Assessment Standards (AS: 8:1:18):

#### **Learning Outcome 1:**

Create, interpret and present work in each of the art forms.

#### **AS8.1.18 Visual Arts: Additional**

Creates art/craft/design works which demonstrate:

- Differentiation between the organic and inorganic aspects of the built and natural environment in design, observational drawing and *two-dimensional* and *three-dimensional* work;

- Interpretation and expression of own understandings of culture and heritage.

We realize that mathematics becomes explicit in this LO, as students are expected to deal with “*two-dimensional* and *three-dimensional*” situations. This activity has a potential to stimulate a mathematical discussion within an Arts and Culture classroom. Furthermore, in grade 9, this grade 8 LO is linked to LO’s 1, 3 and 4 in which learners are expected to deal with *Lines, Forms and Shapes as Art Elements* (Arts and Culture Grade 9 Learner’s Book, 2006). At this level, the activity incorporates a lot of mathematical concepts in a form of horizontal lines, vertical lines, diagonal lines, three-dimensional and two-dimensional shapes, the concept of a negative and a positive, etc. An Arts and Culture teacher is now faced with a challenge of having to display his or her mathematical expertise to the students. It becomes a matter of concern how Arts and Culture teachers will leave up to this new pedagogical challenge, hence the aim of this study was to establish how the Arts and Culture teachers deal with these challenges.

### **1.3 Significance of the study**

The researcher believed that this research will be of extreme significance to the entire educational system. The impression was that this research will provide a yardstick measure to evaluate the progress made in terms of realizing the envisaged goals of success regarding integrated teaching and learning. The results of this study are likely to heighten awareness regarding the actual challenges that the teachers are facing in their bid to enact the visions and goals of the new curriculum. This should research should provide realization that attaining the desired outcomes of the new curriculum requires a concerted effort from all stake holders, and teachers need to be supported continuously and be properly orientated in terms of knowledge and learning and teaching resources.

#### **1.4 Research questions**

From the preceding discussions it is noted that Arts and Culture teachers are faced with a pedagogical challenge of having to incorporate mathematics into their lessons. This realization continues to emphasize the fact that there are quite a number of instances in which Arts and Culture, as subject, tries to speak to mathematics. However, such is a major concern: *Will the Arts and Culture teachers be in a position to realize these opportunities to link Arts and Culture with mathematics? How do these teachers embrace these new pedagogical challenges and opportunities?* This study should provide answers to questions such as these. Answers to these questions were obtained through an empirical investigation of the following research questions:

- What are the mathematical demands of an Arts and Culture curriculum at grade 9 level?
- Within the context of a new curriculum (Revised National Curriculum Statement), what connections does an Arts and Culture teacher make between mathematical concepts in Arts and Culture topic?

#### **1.5 Researcher's understanding of integration**

As already alluded, integration was at the heart of this study. The researcher needed to investigate how teachers integrated across subjects, and to achieve this, the researcher needed to initially provide a framework of reference for the study. The researcher's understanding and position on integration was paramount for this purpose, because it would serve as a basis of judgement. The researcher began from the premise that integration is interpreted in different ways (Davison et. al., 1995). The researcher's understanding of integration had been influenced by the definition provided by Banks (1993), in Davison et. al., 1995, in which he describes it as:

The extent to which teacher uses examples, data, and information from a variety of disciplines and cultures to illustrate the key concepts, principles, generalizations, and theories in their subject areas or disciplines. (p. 227)

This definition (Banks, 1993) was found to be compatible with generally perceived views on integration. From this background the thought of another question: *What does the integration of mathematics in other subjects mean?* When the researcher read through a Revised Curriculum Statement (RNCS) Grades R-9 for Mathematics (2003), the following description was found:

When mathematics is integrated in other Learning Areas (subjects), mathematics becomes a tool for exploring and understanding aspects of other Learning Areas. (p. 25)

Within the context of these guidelines, the researcher attempted to observe how an Arts and Culture teacher realized and embraced opportunities to utilize mathematics as a tool in his or her subject (Arts and Culture). For instance when a certain topic in Arts and Culture demands that a concept of ‘lines’ be explored in an Arts and Culture class, how does an Arts and Culture teacher uses mathematics to explain and illustrate terms such as “straight line”, “parallel lines”, “diagonals”, etc.?

### **1.6 Concerns and weaknesses of the study**

One of the emerging issues in this study was the realization that people understand, and possibly apply, integration differently (Davison et. al., 1995). Given this background, the researcher had to explore questions such as: Does an Arts and Culture educator share the researcher’s definition of integration? How do Arts and Culture teachers forge connections between mathematics and Arts and Culture? Do they do it as the researcher would expect? Questions such as these became even more important in view of what the theory of *Situated Learning* (to be discussed later) suggests about the learning and developmental processes. This theory presupposes that one learns differently in different situations and contexts (Lave and Wenger, 1991).

The other concern was that the Arts and Culture Policy Documents (Arts and Culture National Curriculum Statement Grades R-9, 2003) do not come up clearly on how



mathematics should be integrated into Arts and Culture. For instance, Arts and Culture policy document states:

Teachers must therefore be aware of and look for opportunities for integration both within and across Learning Areas. (p. 6)

From this background the researcher felt that one could conclude that it is left at the teacher's own peril to decide on how to implement integration. What if the teacher does not see any need to incorporate mathematics into his or her lesson? What if the teacher decides to deal with the situation differently, not in a manner that would allow one to see and observe mathematics "*coming alive*", or being incorporated in Arts and Culture? This study provided the researcher with an opportunity to address some of these issues.

The other issue was in line with variations in terms of defining mathematical concepts. What an Arts and Culture teacher could be considering to be mathematics could differ from what mathematicians (or mathematics education researchers) regard as mathematics. So what the researcher conceive to be mathematics could not necessary be what the Arts and Culture teacher observe (in practice) as mathematics. This was identified as a possible tension that would likely come up in this research, so the researched provided a description of mathematics or a mathematical concept, from a researcher's perspective.

### **1.7 Data collection**

For this study data was collected through the following instruments and techniques, and in the order that follows. Two grade 9 Arts and Culture teachers were given certain concepts from which they were supposed to construct concept maps (to be discussed later). This concept map activity was followed by interviews to teachers, however, one grade 9 mathematics teacher was also drawn into these interviews when she was also asked to comment on an Arts and Culture activity in which mathematics was embedded. The two Arts and Culture teachers were also asked to comment on this activity. Data was also collected through an overview analysis of an Arts and

Culture grade 9 curriculum document. These processes occurred similarly at two levels of the study, namely, during the piloting stage and also during the actual (main) study stage.

### **1.7.1 Concept maps**

As already explained, teachers had to construct concept maps from a few concepts which had been drawn from an Arts and Culture grade 9 textbook, which was a prescribed textbook in the school in which both teachers were teaching. These concepts maps served as the point of departure for the study as the subsequent interviews were constructed around them.

### **1.7.2 Interviews**

After the concept mapping activities teachers were interviewed on their earlier responses to the concept mapping activities. These interviews were conducted separately and independently. As already explained, one grade 9 mathematics teacher was interviewed on an Arts and Culture activity that had mathematical concepts embedded in it. This was done with a purpose to get views from two perspectives, mathematics and Arts and Culture.

### **1.7.3 Document analysis**

Regarding the second research question, which posed a question on the levels of mathematical demands in a grade 9 Arts and Culture curriculum, the researcher opted to go through a Departmental (DoE) curriculum document. To collect this data the researcher compiled a checklist (to be discussed later) which served as a lens for document analysis. This process was also essential as it shed light in terms of ascertaining levels and degrees of Departmental expectations regarding integration.

## **1.8 Organisation of the study**

This report has been organised in the following manner. Chapter one provides an outline of a summarised report on a contextual background of the study. To a larger extent, this chapter is a preview of some of the subsequent chapters of this report. Chapter two presents a report on the literature that was explored with the view to

shape this study. It is also in this chapter where theoretical perspectives and conceptual constructs that framed this study are outlined and substantially elaborated on. The rationale and justifications for using these frameworks are also provided in this chapter. Chapter three reflects on the methodology and the design for the study. It is also in this chapter where data collecting techniques are elaborated on. The two stages of data collection, the pilot and the actual study stages, are also discussed in this chapter. Analysis and interpretation of the data form part of a larger discussion in chapter four. Data has been presented and interpreted within the context of the adopted theoretical disposition. It is at this stage of the report where all theoretical frameworks that were adopted for this study become visible. The final chapter, chapter five, is a culmination of the study in which all the research findings are discussed and relevant conclusions drawn. It is also in this chapter where recommendations for teaching practice, for the curriculum and for future research are made.

## **CHAPTER 2: Literature review and theoretical framework**

### **2.1 Introduction**

For this study a number of research studies conducted in the past was reviewed. This process was necessary as it provided the researcher with valuable information on issues that related to the study. The review was mainly designed to accomplish the following research goals: (i) to trace any historical connections between mathematics and Arts and Culture; (ii) to identify the gap between what had been accomplished, in terms of research work, and what was still out there to be explored; and also; (iii) to allow the previous studies to shape the position and location of my study theoretically and methodologically.

### **2.2 Connections between mathematics and Arts and Culture**

Some researchers have argued that there is a historical lineage of connection between mathematics and Arts and Culture (Beckmann, Michelsen and Sriraman, 2005). Arfaei, Hart, Kaplan, Moody and Sarhangi (2005), reporting on the “Renaissance Banff”, a four-day conference on mathematics and its connections to art, music and science held in Banff Centre in Canada in 2005, have provided numerous examples that have pointed to a link between the two disciplines, mathematics and Arts and Culture. For instance, they have cited that ‘in antiquity and during the era of Islamic art, artists regularly used mathematical ideas in creating new art and architecture, and the results were often of exquisite beauty’ (p. 1). They substantiate on this assertion by providing yet another example drawn from the European renaissance era. They can be quoted as having said that ‘during the European Renaissance, art, mathematics, architecture, science, and music flourished seamlessly side by side’. (p. 1)

Now the inevitable question to ask is as follows: How was this connection compromised and eventually lost, as it seems to be the case now? Arfaei et. al., (2005) provide an explanation in this regard, and they respond:

Over the centuries this unity of purpose and thought was lost as disciplines became more specialized and their internal language became more technical. (p. 2)

This is a sad state of affairs. However, the new curriculum, with integration as its cornerstone, provides us with an opportunity to restore links across disciplines. To achieve this teachers should be positioned in a manner that will make them realize these exciting opportunities of teaching their subjects within the context of others, for instance, teaching mathematics within the context of visual art. This move could yield positive educational outcomes, which could see learners improving their grades in those areas of mathematics that are generally perceived to be abstract, like geometry.

The first level of van Hiele's framework (section 2.5.2) of learner's educational development deals with visualization as a significant level for progress in understanding geometry. Visual art can provide fascinating experiences in a mathematics class, which could play a role in easing tension that is normally associated with the teaching of mathematics, particularly geometry. Grayfer (2005), in Beckmann, Michelsen and Sriraman (2005) noted:

Since art classes usually serve as an enjoyable learning experience for the students, it can be assumed that combining art with mathematics should cause the students to feel more positive towards the study of mathematics. (p. 6)

This can be illustrated by some of the beautiful artworks which were presented at the "Renaissance Banff" conference. Figure 1 in the next page shows artworks of Gerda de Vries and Bradford Hansen Smith. Gerda de Vries, whose wonderful quilts were based on abstract geometric designs, acknowledged that 'my quilts reflect a structured approach to design, and are the brainchild of someone who has little choice but to think mathematically'. (p. 5)

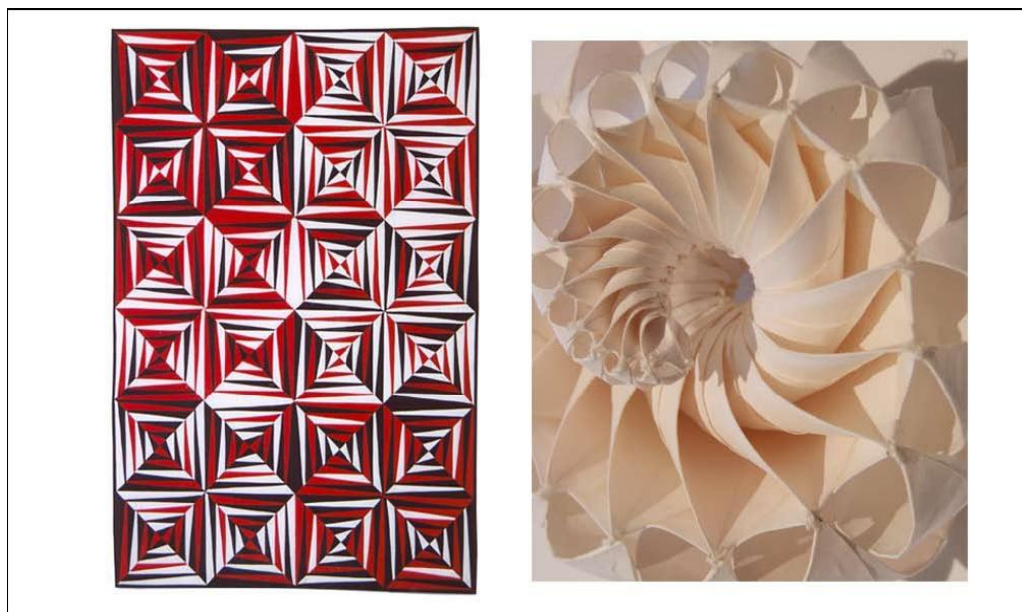


Figure 1: Quilts by Gerda de Vries; paper spiral by Bradford Hansen Smith.

This is a good case of how connections can be forged between mathematics and Arts and Culture. Actually these connections seem to be natural, as can be observed in another example of Irene Rousseau and Mary William's tessellations. Irene Rousseau's work of art and design has been described as 'a revelation of an artist who is bridging the disciplines of art and mathematics with beautiful mosaic wall sculptures that are based on tessellated patterns from hyperbolic geometry' (Arfaei et. al., 2005:5), see the diagram below.



Figure 2: Two hyperbolic tessellations: Irene Rousseau and Mary Williams.

From this background it seems that connections between mathematics and Arts and Culture are natural and inextricable. It seems that art is a derivative of mathematics. It would then be fascinating to expose Arts and Culture teachers to this form of knowledge and experience. Their exposure would enhance their desire to forge connections between their subject, Arts and Culture, and mathematics.

### **2.3 Identifying the gap**

From the beginning of literature review, the researcher realized that most of the articles reviewed on integration seemed to place more attention on the integration of mathematics and science (Berlin and White, 1994; Huntley, 1999; Hurley, 2001; Lyublinskaya, 2006). It was observed that there was very little amount of research work reported and documented on the integration of mathematics with other subjects, such as Arts and Culture, which was the focus of the study. For instance, Huntley's (1999) study explored, both theoretically and empirically, how teachers integrated mathematics and science in their teaching. Davison et. al., (1995) reported on what it means to integrate mathematics and science. It emerged from this background that much of the focus had been placed on the integration of mathematics and science.

Having said that most of the literature reviewed on integration placed much focus on the integration of mathematics and science, it also emerged that the amount of research work done on the integration of mathematics and science is relatively small. In this respect, Huntley (1999) noted that the territory of research on educational integrated teaching and learning is still 'largely unexplored'. Berlin (1991) also concurred with Huntley (1999) that there is very little research work that has been undertaken on the notion of integration. Their studies suggested that there was a huge gap on research in the area of integration that needed to be engaged with, empirically. This is in addition to the unavailability of a common definition for integration (Czerniak et. al., 1999).

Findings from previous related research work provided a framework to anticipate how the current study would take its shape. For instance, Huntley (1999) reported that

‘although some activities provided opportunities for development of both mathematical and scientific content, this potential was never realized’ (p. 64).

These findings (Huntley, 1999) were seen to be linking to the second research question, in which the objective was to explore types of connections Arts and Culture teachers make between selected concepts in mathematics and concepts in an Arts and Culture topic. Based on this research question the researcher needed to establish whether Arts and Culture teachers were able to realize opportunities to incorporate mathematics into their lessons.

#### **2.4 Positioning the study theoretically and methodologically**

Huntley (1999) used ‘a qualitative mode of inquiry emphasizing description, induction, grounded theory, and the study of people’s understanding’ (p.60). The theoretical constructs and analytical tools employed by Huntley were amongst those that the researcher considered for this study. The researcher also used interviewing as a ‘data elicitation technique’ (Breakwell, 1995:231), which was found to be largely used by most researchers.

Adler’s et. al., (2000) paper, which focuses on ‘integration within and across mathematics’, was also considered to be a key paper for this study. The paper is based on the three stories, two of which involved two teachers who seem to be grappling with the notion of integration in their classroom teaching. The first teacher, Mrs Shongwe (pseudonym), who is an experienced grade 7 mathematics teacher is depicted as presenting a mathematics lesson (activity) in which students were supposed to collect, categorize and count the garbage collected. This activity would later be followed by the construction of a graph depicting the data collected. The objective of the activity was to integrate mathematics with the out-of-school context. Although Mrs Shongwe started her lesson (activity) quite well, it later occurred that the lack of knowledge, ‘the status of knowledge’ (Adler et. al., 2000), on the part of the teacher threatened the success of the lesson. At a point where both the teacher and the students could not classify ‘a polystyrene plate’ as either a paper or a plastic, they then resorted to voting methods in search for an appropriate answer. However, voting



is not a reliable method for seeking correct responses. Adler et. al. questioned the authenticity of such a procedure. However, this procedure resulted from the lack of knowledge on the part of the teacher. Against this background, Adler et. al. argue that for integration to be successful, both the teacher's knowledge of the subject and the teacher's wider knowledge are significant.

Adler et. al., (2000) used the theory of situated learning to argue that 'the notion of transfer of knowledge across contexts of use (learning) needs to be explored in greater depth and not simply taken as a given' (p. 11). They argued that the view that integration of mathematics across the curriculum is not feasible from either a practical or a theoretical point of view. Adler et. al.'s paper was relevant to this study as it focused on integration, and that it was also located within the theory of situated learning. They used this theory and support the notion that knowledge transfer from one context of learning to the other is potentially problematic. In this study the researcher also used the theory of situated learning to explain why teachers experience difficulties in their attempts to transfer content knowledge from one subject field (context) to the other.

As noted earlier, Huntley (1999), Czerniak et. al., (1999) and Hurley (2001) placed their focus on the integration of mathematics and science. However, Czerniak et. al., (1999) also raised a concern that 'there is little evidence that an integrated curriculum is any more effective' (p. 425). They also raised the issue of teacher knowledge, arguing that teachers 'are certified to or licensed in specific disciplines and, therefore, do not possess knowledge to integrate'. They further acknowledge that 'inadequate teacher preparation for integration' (p. 427) poses a threat to the success of integrated teaching and learning. These issues also emerged during the course of this study. Arts and Culture teachers who participated in this study also raised similar concerns that they did not have the mathematics knowledge that is critically significant to facilitate links between Arts & Culture and mathematics. Acknowledgement by Czerniak et. al. that there is little evidence to suggest that 'curriculum integration is a better way to provide instruction' (p. 427), seems to agree with the situated view that knowledge transfer is problematic.

Huntley (1999), whose paper is based on theoretical and empirical investigation of integrated teaching involving mathematics and science, also argue that ‘teachers with limited understanding of mathematics have limited capacity for making deep connections between the disciplines during classroom instruction’ (p. 64). This view was also compatible with the observations the researcher made in this study. Grade 9 Arts and Culture teachers also indicated that their inability to make connections between their subject (Arts and Culture) and mathematics was mainly due to their limited knowledge of mathematics. Huntley’s paper was based on a case study that involved four mathematics teachers who were teaching in a middle school. The teachers taught at the middle school level, and their goal of instruction was ‘to dissolve the disciplinary boundaries between mathematics and science’ (p. 60). Although the participants were mathematics teachers, they were described as having ‘limited mathematics coursework’ (p. 61). Based on the classroom observations, Huntley found that (i) there were no activities in which the goal was learning new material from both mathematics and science; (ii) some activities provided opportunities for development of both mathematics and science content, this potential was never realized.

Huntley argued that ‘a contributing factor to the absence of strong connections between the disciplines during these activities’ could have been due to the teachers’ ‘limited coursework in mathematics and science beyond high school’ (p. 64). Huntley concluded that, ‘a teacher’s capacity to capitalize on the many connections between mathematics and science – the ability to make integrated lessons more powerful than separate instruction in mathematics and science – depends on the teacher’s mathematics and science content knowledge’ (p. 64). From these observations Huntley suggested that there is ‘a gap between integrated instruction in theory and practice’ (p. 65).

As pointed out earlier on, these issues, as revealed by Huntley in his paper, also emerged in this study. Grade 9 Arts and Culture teachers kept on mentioning the lack of mathematical knowledge as hindering their desire to forge connections between Arts and Culture and mathematics. However, interaction with the teachers also revealed that they were, in some instances, reluctant to incorporate some of their

acquired integration knowledge in their classroom practice. Hence the researcher also observed a gap between an idealized curriculum and the realized curriculum as suggested by Huntley.

## **2.5 The theoretical framework for the study**

The purpose of this section is to unpack some of the theoretical frameworks that the researcher used in shaping this study, and also in the analysis of the data. As noted earlier, this study was framed within the theory of ‘situated learning’ (Lave and Wenger, 1991). The researcher used this theory in analysing and interpreting the data that had been collected from teachers. Van Hiele’s theoretical framework was also seen to be useful in helping the researcher to provide a justification for encouraging connections between mathematics and Arts and Culture. Bernstein’s theoretical concepts of classification and framing, were also used in the study, as they are often cited as useful analytical tools in discussions relating to integrated curricula.

### **2.5.1 Theory of situated learning**

Situated theory is founded on the premise that knowledge is situated, and is a product of the activity, context, and culture in which it is developed and used (Brown, Collins and Duguid, 1989). I realized that situated, in this instance, should not be construed as implying “*in some location*” or “*involving people*”. Proponents of this theory believe that knowledge is not necessarily situated or located in textbooks but rather in communities that share common practices and activity. Hence learning is achieved through participation, however, learning is not necessarily participation. Communities participate differently, they engage in different activities of learning. This would also suggest that one learns differently in different situations, so learning is situated within a context.

According to Brown et. al., (1989), these communities have a prescribed culture of doing which emanates from their contextual backgrounds in which they exist. Knowledge is then gained or given meaning through participation in such communities, and would be relational to the context in which it is gained and developed. Brown et. al. argue that meaning is inherited from the context of use. The

key issue here is that the '*development of knowledge is situated within a context*', that is, the development and formation of identity are both tied to the setting in which they are acquired (Adler et. al., 2000). Adler et. al. use this notion to argue that transferring knowledge from one setting (context) to another is always problematic. They have noted that 'knowledge and skills cannot be neatly lifted out of one setting and imported ready-to-use into a new setting' (p.11).

The researcher found these views on situated learning relevant to this study, particularly in view of what is revealed regarding the notion of '*activity, culture and context*'. This led to the constructing of the following conceptual diagram regarding the theory of situated learning, which the researcher also use to explain the problematic nature of negotiating meaning across different fields of learning. See the diagram on the next page.

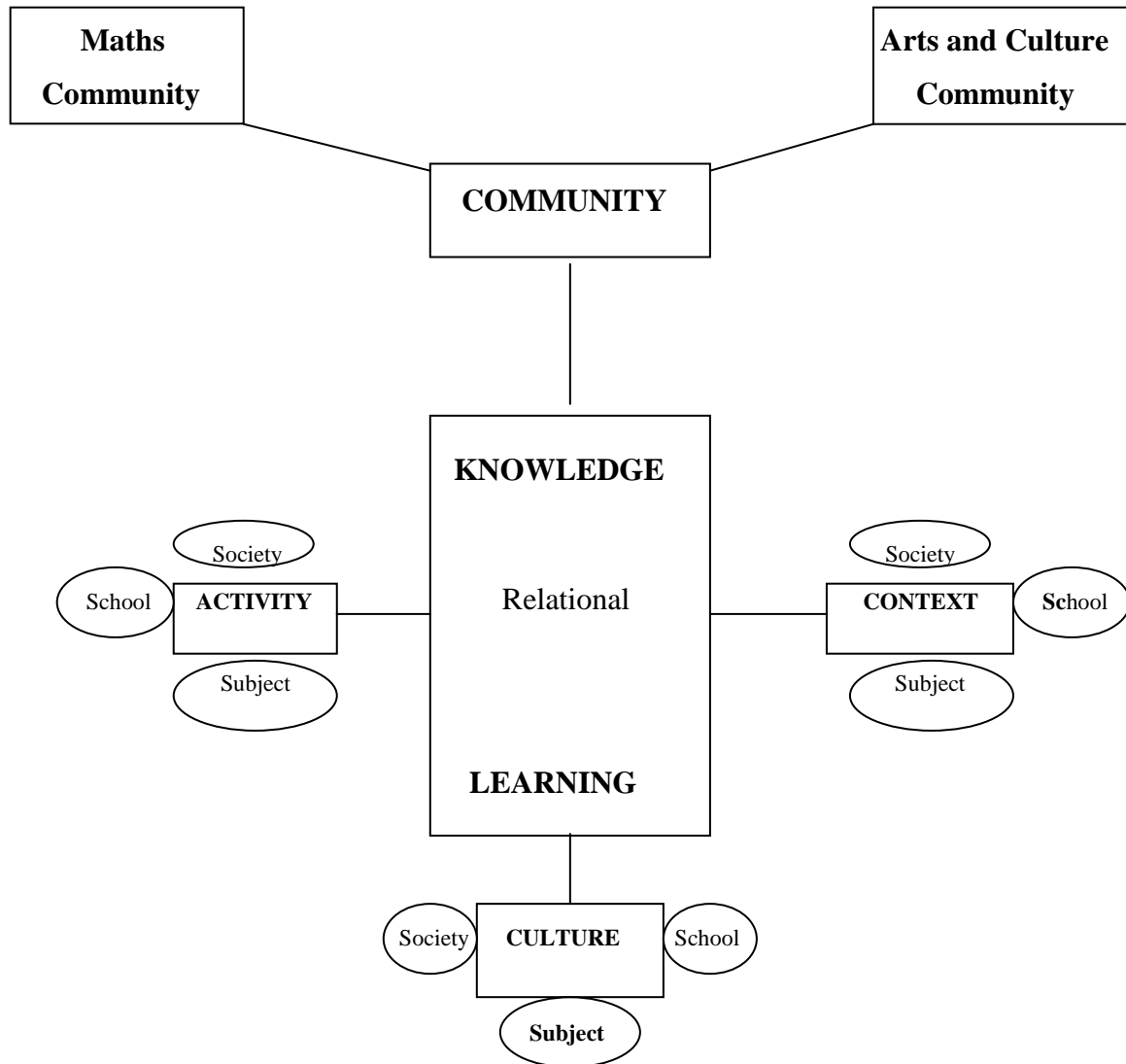


Figure 3: Situated theory within a school and subject contexts.

Figure 3 on the depicts situated theory within the context of the school and that of a subject. If we regard each subject as providing its own learning context, imposing its own teaching and learning culture, and also conducting its own learning activities, it can be explained why it would then be problematic to negotiate meaning across different fields of learning, each of which constitutes a relatively different teaching and learning context. In this study the researcher viewed mathematics and Arts and Culture as presenting different contexts for teaching and learning, which therefore

means that teaching and learning, and hence the development of knowledge, can take place in different forms within these relatively distinct contexts.

It is the goal of integration to encourage teachers to apply same knowledge in different settings (subjects), particularly when they have to deal with parallel concepts across learning fields. The researcher used situated theory to argue that the process of transferring knowledge across subjects or contexts of learning would be problematic, as also argued by Adler et. al., (2000). How one conceives and embeds concepts from one discipline to another depends on one's understanding of the possibilities of connections that are available. Such a conception is likely to be subjective and highly dependent on the nature of the contexts involved. This problem is also compounded by the fact that teachers were trained within the context of their subjects, and this form of training inhibits any pedagogical attempt to navigate freely across different learning fields. At the beginning of this study the researcher was keen to observe how Arts and Culture teachers make this navigation between Arts and Culture and mathematics.

### **2.5.2 Van Hiele's framework**

The van Hiele's theory supports the notion that the learner's progress and development in geometry depend on the way in which he is taught. This theory, which is named after two former high school mathematics teachers in the late 1950's, Dina van Hiele and Pierre van Hiele, is founded on the belief that students progress through various levels as they deal with geometrical or spatial concepts. The theory has established five levels of thought when students deal with geometrical problems. These levels are: visualization; analysis; informal deduction; deduction; and rigor.

For the purpose of this study the researcher only focused on the first level (level 0), namely, visualization. This theory claims that the success of instruction at this level depends on visual representations presented to the student. For instance, if a physical structure of a rectangle is given to the students, they can relate it to a familiar shape like a door (Malloy, 2002). At this level students can manipulate physical models, build geometric structures and draw diagrams. All these activities relate to visual art. From this level students can progress to higher levels. Through these differentiated

methods of instruction, van Hiele's theory argues that the student can progress successfully in the comprehension of geometrical concepts. In relation to this study this theory was used to achieve the following research objective: to strengthen the researcher's claim that visualization, as an aspect of art, is a necessary learning tool as it facilitates learning and comprehension of abstract mathematical concepts. Learners usually grapple with spatial concepts of mathematics, however, through visual representation of these concepts comprehension can be enhanced and facilitated.

Some of the previous studies have attested to this claim. Stapleton (2008) conducted a four-year study which was based on the assumption that 'elementary students in socio-economically deprived settings, who exhibited minimal success in standardized testing situations, would benefit academically from exposure to community arts and cultural programming integrated into the curriculum' (p. 1). Three elementary schools from Dallas participated in this study. One school, Rosemont Elementary (Stapleton, 2008), was provided with a 'significant community arts and cultural programming' (p. 1) which was fully integrated into the core curriculum. The second school benefited from these resources without integrating them, and the third school had no community arts or cultural programming at all (Stapleton). By the third year of the study, the results proved that teachers from Rosemont Elementary 'had the skills and knowledge needed to integrate the community arts and cultural programming' (p. 1). Teachers from this school successfully integrated arts in mathematics, for instance, as Stapleton noted, 'second-grade students used dance to learn basic geometric shapes' (p. 1), and 'fifth-grade students simulated and described the path of sound waves' (p. 1). When the study was concluded in 2007, three schools showed significant differences in students' levels of achievement. The Rosemont School 'maintained dramatically higher average scores than the other two schools' (p. 2) and the assessment report provided concluded that 'the results of this study overwhelming support the premise that integrating community arts programming into the classroom enhances learning' (p. 2). The study was concluded with a recommendation to train teachers for integration as it was noted that 'with teachers trained in the techniques of incorporating arts programming into the core curriculum, art becomes a vital tool in increasing a child's understanding and academic achievement' (p. 2), as suggested in van Hiele's theory.

Nutter (2007), who reported on the mayor's plan to 'promote Arts and Culture in Philadelphia' (p. 1), has acknowledged that 'Philadelphia should support arts and culture and weave them into as many areas of civic life as possible' (p. 2). Nutter noted that 'the lack of arts education in public schools is a particular weakness' (p. 2), and further acknowledged that 'arts education can enhance learning on other subjects, such as math' (p. 3). Similar views had earlier been echoed by Catterall, Chapleau and Iwanaga (1999), who also acknowledged that 'students with high involvement in the arts, across the socio-economic strata, performed better in school and stayed in school longer than students with low involvement' (p. 6). The Arts-Connection project (Hefferen, 2005) worked with 120 New York City public schools in programs that included dance, the visual arts, theatre, and music, in over four years. The purpose of this project was to 'see if classrooms with the strongest arts programming and the most evidence of cognitive, social, and personal development also showed evidence of potential gains in academic areas' (p. 34). In his extensive analysis of qualitative as well as quantitative data, Hefferen reported that 'cognitive skills such as creativity, elaboration, originality, and the ability to conceive of multiple ways of representing a problem were all enhanced by the experience with the arts' (p. 36).

From these contributions one realizes the benefits of incorporating subjects such as Arts and Culture into mathematics. The researcher has used van Hiele's theory to highlight the need to encourage differentiated teaching and learning at schools. This theory, as already mentioned, advocates the notion that students learn better when methods of instruction are varied, a view that is also advocated in integrated teaching and learning. Indeed, integrated teaching and learning can provide ideal opportunities for students to interact with concepts drawn from different contexts.

### **2.5.3 Bernstein's theoretical constructs**

Bernstein (1982) talks about two key concepts, namely classification and framing, which are useful tools for the analysis of any curriculum that an education system is offering. Classification is defined as 'the degree of boundary maintenance between contents' (Bernstein 1982:159). At school level, this could refer to the extent at which subjects relate (speak) to each other, that is, how they integrate. Graven (2002) has contributed on this definition with a further illustration that classification does not



simply refer to what is classified but also to the relations between these areas of learning. The idea of integration is strongly advocated in the new curriculum, as suggested by an Arts and Culture RNCS Document (2003): ‘Integrated learning is central to outcomes-based education’ (p. 6). In terms of Bernstein’s notion of classification this is viewed as an attempt to weaken classification between subjects, as opposed to previously stronger classifications between subjects.

Framing, on the other hand, is described as the form (structure) of the context in which knowledge is transmitted and received by learners (Bernstein, 1982). A closer look at this definition suggests that framing deals with issues of control, that is, who controls what? It is about control over the selection of the communication; its sequencing; its pacing; the criterion; and the social base. When the learner (acquirer) has more control over issues such as pacing, social base (learner determining context of discourse), the framing is said to be weak. When the teacher (transmitter) enjoys more control over selection, sequence, pacing, etc., framing is said to be stronger, as it used to be the case with the traditional version of the curriculum.

The researcher has used Bernstein’s theoretical constructs to explain certain aspects of integrated teaching curriculum. These theoretical concepts were mainly used in the section where the researcher discusses the findings of the research. Like Adler, et. al., (2000) the researcher has also used Bernstein’s notion of classification and framing to explore integration, within the context of a new curriculum. Also drawn in the discussion were Bernstein’s (1982) concepts of ‘recognition and realization rules’ as elaborated in the section that follows.

#### **2.5.3.1 Recognition rule**

Bernstein (1996) defines recognition rule as an intuitive rule that enables one to recognize ‘the speciality of the context’ (Bernstein, 1996) or being able to identify the demands of the situation or context. This, in simple terms, would refer to the ability to produce desirable responses in an evaluative setting, like a school. Bernstein refers to this process as the ability to produce ‘a legitimate text’, what is pedagogically desirable to be an expectable form of response. Those that are engaged in a similar

pedagogic discourse should share the same *recognition rule* for a pedagogic communication to be effective. This should be possible even if participants come from different contextual backgrounds.

#### **2.5.3.2 Realization rule**

The realization rule is about: (i) how we put meaning together to create a ‘legitimate text’ (Bernstein, 1996); (ii) the ability to produce legitimate communication; (iii) the ability to produce or speak the expected legitimate text. However, Bernstein argues that being able to communicate or speak the legitimate text requires a code, a ‘legitimate pedagogic code’. Students need to share the same pedagogic code in order to produce a common ‘legitimate text’. In this study the researcher has used these rules to highlight the issue of intuitive codes that are developed and assigned to forms of knowledge that are located in different fields of learning. Each time we are called upon to react to a particular form of knowledge in a specified field of learning, these intuitive codes are thought to be at play, and consequently influence the extent to which we recognize the knowledge presented to us at that moment in time. However, the situated theory (Levy and Wenger) would also argue that these codes would be developed differently in different fields of learning, and as such, forms of knowledge would be recognized and realized differently in different learning fields, thus making the transfer of knowledge or negotiation of meaning across learning fields problematic (Adler et. al., 2000).

## **CHAPTER 3: Research design and methodology**

### **3.1 Introduction**

This study was conducted as a qualitative descriptive case study, in which two grade 9 Arts and Culture teachers were the primary participants. Another grade 9 mathematics teacher participated in the study. Two other grade 9 Arts and Culture teachers participated in the pilot study. The two Arts and Culture teachers who participated in the main study were selected on the following basis that they were the two Arts and Culture master teachers within the General Education Training (GET) phase, that is, grades 8 and 9, in the school. They were quite familiar with OBE style of teaching. They were the two of the only three teachers that were offering Arts and Culture within the school and had attended various workshops and meetings on Arts and Culture. Each of these teachers had more than fifteen years teaching experience, hence they were not only well versed with grade 9 Arts and Culture curriculum but were also quite familiar with traditional styles of classroom instruction.

The researcher interviewed teachers using semi-structured and structured interviews. The construction of the interview questions was influenced by guidelines from Frankel and Wallen (1990), Neuman (1994) and Breakwell (1995), however, this process was mainly influenced by both the research questions and research goals (Hatch, 2002). Guided by the post-positivist approach (Hatch), the researcher personally collected the data and posed as an instrument of data collection (Hatch), a feature that is regarded as characteristic in a qualitative research. After the collection of data the researcher relied on 'typological' methods to analyse it (section 5.7.2.2). Typological analysis involves 'a process of dividing the data into categories on the basis of some canon for disaggregating the whole phenomenon under study' (Hatch, 2002:152). These typologies were constructed from the interview questions, which had been formulated from both the research questions as well as research goals (section 3.6).

### 3.2 Why a qualitative study

Hatch (2002) draws a clear distinction between a qualitative and a quantitative study. Hatch's discussions on the 'characteristic qualities that distinguish qualitative work from other research approaches' (p. 6) were helpful and served as a guideline for making a decision to follow the qualitative route. On this aspect, Hatch listed few defining features that are regarded as inherently infused to a qualitative research. Some of these included one's (researcher) immersion to a *natural setting*, being considerate of *participant's perspective*, gaining *centrality of meaning* for each individual engaged in the research, and so on. This study was observed to be continually depicting similar features, and that it was inevitably playing itself out as qualitatively. As the researcher was planning to involve real people (teachers) in their real setting (classroom/school), the researcher was now able to realize that these attributes were closely linked to a qualitative make-up of a research study.

During the interviews, the researcher encouraged teachers to behave naturally and honestly. It was realized this aspect would be very critical in optimising the level of accuracy in data collection. To achieve this, the researcher engaged with teachers (participants) and provided them with detailed information in relation to the research. The researcher openly declared the intentions of the research to the teachers right from the onset; the researcher felt it would be necessary to explain to the teachers why the research would be conducted and the significance of their involvement in it. The researcher pleaded with the participants to act with honesty and accountability as this would assist to produce results that would be valid and reliable. The researcher also realized that teachers needed to be made aware that the existing personal and professional relationships between the researcher and them would not jeopardize or impact on their participation in the research.

Triangulation was also considered in this study. Triangulation is 'the way of using more than one method (instrument) to verify the authenticity of the data collected and data analysis' (Hitchcock and Hughes, 1995: 324). To a certain extent, this was also achieved through a piloted process, in which the results were constantly compared with those of the main study. The two sets of results, from the piloted and the main studies, showed consistency that confirmed their authenticity and validity. At another

level of this aspect, teachers (participants) were given an opportunity to verify the authenticity of the interviewing process. The audio-recorded interviews were taken back to the teachers in order to verify the plausibility of these results. This provided teachers with an opportunity to have a say in the study, that is, to have their perspective represented (Hatch, 2002). Together with the teachers we listened to the recorded interviews and the teachers were able to acknowledge the authenticity of the interviews, they verified and acknowledged the originality of the material as well as the sources.

### **3.3 Why a case study**

This was a study at Masters level, with time constraints imposing their own implicit challenges on it. As a practicing teacher, the researcher did the study on a part time basis, which created a lot of tension between the studies and the researcher's professional duties. Time was not on side of the researcher, and this meant that the researcher had to confine the dimensions of this study within manageable means. The researcher had to be reasonable and realistic, not being too ambitious, in terms of deciding on the methodological aspects of the research. Firstly, the researcher needed to ensure that the study would be 'doable', that is, it would be possible to achieve all the research goals of the study within a limited time frame. That is when the idea of a case study was considered.

Hitchcock et. al., (1995) provided the researcher with an in-depth descriptive account of what entails a case study research. They described it as 'the collection and presentation of detailed, relatively unstructured information from a range of sources about a particular individual, group, or institution, usually including the accounts of the subjects themselves' (p.318).

Phrases like '*small scale study*', '*concentration upon a particular incident*', '*examination of a single instance*', etc., have always been linked to a case study. The researcher found these aspects of a case study resonating with this study and also responding positively to relative research circumstances that characterized this study. The goal was to keep the study within manageable means, not allowing it to spiral out

of proportions. This meant that the researcher needed to tailor certain aspects of the study and establish a definite focus of purpose. The researcher needed to conduct a small-scale study and also focus on a particular aspect of the study, which in this study was integration. Integration provided empirical field within which the study would be conducted.

Yin (1984), in Hitchcock et. al., (1995: 321) identified three distinct types of case studies, namely, exploratory, descriptive and explanatory. Among these the researcher found a descriptive case study more compatible with this study. As the researcher intended to provide a narrative report of the findings of my study, it was realized that a descriptive approach would provide mechanism to achieve this. Descriptive case studies are aimed at giving a narrative account of life as it is in a social situation; they are high in detail, as argued by Yin (1984).

The research goals and questions of the study also played a part in the methodological choice of the study. Envisaged responses to the research questions necessitated the use of a case study approach. As the needed to interact extensively with the informants, in order to collect the data, the case study would make this possible as it provides opportunities for an ideal one-on-one interaction. In this case study three teachers were involved, however, only two were the primary participants (section 3.1). The researcher worked with them independently but within the same school context. The researcher felt it would be appropriate to interact with teachers within the confines of their working environments, as this would generate a conducive environment as they draw from their teaching experiences. Hitchcock et. al., (1995) have noted that doing a case study is ‘the most appropriate format and orientation for school-based research’ (p. 316). It provides one with an opportunity to use a sample, which in this study was a team of three teachers, ‘as a representative of a large kind’ (p. 316). Involving the three teachers in this study allowed the researcher to collect in-depth information that provided meaningful responses to the research questions.

### 3.4 The concept map

This study was initiated on a concept mapping activity to which two grade 9 Arts and Culture teachers responded (appendix I). The following concepts were drawn from a grade 9 Arts and Culture textbook, Millennium Arts and Culture Grade 9 Learner's Book: *angle; area; colour; dance; design; dimension; melody; parallel; pattern; percentage; positive*. The textbook from which these concepts had been drawn happened to be the prescribed textbook for the school in which the participating teachers (in the main study) were working. The researcher started by going through the textbook, the goal of which was to identify concepts which had mathematics embedded in them, that is, concepts which were seen to be running parallel between mathematics and Arts and Culture. It was quite fascinating to realize that there was an abundance of such concepts drawn from an Arts and Culture textbook, concepts that would likely encourage connections between Arts and Culture and mathematics. For instance, within the concept of music, the researcher noted that the notion of fractions inevitably emerged.

There were quite a handful of such integrating themes within the Arts and Culture curriculum. However, the researcher was keen to observe how Arts and Culture teachers would react to such themes and concepts; did they recognize them as integrating themes or concepts? What was their conceptual response to these themes and concepts, particularly within the context of integrated teaching and learning? That is when the idea of a 'concept map' was considered. The researcher had to select, randomly and also intentionally, some of the concepts that would assist the researcher towards evaluating teachers' awareness of integrating opportunities that were presented to them by the new curriculum. The concept mapping activity became a preferred option to initiate the study. However, the next question was: *Why does the researcher has to achieve this through a concept mapping activity?* This led the researcher to yet another aspect of this study, the researcher had to evaluate the relevance of the notion of a '*concept map*' in this study. Above it all, the researcher realized it was also imperative to also consider the implications of using such a tool in pursuing the envisaged research goals.

According to Bolte (1999), concept maps can be defined as graphical representations linking related concepts to form chains of relationships. Novak (1984) has concurred with this notion and has indicated that concept maps have been ‘developed specifically to tap into a learner’s cognitive structure and to externalize, for both the learner and the teacher to see, what the learner already knows’ (p. 40). From these definitions the researcher realized that a concept map can be used as a valuable tool to trace kinds of cognitive connections that one can construct on relative concepts or subjects of knowledge. The benefits of using concept maps have been largely documented. Some of the benefits are that concepts maps are quicker, more direct and considerably less verbal (Dunstone and White, 1992). In line with Bolte (1999), concept maps can be helpful in providing the required insight into the degree of connectedness of one’s knowledge with respect to the given subject. However, the downside of using a concept map as a data elicitation tool should also be considered. Allchin (2002), in Mwakapenda, 2004 has cited some of the weaknesses in using this tool. Allchin has argued that concept maps are ‘inherently selective. They can only represent selectively, based on the mapmaker’s purpose’ (p. 146).

These views helped the researcher to realize that there was a need to consider other complementary tools like an interview, which could help the researcher to ‘press and probe’ (Brodie, 2004) teachers for greater clarity. According to Brodie, pressing and probing are useful tools to push interviewees for ‘more on their ideas’ (p. 5). This allows the interviewees ‘to clarify, justify or explain more clearly’ (p. 5). Concept maps only reflect on ideas in a graphic form, the verbal interaction between a researcher and a participant could be missing. The participant might not be available for clarification on a constructed concept map, which could lead the researcher to arrive at the conclusions that might misrepresent the participant’s perspective (Hatch, 2002). In view of these considerations the researcher came to the conclusion that interviews would be a better option to supplement the concept mapping activity.

The researcher also explored the possibility that teachers who were supposed to take part in the concept mapping activity could be naïve on the use of concept maps in demonstrating their knowledge. This presented another dimension in this study where the researcher was called upon to probe teachers on their knowledge and



understanding around the notion of concept mapping. The researcher discovered that teachers were acquainted with the idea of concept mapping, however, it was not a common feature of their classroom practice. When this issue was ultimately resolved, teachers started working on their concept mapping activity. The concept mapping activity given to teachers was such that they had to identifying concepts that they would perceived as “pure Arts and Culture”, “pure mathematics”, and those that would be perceived as “integrating between Arts and Culture and mathematics”. The word “pure” here was meant to imply “non-involvement/ interaction” or “non-integration” of one subject or concept with another, not connecting entirely or relating to another subject. If a certain concept, for instance, was perceived to be “pure mathematics” with respect to Arts and Culture, it would mean that the concept would not allow its integration to Arts and Culture, or visa versa. That was the contextual meaning of the word, “pure”, which the researcher presumably shared with teachers, however this assumption was further evaluated through subsequent interviews. The interviews revealed that this assumption were accurate.

### **3.5 Reliability and validity**

Reliability is defined as the way of obtaining similar results under the same conditions (Maxwell, 1992). As the researcher relied mainly on concept mapping activity and interviewing for data elicitation, there was a need to evaluate the reliability of these instruments. The researcher constantly interrogated the instruments’ ability to produce the same results if they were to be administered on a different set of teachers who were also teaching grade 9 Arts and Culture, perhaps in a different school environment. That is when the issue of piloting was also considered; it served the purpose of addressing such a critical issue of the reliability around research instruments. In section 3.8 the issue of piloting is explored in depth, as it also formed a significant component of this study.

Validity, on the other hand, is a way of getting the intended or accurate results (Maxwell, 1992). In simple terms, this means the two instruments of data collection had to be evaluated on their potential to produce the intended research results. The results obtained through these instruments were supposed to directly respond to the

research questions as well as the research objectives if they were to be deemed valid, that is, the results have managed to assist the researcher to achieve the anticipated research goals and objectives. However, the intriguing question was: In which way would this be feasible, how would the researcher ensure the validity of the data collecting instruments? The researcher achieved this through ensuring that each question, which was asked in the interview, was directly linked to either the research questions or research goals. Table 3.1 can be helpful in providing information on how the interview questions were constructed from research questions and objectives, and how subsequent typologies were also established. All it meant was that none of the research questions would be haphazardly compiled and articulated, every question had to be carefully constructed and in cases where it became evident that the intended response was not being provided, a follow-up question (probing) was opted to an extent where the informant provided the desired response. This process ensured the validity in the data collecting instruments, particularly the interviews.

### **3.6 Interviews**

The interviews were a derivative of the concept mapping activities. They happened to be the major data-collecting instruments for this study. As the researcher has already indicated in the preceding discussions, aspects of reliability and validity came to play at this stage of the research, there was a need to ensure that the respondents would be positioned in a manner that would encourage them to provide accurate and intended responses to questions posed (Breakwell, 1995). The researcher needed to come upfront in terms of providing necessary details of the study to the participating teachers. The researcher knew all the participants on a personal level, however, there was a need to unpack the researcher's identity as a researcher. As was illustrated in section 3.2, teachers were requested to act with honesty, to provide genuine responses and also to act naturally. Two grade 9 Arts and Culture teachers were interviewed in the main component of the study, and only one grade 9 Arts and Culture teacher was interviewed at the piloting stage (section 3.8). As earlier indicated, different teachers were involved in both stages and these interviews were conducted independently.

In each of the stages, pilot and main, a grade 9 mathematics teacher was also engaged in the study in a form of providing a comment regarding an activity which had been taken from a grade 9 Arts and Culture textbook (appendix II). This activity had mathematical concepts embedded on it, as a result, the researcher was keen to observe how a mathematics teacher would expect students to respond to such an activity, within the context of an Arts and Culture classroom. This teacher needed to indicate how she thought the infusion of a mathematical concept in the Arts and Culture activity would influence students' responses to the activity. This teacher provided *only* that comment. Drawing from a situated perspective, the teacher's comments would help the researcher to observe how a teacher who happened to be coming from a different contextual background, mathematics, would conceive and interpret this activity. It would be fascinating to observe how teachers from two different learning fields (contexts) would look at the same learning situation from their different perspectives.

Table 3.1 below provides insight on how the interview questions were constructed. As could be observed from the table, the interview questions were not constructed in isolation, rather, they were derived from the research questions as well as the research goals and objectives. The table also reflects on typologies, which were used as categories of data analysis (section 3.1 and 5.7.2.2). Table 3.1 was arranged in such a way that each research question or research goal gave rise to a number of possible interview questions which subsequently yielded typologies. For instance, research question 1 in the table below, gave rise to seven possible interview questions (1.1 to 1.7), so the research question 2 or the research objective 2 would give possible interview questions from 2.1 onwards, and so forth. If, for instance, a possible research question created a typology, the researcher would then name the typology in line with the possible interview question from which it originated. If a research objective 2.1 created only one typology, the researcher subsequently named the typology 2.1.1. However, if this research objective created two typologies, the resulting typologies would be named 2.1.1 and 2.1.2 respectively. This format of numbering was followed in the table below (table 1), and should be used for further interpretation of the table's content.

Research aim/objective	Focus of interview question	Resulting Typology
1. Explore connections between Arts and Culture and mathematics.	1.1 Teacher's views and perceptions on integration. 1.2 Teacher's understanding of integration. 1.3 Teacher's meaning of AC-MAT <sup>1</sup> integration. 1.4 Does teacher recognize opportunities for integration? 1.5 How does teacher plan for integration? 1.6 What happens if a teacher encounters an unfamiliar MAT concept? 1.7 What happens if MAT concept comes up unintentionally in class?	1.1.1 Positive/ Negative on integration. 1.2.1 Has definition for integration. 1.3.1 Understands/ Does not understand AC-MAT connections. 1.4.1 Aware/ Not aware of integrating opportunities. 1.5.1 Plans/ No plan for integration. 1.6.1 Relies on colleagues/students/research. 1.7.1 Ignores MAT/allows discussion/ prohibits discussion.
2. To highlight new pedagogical challenges for teachers.	2.1 Teacher's reaction to integrated teaching. 2.2 Meanings attached to integration. 2.3 Teacher's readiness towards integration. 2.4 Teacher's level of MAT knowledge.	2.1.1 Positive/ Negative/ Attends workshops/Reluctant. 2.2.1 Good approach/ Bad. 2.3.1 Ready/ Not ready. 2.4.1 Little/ Average/ Low.
3. To evaluate progress on integrated teaching.	3.1 Teacher's view on progress made on integration. 3.2 What are the critical factors for success? 3.3 How often does a teacher integrate?	3.1.1 Progressive/ Stagnant. 3.2.1 Determining Factors. 3.3.1 Often/ Seldom on integration.
4. Heightening awareness of a gap between anticipated and intended curricula.	4.1 What does curriculum documents say on integration, generally and AC-MAT? 4.2 What is the extent of document's explicitness on integration? 4.3 Teachers' and teacher's response to departmental guidelines on integration? 4.4 Are the goals and objectives of	4.1.1 Comments on integration/ None. 4.2.1 Explicit/ Moderate/ Vague. 4.3.1 Positive/ Negative/ No guidelines. 4.4.1 Yes/ No.

<sup>1</sup> AC in this instance refers to Arts and Culture and MAT to mathematics. The use of these acronyms in the chapters and sections that follow carry the same meaning.

	integrated teaching achievable?	
5. Highlight need to train teachers.	5.1 Teacher's views on teacher training on integration. 5.2 What is the missing link? 5.3 For AC teacher to infuse MAT in her subject, what is needed?	5.1.1 Well trained/ Ill trained/ Not trained. 5.2.1 Way-forward. 5.3.1 Suggestions.

Table 3.1 The relationship between research questions (objectives), interview questions and typologies.

This format of question construction ensured that the researcher maintained internal consistency amongst the respondents. This was made possible because each question had originated from either a research question or a research goal, without necessarily favouring a particular participant. This process ensured that all participants were subjected to similar interview questions. There were of course instances where questions were personalized, perhaps as a result of previously offered responses by the participants, however, this did not threaten consistency which the researcher intended to achieve. All questions had to be responded to within the context of their initially structured questions. This made the interviews to be semi-structured (Breakwell, 1995) to a certain extent. Unclear questions were rephrased, hence teachers were able to respond to all interview questions. All interviews were conducted after the school's contact time and teachers were interviewed separately.

### 3.7 Analytical tool

Besides the concept mapping activity and subsequent interviews, the researcher also decided to look into certain aspects of the grade 9 Arts and Culture curriculum. This meant that the researcher had to interrogate the Department of Education's Curriculum Document for grade 9 Arts and Culture. The purpose of this exercise was to try and evaluate the extent to which the notion of integration was explicitly being explored in the grade 9 Arts and Culture curriculum. This investigation was necessary as it provided insight on the extent in which grade 9 Arts and Culture teachers were encouraged on integrated teaching. Findings of this investigation also helped the researcher to measure the level of mathematical demands that the grade 9 Arts and

Culture curriculum imposed on Arts and Culture teachers and students, as was investigated by the second research question of this study. On another level, this analysis helped the researcher to evaluate the level of the willingness of the Department of Education to provide support and guidance to teachers on the issue of integration.

To be able to conduct these analytical investigations the researcher designed an analytical tool that served as a checklist in my investigation of the content of the Arts and Culture curriculum document. This tool is represented in table 3.2 below. The phrase ‘AC-Real life’ in table 3.2 refers to the integration of Arts and Culture (AC) with the real world (Real). Data collected from this investigation formed part of a discussion in the next chapters.

Aspect of focus	Page	I N T E G R A T I O N				Implicit	Explicit
		Within	Across	AC-Real life	Not specific		
1. Talks about integration.							
2. Encourages integration.							
3. Guidelines on integration.							
4. Supports teachers on integration.							
<b>Percentage Per Integration Type</b>		.....%	.....%	.....%	.....%		
<b>Implicit/ Explicit Percentage</b>							

Table 3.2: Analytical tool used to analyse the grade 9 Arts and Culture Curriculum Document.

It is important to illustrate how this table was interpreted in order to collect data from the curriculum document. The researcher used the term “implicit” to imply a situation in which the actual word “integration” was not directly used in a particular sentence, however, one would be able to get the sense that the sentence used in the document referred to integration. In this instance it would not be quite obvious right away that

the content of the sentence was in actual fact referring to integration. This can be observed from the following sentence extracted from the document:

....when planning, different context and local realities, like the needs of the community, school and learners, will be considered. (p. 2)

As can be noticed, this sentence subtle as it speaks about the integration of a subject with the outside world, but this might not be quite obvious. The researcher regarded such cases as representing “implicit” integration. The researcher would then classify the quoted sentence above under “AC-Real life” and “implicit”. The term “explicit”, on the other hand, referred to a situation in which the term integration was vividly and explicitly used in the sentence.

In the next chapter, in which table 3.2 had been completed, the researcher used codes to describe the findings. These codes have been explained in order to achieve commonality of understanding towards the interpretation of the findings. For instance, under the column “within” of table 4.1 in chapter 4 “AC-AC” would imply integration within Arts and Culture as a subject. Under the “across” column, one could possibly have AC-subject, referring to the integration of Arts and Culture with any other subject except mathematics, and AC-MAT which would refer to Arts and Culture integration with mathematics. “AC-real life”, as already explained, would refer to the integration of Arts and Culture with real life. Under the “not specific” column, one would possibly have the following descriptors: “subject-subject” (integration not involving Arts and Culture or mathematics, rather other subjects), “school-life” (school and real life integration) or just “general” (not quite specific to any of the cases of integration mentioned above).

The second question of the study dealt with the issue regarding the level of mathematical demands within a grade 9 Arts and Culture curriculum. The results from table 3.2 were able to help the researcher to ascertain that aspect. The results obtained from table 3.2 have been analysed and interpreted in section 5.4 of chapter 5. From the “within” column, the researcher observed the number of instances the “AC-MAT” connection occurred, and looking at this against the total number of the “within’s” in

this column, the researcher was able to determine the AC-MAT percentage of occurrences. This percentage reflected the implicit mathematical demands and expectations within the Arts and Culture curriculum. To validate these empirical findings the researcher designed yet another tool (table 3.3) which would address this issue extensively and specifically. The researcher took all the AC-MAT connections that had been identified from the Arts and Culture curriculum document and traced a mathematical concept to which each AC-MAT connection was linked. The researcher then evaluated the level of a mathematical demand that each AC-MAT connection was imposing on Arts and Culture teachers and students. The context with which each AC-MAT had been presented in the curriculum document would help the researcher to determine this aspect, see table 3.3 below.

AC-MAT (page)	MAT Topic/ Theme Covered	Level of MAT Competency (High; Average; Low)

Table 3.3: Evaluative tool for mathematical demands in the grade 9 Arts and Culture curriculum.

The completed versions of tables 3.2 and 3.3 have been included in chapter 4 and their subsequent data are interpreted in chapter 5.

### 3.8 Piloting

Piloting or pre-testing (Breakwell, 1995) is a necessary feature of any research study. It also entails its own logistics and dynamics that are worth documenting in this report. Getting teachers into participating in the pilot study was also met with various challenges. This process had to happen at a time when teachers, actually all civil servants, were fresh from a four-week industrial action, hence most teachers were still very angry with the employer (Department of Education) as they felt that their demands for better living wages had not been acceded to.



Firstly, they had resolved that they would not cooperate with the employer, or engage in any activity that they perceived as advancing the interests of the employer. Secondly, some of the teachers felt they needed to embark on catch-up programmes as they realized they had wasted a lot of time, they would then allow no one to take away their valuable teaching time. The researcher had to deal with these challenges. Some teachers were sceptical and reluctant to involve themselves in this research, some perceived it as a government (employer) thing. Some felt they would not have time for a pilot research. This meant the researcher had to clarify some of the following issues regarding the study, the researcher's identity, who the researcher was in terms of research and professionally, and mainly, the purpose of the study. Some of the teachers finally agreed to involve themselves in the study, and the concerned parties agreed that all research activities would take place outside the teaching time. The agreement was that all research activities would take place between 14H00 and 15H00. The researcher managed to involve three grade 9 Arts and Culture teachers and one grade 9 mathematics teacher. This sample was representative of the sample that the researcher intended to use in the main study.

The aspects of the research, which were subjected to the piloting process, were the concept mapping activities, teachers' comments on an Arts and Culture activity and the interviews. The purpose was to interview all three Arts and Culture teachers, however due to time constraints during the pilot study, only one teacher was interviewed (appendix XI). Data analysis also draws from this interview, but mainly from teachers' concept maps. Two of the teachers, teacher 1 and teacher 3, worked in the same school and were teaching Arts and Culture on a fulltime basis. Each one had teaching experience of fifteen years or more. Both teachers were quite familiar with both versions of the curricula, the traditional and the new revised curriculum. All teachers, including teacher 2, acknowledged that they had attended OBE training workshops arranged by the Department of Education (DoE) and, at other times, by the non-governmental organizations (NGO). Teacher 2 worked in a different school, and had only one grade 9 Arts and Culture class. Due to these constraints, most of the data was collected from teacher 1 and teacher 3, and only teacher 3 was subsequently interviewed. The grade 9 mathematics teacher was working in the same school as teacher 2.

It must be noted that the main purpose of a piloted study was to evaluate, mainly, the reliability and validity of the selected instruments (section 3.5). This stage would also help the researcher to identify shortcomings regarding research methodology and work towards rectifying timeously. Data collected from the piloted study also proved to be plausible with other studies, it was in line with the results obtained from previously conducted studies. This made the researcher to realize that the study was not an isolated case.

## **CHAPTER 4: Data collection**

### **4.1 Introduction**

It was mentioned in the previous sections that the data was collected by means of four methods or tools. These were listed as '*Document Analysis*', '*Concept Mapping Activity*', '*Teachers' Comments*' and '*Interviews*'. In chapter 3 it was also illustrated how each of these tools would be administered, both on teachers and also on the Departmental (DoE) document, in order to collect data. Therefore, the purpose of this chapter is not only to illustrate how data was collected but also to present the collected data. The next chapter, chapter 5, provides a report that focuses on the analysis and interpretation of the results.

### **4.2 Ethical considerations**

Consent forms were immediately issued to all those that would be taking part in or be affected by my research work, namely, Gauteng Department of Education (GDE), school principals and teachers. The content and the language used in the consent letters to all the affected parties were straightforward and precise, providing all the information concerning the study. Same letters (with same content) were sent to teachers to maintain consistency across everyone. The letters were not written in a manner that would compel the intended research participants to comply with the request, the letters were democratic, reserving a room for refusal to participate, and with no penalty or ill-feelings regarding that decision.

All questions that arose from the consent forms and letters were dealt with thoroughly and precisely. The researcher continually emphasized that everyone would be given a fair chance to choose whether to participate or not to participate in the study and that there would be no special incentives or rewards for those that would eventually affirm their participation, and also that there would be no ill-feelings for non-participation. Teachers would not make decisions on the basis of sympathy towards the researcher,

they needed to make a decision that would make them happy. The researcher also assured the participants that in cases where audio-recordings would be taking place, participants would be assured of anonymity, privacy and the destruction of the material that would have been used during the course of the research. The researcher also planned to be upfront in terms of unpacking all the essential aspects of the research. The researcher's identity was fully disclosed, particularly as a researcher. The objectives of the study were also advanced to the intended participants. The purpose behind this gesture was to earn trust from those that would eventually participate in the study.

All of this was done after the University Ethical Committee had granted permission for the research to proceed. Separate consent forms and letters for interviews and recordings were given to the participants (teachers). All of these delicate stages were finally followed by the data collecting stages. It has already been indicated that data was collected in four distinct methods, namely, document analysis, concept mapping activity, interviews and teachers' comments. There was only a single phase for document analysis process, however the other data-collecting processes occurred at two levels, namely, the piloting stage and also when the main study finally took off.

#### **4.3 Document analysis**

In section 3.7 a reported was presented on the two analytical tools (tables 3.2 and 3.3) which were utilized in evaluating certain aspects of the grade 9 Arts and Culture curriculum document. The following document was analysed: *Arts and Culture, Teacher's Guide for the Development of Learning Programmes, Revised National Curriculum Statement Grades R-9, (2003)*. As the caption of the document suggests, the objective of this document was to provide guidance to teachers in terms of assisting teachers to develop learning programmes that would facilitate and enhance the actual implementation of integrated teaching, as envisaged by the new curriculum. So it would be proper to interact with such a document, as it would be in a position share light on the extent to which the idea of integrated teaching is advocated in the Arts and Culture curriculum. When the document was interrogated, the researcher aimed to find out whether the document: (i) talks about integration; (ii) encourages

integration; (iii) provides guidelines on integration; (iv) supports teachers on integration.

A separate checklist for each area of focus (see tables 4.1 to 4.4) was designed, however, it turned out that most of the data was generated from the first area of focus, namely, '*talk about integration*', as can be observed from table 4.1 below. Within this first area of focus the researcher's evaluation focused on two aspects, namely, 'the type<sup>2</sup> of integration' and the nature of integration in terms of it being 'implicit' or 'explicit' (section 3.7). It should also be noted that the focus of the whole study was on AC-MAT integration, however, other forms of integration, AC-AC, AC-subject and AC-life, were also explored and this was necessary, primarily because these other forms of integration would present a context around which the researcher could make comparison process feasible. With the presence of other forms of integration the researcher was able to establish the 'percentages of the occurrence' for each of the integration type. The percentage of occurrence obtained for AC-MAT integration was compared with percentages obtained in other integration types. This helped the researcher to determine the extent to which Arts and Culture demonstrated willingness to infuse mathematics in its curriculum. High percentages would suggest greater willingness by the document to infuse mathematics in its curriculum, and visa versa.

The issue of 'implicitness' and 'explicitness' of AC-MAT connections was given further attention. This was an issue of paramount significance, as the researcher needed to evaluate the manner and the extent to which the AC-MAT connections were advocated in the Arts and Culture curriculum. For instance, if the AC-MAT connection was seen to be explicitly articulated in the document, it would be relatively possible to trace a mathematical concept that would need to be addressed in that AC-MAT connection and thus be in a position to determine the level of a mathematical demand (table 3.3) that AC-MAT imposes on a teacher. The following table reflects on the findings of the first aspect of focus.

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<sup>2</sup> In section 3.7 the acronyms AC-AC, AC-MAT, AC-subject and AC-life were given meanings. In all chapters I have allowed the acronyms to preserve these meanings.

**Aspect of focus:** Talks about integration (comments on integration).

Page	I N T E G R A T I O N				Implicit	Explicit
	Within	Across	AC-real	not specific		
2				general	√	
2	AC-AC				√	
2	AC-AC					√
2			AC-life			√
3	AC-AC					√
3			AC-life		√	
3	AC-AC					√
3			AC-life		√	
3	AC-AC					√
4	AC-AC					√
4		AC-subject				√
4	AC-AC					√
4			AC-life		√	
4	AC-AC					√
5	AC-AC				√	
6				general		√
6				general		√
7				general	√	
8				general		√
10			AC-life		√	
11	AC-AC					√
12		AC-subject				√
13			AC-life		√	
16	AC-AC					√
16	AC-AC					√
20		AC-MAT			√	
20		AC-MAT			√	
20		AC-MAT			√	
20		AC-MAT			√	
20		AC-MAT			√	
21	AC-AC					√
22	AC-AC					√
23	AC-AC					√
23		AC-MAT			√	
23	AC-AC					√
23	AC-AC				√	
23			AC-life			√
25			AC-life			√

Page	Within	Across	AC-real	not specific	Implicit	Explicit
25		AC-MAT			√	
25		AC-MAT			√	
26				general		√
26		AC-MAT			√	
29		AC-MAT			√	
30		AC-MAT				√
32	AC-AC					√
32	AC-AC					√
33	AC-AC					√
35	AC-AC					√
35	AC-AC				√	
36		AC-subject				√
36		AC-subject			√	
36	AC-AC					√
36		AC-MAT				√
38				general		√
38	AC-AC					√
39		AC-subject				√
44		AC-MAT			√	
45	AC-AC					√
45	AC-AC					√
47	AC-AC					√
53	AC-AC					√
56			AC-life		√	
56			AC-life			√
57		AC-MAT			√	
57	AC-AC					√
57				general		√
58	AC-AC					√
58				general		√
58	AC-AC					√
58	AC-AC					√
61	AC-AC					√
<b>Percentage of occurrence</b>	<b>46%</b>	<b>27%</b>	<b>14%</b>	<b>13%</b>		

Table 4.1: Data collected for the first aspect of focus.

It can be realized that AC-MAT connections, which were the focus of this study, constituted 27% of the entire percentage distribution. The two tables below, tables 4.1.1 and 4.1.2, are helpful in simplifying the findings and also to explain how percentages such as 27% were obtained in table 4.1 above.

Integration type	Number of occurrences	Percentage of occurrences
AC-AC	33	46%
AC-subject	05	7%
AC-MAT <sup>3</sup>	14	20%
AC-real	10	14%
General	09	13%
<b>Total number of occurrences</b>	<b>71</b>	<b>100%</b>

Table 4.1.1: Types of connections depicted on the grade 9 Arts and Culture curriculum document and the ratio of their occurrences.

The preceding table 4.1.1 was able to help to split the 27%, which had been obtained from table 4.1, into further 20% for AC-MAT and 7% for AC-subject. 20% of AC-MAT connection seemed to suggest that this type of connection was well advocated in the Arts and Culture curriculum, it seemed there was a gesture of willingness by Arts and Culture curriculum to incorporate mathematics into its curriculum. Was this the case? This question captured the researcher's attention, and was answered when AC-MAT was singled out and critically analysed. The following table, table 4.1.2, illustrates how this was achieved through the analysis of the "implicit" and "explicit" columns for AC-MAT connections. The researcher looked at "implicit" as referring to a subtle or unintentional mention of a type of connection, without providing clarity on the connection. On the other hand, "explicit" was construed as referring to the clarity of purpose to encourage the suggested type of connection. Using this as a frame of reference was helpful in terms of collecting the necessary information on the Arts and Culture document's position to encourage the infusion of mathematics in its curriculum. Table 4.1.2 on the next page provides summarized information in this regard.

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<sup>3</sup> AC-MAT was at the heart of this study; hence much focus was paid on AC-MAT data.



	Implicit	Explicit
Number of occurrences	12	2
% of occurrences	86%	14%

Table 4.1.2: AC-MAT connections.

It was interesting to observe that although AC-MAT connections had claimed 20% from the entire integration forms in the grade 9 Arts and Culture curriculum, with further examination, this proved to be a mere subtle (implicit) demonstration of integration, as suggested by table 4.1.2 above. There were only two instances where the document explicitly reflected on AC-MAT connection. This was quite disturbing in view of the discussions raised around a historical connection between these two subjects (section 2.2). These findings, and their implications, have been discussed thoroughly in chapter 5.

Table 4.2 below presents the findings on the second aspect of research focus, namely, ‘guidelines on integration’. Again, exploring this area of focus was essential for this research because indications in this regard would reflect on the ways in which teachers positioned themselves on integrated teaching. The rationale was that if guidelines for teachers were not explicit, it would then be ambitious to expect them to know exactly what to do in their classrooms. Certainly, the manner in which teachers are guided on curriculum delivery is bound to mould their teaching strategies. If, for instance, teachers are poorly guided, they might resort to teaching techniques that might defeat the goals and visions of integrated teaching. So, the manner in which teachers are guided or socialized on their teaching strategies, will, to a certain extent, influence *how* they perform their roles as curriculum implementers. The first research question aimed to investigate *how* teachers performed their essential roles as the implementers of the new curriculum, the focus of which is integration. It was in this background that the researcher perceived the second area of focus as a relevant component of the study, and the results from this investigation are depicted in table 4.2 on the next page.

**Area of focus:** Guidelines on integration.

Page	I N T E G R A T I O N				Implicit	Explicit
	within	Across	AC-real	not specific		
3	AC-AC					√
4				general	√	
6				general		√
12		AC-subject			√	
36		AC-subject			√	

Table 4.2: Document's guidelines to Arts and Culture teachers on integration.

The next area of focus was in connection with the document's teacher-support on integration. This also turned out to be a critical area for the study. The researcher argued that if the curriculum document demonstrated explicit eagerness to support teachers on new strategies regarding integrated teaching, then the content of the document would be expected to demonstrate these intentions very explicitly. The researcher further argued that if the curriculum designers provided adequate support and expected guidance to teachers, such as those of Arts and Culture, then the expectation to integrate Arts and Culture with mathematics would be justified. Table 4.3 below reflects on the findings of this investigation.

**Area of focus:** Supports teachers on integration.

Page	I N T E G R A T I O N				Implicit	Explicit
	within	Across	AC-real	not specific		
3		AC-subject			√	
11	AC-AC				√	
12		AC-subject			√	

Table 4.3: Document's teacher-support on integration.

The final area of exploration was the focus on the document's tendency or willingness to encourage teachers to integrate. Indeed, this was yet another avenue of exploration that could provide the researcher with valuable information in terms of looking at the gap between theory and practice. The researcher needed to make a comparison between the document's expectations of curriculum delivery, and the actual

realization of this aspect at classroom level. In terms of the document's support to teachers, this meant that the researcher needed to investigate how or in which way the document articulated its intentions to encourage teachers to incorporate the notion of integration in their teaching styles. Comparing the results of this aspect with those obtained in other tables would assist the researcher to comment on 'what is expected' and 'what is realized' in terms of the new curriculum.

What was striking, as illustrated in table 4.4 below, was that it became clear that the document continuously encouraged Arts and Culture teachers to integrate in their teaching practice. This was quite explicit as could be observed from table 4.4 below. However, the researcher argued, it was one thing to 'encourage' someone to do something, and another to show him how to do it, perhaps in terms of providing visible support (table 4.3) and effective guidance (table 4.4). It was at this stage of the document's analysis that the research became so interesting; the findings were consolidating each other. This aspect has been dealt with extensively in the next two chapters, chapter 5 and chapter 6. See the results of the fourth aspect of focus as reflected in table 4.4 on the next page.

**Area of focus:** Encourages integration.

Page	I N	T E G	R A T	I O N	Implicit	Explicit
	within	Across	AC-real	not specific		
2	AC-AC					√
2		AC-subject				√
3	AC-AC					√
3	AC-AC					√
4		AC-subject				√
4			AC-life			√
4				general		√
6				general		√
7				general		√
8				general		√
11	AC-AC					√
11				general		√
12		AC-subject				√
13			AC-life			√
21	AC-AC					√
23			AC-life			√
38				general		√

Table 4.4: Document's intentions to encourage teachers on integrated teaching.

Finally, the researcher turns attention to the tool which was used to determine the level of mathematics demand that the Arts and Culture curriculum imposes on Arts and Culture teachers. This area of focus responded directly to the first research question (RQ1). The question was; how would the researcher determine these levels of mathematical demands within the document analysed. The tables 4.1 to 4.4 were used for the purpose of gathering information in this regard, hence the information reflected in table 4.5 is informed by the information reflected on the previous tables, particularly table 4.1. The researcher focused on all the AC-MAT connections reflected on tables 4.1 to 4.2, however it was realized that all the AC-MAT that were reflected in tables 4.2 to 4.4 also featured in table 4.1, although they were assessed at different areas of focus in each of these tables. For instance, in table 4.2 the researcher realized that there was an AC-MAT connection (page 3) which had previously been featured in table 4.1. This narrowed the scope of analysis, the researcher eventually

focused on table 4.1, which was supposedly representative of all AC-MAT connections that had been drawn from the document.

The next step was to ascertain the level of mathematics that was embedded in these AC-MAT connections in table 4.1. The researcher also needed to come up with a tool or an instrument that would facilitate this process. Initially the researcher thought this process would mean the re-evaluation of the document, that is, going back to all the AC-MAT in the document and look at the mathematics that would be represented in each AC-MAT, and subsequently evaluate it. This process was deemed to be insignificant as the information in this regard had already been collected. From table 4.1, 14 instances where the document had reflected on AC-MAT connection (also see table 4.1.1) were realized, however, on further analysis of these AC-MAT connections it came out that almost all of them were “implicit” cases, and only one of them came out “explicitly”. To the researcher this was an issue that would have serious research implication. What “implicit” meant in this case was that the AC-MAT that is covered in the document does not spell out clearly that mathematics should be incorporated in it, that is, it would be the prerogative of an individual Arts and Culture teacher to recognise this or not. The following example clarifies this point.

On page 26 of the document there is an AC-MAT connection which was classified as “implicit”, and this is how this AC-MAT connection is captured in the document:

**Example:** ‘Redress **imbalances** caused by cultural intolerance.’ (p. 26)

The researcher believed that the term ‘balancing’, in the example above, had the potential to initiate a mathematical discussion, however, this was not quite eminent in this phrase. It is not a compelling phrase that insists on the inclusion of mathematics in the discussion, so the teachers would ‘apply their minds’ as the document openly puts it on page 11. In such instances the researcher concluded that there was no level of mathematics competency that was imposed on the Arts and Culture teacher. Most of the AC-MAT that were implicit in the document followed this pattern.

As already indicated, there were only two instances where the document explicitly reflected on AC-MAT. Only one example has been discussed to clarify this point.

**Example:** ‘Instead of 2-D art tasks such as painting and drawing, blind/ partially sighted learners may be able to sculpt clay models in 3-D.’ (p. 30)

The above activity was regarded to be quite explicit in its intentions to engage with mathematics. 2-D and 3-D are well known to be the topics in mathematics, and the teacher here would have to explain the notion of dimensions, using mathematics as a tool. Although the document does not directly refer teachers to mathematics, however, one realizes that the activity above is a compelling case; it encourages the involvement of mathematics. Again the explanations of 2-D and 3-D that would go along with this activity would not demand higher levels of mathematical competency.

#### **4.4 Two faces of the research**

As it was indicated earlier on, this study occurred at two levels, namely, the pilot stage and the stage at which the actual study was undertaken. Although the content of this report has focussed largely on the findings of the main study, the researcher also felt obliged to present a report on the findings and observations of the piloted study. Using tables of classification the researcher tried to classify teachers’ responses in respect of research questions and goals. All in all, three teachers were interviewed in the intermediate stages of this research, one during the pilot stage and the other two during the main study. In the sections that follow the researcher has only reflected on the set of data (interviews) that directly addressed the research questions and goals, however, the actual transcripts of these interviews are obtainable in appendices section. Each interview was preceded by a concept mapping activity, and these concept maps, from the three teachers, can be viewed in appendices section of this report.

#### **4.5 Concept maps**

Table 4.5 below contains a summary of the academic and teaching backgrounds of the teachers that took part in this study. The inclusion of this information was necessary in terms of arguing teacher-knowledge on newly adopted styles of teaching. The researcher also felt that this background would also provide a justification, not

necessarily to a greater degree, for the extent to which each teacher would go out to explore integrated teaching. The names used for all teachers in table 4.6 below are pseudonyms, however, all other information in this table is original. The researcher had earlier promised teachers that their actual identities would not be revealed; that information would be kept in the researcher's file.

<b>Teacher<sup>4</sup></b>	<b>Age</b>	<b>Research Stage</b>	<b>Qualifications<sup>5</sup></b>	<b>Teaching Experience</b>	<b>Years of teaching AC</b>	<b>Have attended OBE/NCS Training</b>
Mr Nkosi	45	Main	BEd	19	More than 5 years	Yes; Both
Mr Mokoena	41	Main	BA	16	More than 5 years	Yes; Both
Ms Sibanyoni	39	Pilot	STD	14	More than 5 years	Yes; Both
Mr Mahlangu	58	Pilot	PTC	23	More than 5 years	Yes; Both

Table 4.5: Participating teachers' background.

In section 3.4 a comprehensive account on how and why the concept mapping activity was administered in this study was provided. Firstly, the concept mapping activity was used with the purpose of initiating the study, however, this was a secondary goal, primarily concept mapping activity would serve as a research tool to tap into teachers' levels of awareness regarding integrating opportunities between their subject, Arts and Culture, and mathematics. This was the primary objective for employing this tool, to a certain extent, it also assisted the researcher to make an assessment on teachers' attitudes about integration, particularly that of mathematics and Arts and Culture.

This activity also precipitated the discussion around teacher knowledge, which is a key aspect of integration (Czerniak et. al., 1999). For instance, it was in the pilot stages of this research where the issue of teacher knowledge became topical. The two teachers who had participated in the concept mapping activity did not know that within a concept of 'melody', which relates to the field of music, there was a lot of mathematics involved in a form of fractions. This lack of knowledge revealed itself in

<sup>4</sup> Pseudonyms have been used for research purposes. Teachers' real names are in the research file.

<sup>5</sup> The acronyms for teachers' qualifications are explained in the 'Acronym Section', see Table of Contents.

the concept maps constructed by both Arts and Culture teachers, they classified ‘melody’ as a concept that was “pure Arts and Culture”, that is, as a non-integrating concept that was completely independent of mathematics. On further probing and pressing (Brodie, 2004) these teachers insisted that music and melody had no place in mathematics. This was quite an interesting observation to make in view of a known link between mathematics and music. For instance, Graumann (2005) has argued that:

..., the ancient theory of music can serve as a field of application for fractions as well. (p. 3)

The researcher thought this would be common knowledge to an Arts and Culture teacher, however, the research findings proved otherwise. This brings up the issue of teacher training and development which has been deliberated on extensively in the next two chapters.

On a positive note, the concept maps revealed that teachers had embraced the notion of integration. In almost all the diagrams (both from pilot and main studies), concepts had been clustered under the category “integration”. This was a revelation that teachers had finally acknowledged that integrated teaching had taken over from traditional styles of teachings. The activity had requested them to classify concepts into three categories, namely, “pure mathematics”, “pure Arts and Culture” and “integrating concepts”. As already indicated, most of the concepts had been placed under the “integrating concepts” category. This can be observed from one of the concept maps drawn by an Arts and Culture teacher during a pilot study, as illustrated in the diagram on the next page (figure 6). Other concepts maps constructed by other teachers have been included in the appendices section and their in-depth analysis and interpretation are covered in chapter 5 and chapter 6.



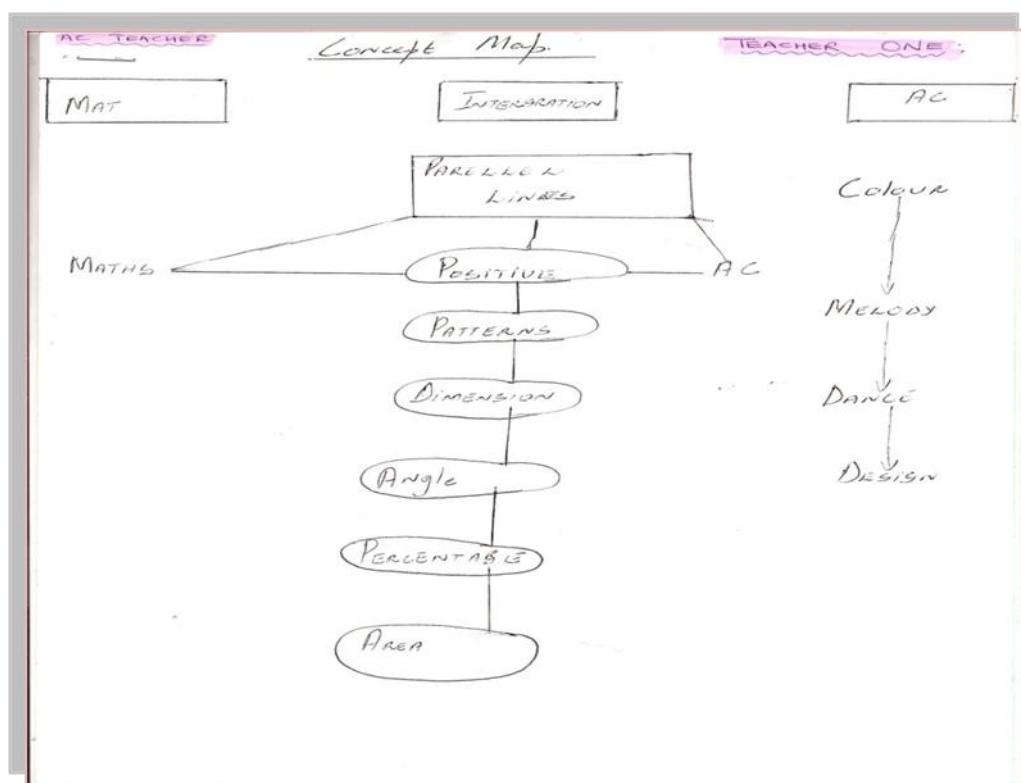


Figure 4: One of teachers' concept maps during the pilot study.

The concept map constructed by one of the teachers that participated in the main study was also worth noting (see the appendix section). This teacher's concept map was a diagram of someone who, he said, represented a teacher. The torso of the diagram's body had been divided into two parts that represented the "integration" and the "no integration" sections. All integrating concepts had been clustered in the head of the diagram, which, as he explained, 'our heads are full of new knowledge that we don't know', and in the hands the diagram was carrying both mathematics and Arts and Culture as subjects. Next to the head she had put the question marks which he explained as implying that 'we don't know much about this integration, we are confused'. When the researcher asked him about what was in the hands of this diagram he said, 'as teachers we find ourselves carrying all of these subjects, and I don't know,... for example sbali<sup>6</sup>, I don't know your maths, ....'. In the bottom part of the diagram the non-integration section was represented. This teacher had classified the concept "percentage" and "area" as only belonging to mathematics (pure

<sup>6</sup> The word is a Zulu word for 'brother-in-law', however, it is also loosely used as a reference to a friend in black South African townships.

mathematics) and the concept of a “pattern” as only belonging to Arts and Culture. These concepts had been placed at the bottom part of this teacher’s diagram and just at the feet of his diagram, where these concepts had been placed, there were two arrows which were pointing towards an exit. This, as the teacher explained, meant that the traditional styles of teaching were being done away with. Further engagement with the teacher shed more light and the researcher was able to determine the teacher’s views and attitudes on integration. This teacher’s diagram can be viewed in the appendices section. More analysis and interpretation on this teacher’s views and comments have been included in the next chapters.

#### **4.6 Interviews**

Interviews were the main instrument for data collection for this study. Three teachers<sup>7</sup> participated in the interviews, one from the piloted study (Ms Sibanyoni) and two from the main study (Mr Nkosi and Mr Mokoena); refer from table 4.5 for more information. The interview questions had been designed in such a way that they would address the research questions (section 1.4) as well as research objectives (section 1.2). As it was highlighted in chapter 1, this study was based on two research questions (RQ), which were underpinned by five research objectives (RO). This report has managed to illustrate how the research questions and research goals would be addressed and achieved during the course of the study. Table 4.7 on the next page provides a summarized version of each RQ and each RO, and the research instrument that was used to address and achieve them (RQs and ROs).

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<sup>7</sup> When referring to the teachers collectively, words like “teachers”, “participants” and “informants” have been used. Pseudonyms have been used when referring to a particular teacher or participant, however, in some instances a participant has been referred to as a teacher. In each of these instances the context of the comment or report has made it possible to identify the teacher under discussion.

Research Question/ Objective	Content of RQ or RO	How it was addressed/ achieved
RQ1	What are the mathematics demands in AC curriculum?	Document analysis.
RQ2	How AC teachers explored AC-MAT connections?	Teacher involvement.
RO1	Highlight pedagogical challenges for teachers.	Teacher involvement.
RO2	Evaluate progress made on AC-MAT integration.	Teacher involvement.
RO3	Highlight the existing gap between idealized and realized curricula.	Document analysis/Teacher involvement.
RO4	Raise issues of teacher training and incapacitation.	Teacher involvement.
RO5	Highlight the benefits of integrated teaching.	Literature/ Publications.

Table 4.6: The summary of research questions and objectives and how they were addressed.

It is important to refer to the table above because the interviews, as well as the typologies, had been formulated around these research questions and research objectives. In section 3.6, it was noted how the interview questions were constructed from the RQs and ROs (table 3.1).

Initially the researcher had contemplated using classroom teacher observation to supplement the interviews, especially when the researcher was thinking about addressing the first research question holistically, however, the researcher had to acknowledge that time would not permit this move. Finally, the researcher had to be content with the fact that the structure of the research would require that the interviews also be part of the study.

#### 4.6.1 Nature of interview questions

Interview questions had been prepared (structured) in advance (Breakwell, 1995), however, teachers were probed differently as a result of varying responses they provided. Probing was also done in such a way that it preserved the main focus of the question (table 3.1). Both structured and unstructured questions were used with a clear research goal in mind. Structured questions are interview questions that are prepared prior the interview session; they are fixed and rigid (Breakwell). These types of

questions have a benefit of preserving the intended goals of an interview, however, they might not necessarily address the actual realities that might surface during the course of an interview. Interviewees vary from one type to another, and this aspect of variety might demand that the interviewer loosen up some questions without necessarily throwing away their initially intended goals. That is where the unstructured interview questions come in, they serve a role of acknowledging and addressing variations amongst participants. Participants respond differently to a same question, and in such instances unstructured probing (Brodie, 2004) comes in. Cohen and Manion (1991) have also advised that if interviews are unstructured, they can allow the participant to be free and flexible. The researcher realized, especially from the teachers' concept maps, that the interviews would neither be structured nor unstructured, but would fall between 'the poles of this continuum' (Breakwell, 1995).

Breakwell (1995), Fraenkel and Wallen (1990) and Neuman (1994) were helpful in providing constructive guidelines on how to compile interview questions. Prior this stage, the researcher had earlier presented a lecture in the Masters students on how to construct good questions for an interview. For this lecture the researcher relied mostly on Breakwell (1995), and Neuman's (1994) publications. The presentation, together with the feedback from fellow students and the lecturer, were helpful in helping the researcher to construct good questions for the interviews. Floyd Fowler, in Fraenkel and Wallen (1990), has suggested four points to consider when constructing questions for either an interview or a questionnaire. Fowler suggests that the following questions should be considered: (i) can the question be asked exactly the same as it is written?; (ii) can the question mean the same thing to everyone?; (iii) can people answer the question?; and (iv) can people be willing to answer this question?

Considering these questions would help the researcher to design questions that would not be threatening to his or her respondents. For instance, when the researcher submitted the research proposal, the following question had been included:

**“How would you rate your knowledge of mathematics? Is it GOOD, AVERAGE or POOR?”**

This question was considered by the reviewers to be threatening to the interviewee, hence the researcher was advised to reconstruct the question. It was revised to the following format:

**“How would you rate your knowledge of mathematics: ‘a lot’, ‘average’ or ‘a little’?”**

All of these guidelines were helpful in the construction of interview questions. However, all of these stages demanded that the researcher also meet with the teachers prior the interviews.

#### **4.6.2 Information to participants**

Teachers needed to be met prior the actual interviewing sessions. The researcher needed to explain the study to these teachers, and also make them realize the significance of their involvement in the research. At times these meetings precipitated a lot of tension amongst teachers, because earlier that year they had been involved in a wage dispute with the employer (GDE). They mistook my research as furthering the interests of the employer. Further interaction with teachers finally eased this tension and teachers willingly participated in the interviews. Teachers were also promised that the findings of the research would also be made available to them. The researcher also reminded teachers that participation in the interviews was not compulsory and if anyone of them wanted to withdraw his or her participation during the course of these interviews that would be allowed. It was agreed that the interviews would take place after the schools’ contact time, which happened to be between 14H00 and 15H00. A day before the interview the researcher phoned the teacher concerned for a reminder and also to find out whether the teacher was still willing to carry on with the interview. All teachers did not disappoint and all the interviews started on time.

The average duration of each interview was 20 minutes. For the interviews the researcher used digital recording equipment, which produced an excellently audible feedback. The recorded material was downloaded to a computer. The researcher could listen to any part of the interview without a difficulty, and there were no instances where the researcher struggled to hear what the interviewee was saying. This was a

technologically advanced equipment, and because of its advanced design the researcher was able to focus attentively to teachers' responses, without having to write down what was being said. This allowed the researcher to know exactly what needed probing in the teacher's comment or response, and the researcher would also be in a favourable position to prepare for the next question. The researcher conducted debriefings at the end of the interviews. Together with each teacher, the researcher would sit down and listen to the recorded interview.

#### **4.6.3 Piloting**

The interviews were initially also piloted. One teacher (Ms Sibanyoni) participated in this interview. The main reason to pilot the interview was to test the reliability and validity aspects of this data collecting instrument (section 3.5). Taking this aspect into consideration would increase the objectivity of the study, objectivity in this case referred to a process of allowing the results of the interviews (both pilot and main) to be coherent, that is, to produce results that will allow them to maintain the aspect of comparability. The researcher would not influence the findings but the results would speak for themselves. At this stage, the comprehension levels of the questions were also tested (Breakwell, 1995). The researcher was able to adjust the questions accordingly and to levels that would accommodate all the participants. Debriefing was also done at this stage. Ms Sibanyoni was interviewed after the contact time, and this interview lasted almost twenty minutes. Like the interviews in the main study, this interview was a follow up from the concept mapping activity that Ms Sibanyoni had earlier constructed. The findings from this interview (Ms Sibanyoni's), together with the concept maps that had been constructed earlier on (Ms Sibanyoni and Mr Mahlangu) were quite insightful and informative, from a research perspective. The researcher was able to present the findings of the concept map and the subsequent interview with Ms Sibanyoni in a symposium that had been arranged by the University of Witwatersrand later that year (2007). In January of the following year the researcher presented a paper, which the presenter had co-authored with the supervisor, at the SAAMSTE<sup>8</sup> conference in Lesotho. The paper focused on the findings of the piloted study.

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<sup>8</sup> SAARMSTE stands for Southern African Association for Research in Mathematics, Science Technology Education.

#### 4.6.4 Main study

When the interviews were conducted in the main study, same procedures were followed. The two teachers, Mr Nkosi and Mr Mokoena, participated at this stage. They had also been earlier subjected to the concept mapping activity. In table 4.6 the information regarding the background of each of the participating teachers is provided. After each of the three interviews the researcher listened to each interview repeatedly in order to identify and establish areas that needed attention in each interview.

#### 4.6.5 Durations of interviews

This varied from one individual to the other. Other Interviewees, like Mr Nkosi, were prone to give more details and also provided more examples to support their views. Other participants were brief and needed probing to produce the desired responses. Other teachers would stammer at the beginning of a sentence and provide a slightly delayed response, such as starting the response with phrases like “... *eh* ...” or “... *ehmm* ...”. What was also noticeable was that some of the participants had personalized phrases which they would include repeatedly in their comments or responses. Phrases such as “... *for an example* ...”, “... *for instance* ...” and “... *you see* ...” constantly featured in some of the responses. These are some of the factors that influenced the length of the interview, but these variations were not quite sizable.

#### 4.6.6. Teachers’ responses

The researcher believes that teachers’ responses were honest and accurate. This could have been due to a number of meetings that the researcher held with the teachers prior the interview sessions. There were aspects of similarities and differences in teachers’ responses, and these were noted and highlighted. For instance, a comparison between Mr Nkosi and Mr Mokoena’s responses to the question where they had been requested to explain the meaning of ‘mathematics and Arts and Culture integration’ (AC-MAT) was also worth noting. These were the teachers’ responses:

**Mr Nkosi:** For example, I would be.... I would be asking for example maths teachers to teach maybe the ....ehh ...what do you call them ... this ... ehh... the ... circles, rectangles, ...ehhh... what do you call them?

For Mr Nkosi AC-MAT integration meant that a mathematics teacher needed to impart mathematics to students, and he, as an Arts and Culture teacher, would not have to discuss mathematics in his lessons (this point came up later on probing).

**Mr Mokoena:** Eh... I think what it means is that ...eh... all the Arts and Culture teachers need a maths workshop, to be well trained in maths for integration.

For this teacher AC-MAT integration meant that Arts and Culture teacher needed to know mathematics, Arts and Culture teachers needed to be trained on mathematics. These were the examples of many ideas that varied amongst the teachers that participated in the interviews.

Both of these responses showed differences, which also revealed teachers' beliefs on integration. However, the researcher also noticed a lot of similarities in some responses. For instance, most teachers shared a view that learners are all-knowing, hence they (teachers) rely on them for integration to happen. When these responses were finally analysed, a system of coding (Hitchcock and Hughes, 1995) was used to establish categories, more on this in the following chapters.

#### **4.6.7 Research question one**

In this section the researcher has only deliberated on the first research question because the second research question has been addressed through the analysis of the Arts and Culture curriculum document. Interviews were primarily designed to address the first research question which investigated methods employed by grade 9 Arts and Culture teachers in forging connections between Arts and Culture and mathematics. In the following discussion the researcher has tried to provide examples of teachers' responses that could be associated with the first research question. However, the researcher has excluded questions and teachers' responses that were meant to address the research objectives of this study, including this aspect of interviews would make this report too long. Most of the teachers' responses have been discussed in the next chapters.



**RQ1: Focus of questions:** Teachers needed to illustrate how they incorporated mathematics in Arts and Culture through their teaching styles. Most of the questions were probing teaching to reveal their teaching strategies and pedagogical approaches that would indicate that they encouraged the incorporation of mathematics into Arts and Culture.

In this category questions such as, *“What is your understanding of integration?”*, *“What does the integration of Arts and Culture and mathematics mean?”*, *“What are your views on mathematics-Arts and Culture integration?”*, *“How do you allow mathematics to come up in you Arts and Culture lessons?”*, etc. were asked to teachers.

What emerged from teachers’ responses was the fact that they seemed to have understanding of what integration is. For instance, this is how one of the interviewees described ‘mathematics-Arts and Culture integration’ (MAT-AC):

‘I would be asking for example maths teachers to teach maybe circle and rectangles, what do you call them (geometry)?’ This teacher insisted that Arts and Culture students needed to know geometric shapes. For instance, in Arts and Culture they talk about ‘dancing in a circular form’, and at times students are requested to demonstrate a ‘triangular posture’, hence students need to come to an Arts and Culture with this knowledge.

This teacher had earlier described integration as a process where teachers, from different subjects, come together and plan together on a certain topic, like HIV/AIDS. This teacher said, ‘integration is something which actually all the teachers of all the Learning Areas ought to meet and say, here and here, is something common, we can meet at this angle, .....’. The other teacher had described it as the mixing or coming together of two or more subjects.

These teachers insisted that integration is not playing out properly in schools, or within and across subjects. One teacher noted ‘we don’t come together as teachers’. This teacher highlighted the problem of communication breakdown amongst teachers,

particularly teachers from different subjects. In this section the researcher has only reflected on few extracts of the interviews, this section would not have been able to reflect on all the critical aspects of the interviews, all the transcripts from these interviews can be viewed in the appendices section of this report.

#### **4.7 Mathematics teachers' comments**

This was a very short activity. Two teachers participated in this activity, one during the pilot stage (teacher 1) and the other during the main study stage (teacher 2). Both of them were female teachers, and were teaching grade 9 mathematics at different schools. These teachers were requested to provide their views by commenting on a certain Arts and Culture activity which incorporated mathematics in it. Each teacher, independently, would comment on how she thought the infusion of a mathematics concept in the activity would influence students' responses. However, one of the teachers, during the main study, constructed a mind map (appendix X) which accompanied her comments.

**This was the question asked to teachers:** "This activity was extracted from a Grade 9 Arts and Culture textbook, *Arts and Culture, Teacher's Guide for the Development of Learning Programmes, Revised National Curriculum Statement Grades R-9, (2003)*. As can be realized, this activity has incorporated the notion of a 'positive' or 'negative' in it. As a mathematics teacher how do you think this notion of 'positive and negative' can influence students' responses, who might have discussed these concepts in a mathematics class?"

Both teachers acknowledged that the activity had a potential to spark on a mathematical discussion. One teacher acknowledged, "this is a good example of how mathematics can be integrated with Arts and Culture". The other teacher started by saying "positive and negative are mainly mathematics concepts, and when you mention them in any subject there is high possibility that mathematics could come in, however, it is the context of use that will determine this.". Referring to the activity itself, this is what both teachers had to say (this is not everything that teachers said, the researcher has only extracted the parts of the comments that directly responded to

the question asked, for the full versions of teachers' comments (appendix VIII and IX):

**Teacher 1:** When this teacher was probed further with her initial response, which had suggested that the teacher acknowledged that this activity was bound to precipitate a mathematics discussion, she went on to say that students' responses would suggest that they had a mathematical background of the concepts 'positive' and 'negative', and this was her response, "positive and negative will make learners to think of maths, and there in their answers they might show that they might want to prove that they have maths background of these terms (*referring to 'positive' and 'negative'*)". She went on to describe a possible scenario which, as she argued, could arise as a result of this activity. She said students "might end up asking the teacher where are the apples that we must add or subtract?". This teacher had earlier demonstrated that students, influenced by their mathematics background, could be prone to wanting to reveal their mathematical background of the terms 'positive' and 'negative', which could subsequently influence them (students) to think of positive as implying addition of apples and negative as the subtraction of apples in the activity (appendix VIII). The research implications of this teacher's comments have been documented in the next two chapters.

**Teacher 2:** They (learners) can say apples are positive when they are added in a bag,  
... If you remove apples from a bag, you will be subtracting them and that  
is a negative, ...

However, teacher 2 had emphatically emphasized the issue of a context as a major determinant for students' interpretation of the activity, particularly the terms 'positive and 'negative'. She acknowledged that the activity presented opportunities for the incorporation of mathematics in an Arts and Culture lesson, however, as she insisted, learners' responses would be shaped by the context in which the notion of 'positive and negative' had been used in the activity or are relatively used in other contexts. She concluded her comments by emphasizing her view: "like I say, not all learners will give a maths example, learners will choose". By the phrase "..., learners will choose", teacher 2 was reiterating her position that "it is the context of use that will

determine this.”, so what she implied was that learners would choose any context which they shall have deemed appropriate and relevant to the phrase ‘positive and negative’ in the activity, it would not be only a mathematics context that would be considered. This was quite an interesting observation to make, in view of what the situated theory of learning suggests about the negotiation of meaning across ‘contexts’. The researcher has analysed and interpreted teacher-2’s comments in subsequent chapters.

#### **4.8 Conclusion**

It has been observed that data in this study was collected through the following tools:

- Document analysis (grade 9 Arts and Culture curriculum);
- Concept mapping activity (grade 9 Arts and Culture teachers);
- Interviews (grade 9 Arts and Culture teachers);
- Teachers’ comments (grade 9 mathematics teachers).

The rationale for using each of these instruments was also provided in this chapter. The researcher illustrated that it was only ‘the analysis of the document’ which was not piloted, all other tools were administered at two levels of the study, that is, they were piloted prior the commencement of the actual study, hence their processes were two-folded. It was also indicated that the data that had been collected at these both stages of the research is documented in this report. The next two chapters, chapter 5 and chapter 6, provide the report on the analysis and interpretation of the data collected through these tools.

## **CHAPTER 5: Data analysis, interpretations and implications**

### **5.1 Introduction**

It is always important to know exactly what data should be collected, and how it will eventually be analysed and interpreted. This process should be guided by the research questions, research objectives, one's research paradigm and the theoretical framework of the study. Data should be collected within the confines of these research premises. This helps the researcher to finally have the data that is manageable; manageable in a sense that it can be accounted for, it can be accurately analysed and appropriately interpreted.

### **5.2 What is data analysis**

Hatch (2002) describes data analysis as a 'systematic search for meaning' (p. 148). This is a stage at which the researcher is expected to demonstrate his/ her acquired technique to break down the data into separate components that should later be synthesized into meaningful texts that could be comprehended by the reader. Data analysis is a means of providing a possibility for a dialogue between a researcher and the community at large. Together with its subsequent interpretations, data analysis accords a researcher with an opportunity to relay his/ her research ideas and empirical findings to the general public. It is the stage at which the intricacies of the entire research work are simplified into digestible and meaningful components. However, for this aspect to be realized the researcher needs to intensely engage with the data, and as Hatch puts it, one needs to 'organise and interpret data in ways that allow researchers to see patterns, identify themes, discover relationships, develop explanations, make interpretations, mount critiques, or generate theories' (p. 148). It is at this stage where one (researcher) is called upon to demonstrate what Hitchcock and Hughes (1995: 298) refer to as 'theoretical sensitivity'. Theoretical sensitivity is the ability to recognise and identify what is important in the data, and to give it

meaning in relation to the study and its adopted theoretical framework. This means that one needs to be continually conscious (sensitive) of his/ her theoretical disposition when dealing with data. Data has to be viewed through the lens of the adopted theoretical perspective.

Of utmost significance is the fact that data analysis is not a spontaneous process, it is in fact achieved through an appropriate utilization of specified analytical tools. Opie (2004) has commented on the ‘types of qualitative data that could lead to various methods of analyses’ (p. 130). Opie distinguishes between two ‘statistical analysis of qualitative data’, namely, ‘descriptive statistics and inferential statistics’ (p. 131). For this study, which has been conducted as a qualitative descriptive case study (section 3.1), descriptive methods of analysis were deemed appropriate. To achieve this, the researcher relied on categories or typologies (Hatch, 2002), which had been predetermined. Data had to be categorised within themes of commonalities, and in section 3.6 this process was clearly illustrated. Each category was allocated with a code (table 5.12) that enabled the researcher to identify data that could be associated to each category. These codes were useful in helping the researcher to analyse the data as Brodie (2004) alluded that they may enable relatively global descriptions of practice. Data in this study was huge as it had been collected through various means and techniques. Through typological methods (Hatch, 2002), the researcher was able to work with the data effectively.

### **5.2.1 When did data analysis start**

This process spontaneously commenced as the process of data collection started. Because the researcher had already established typologies, each time when an issue that was seen to be addressing a particular typology emerged, the researcher noted it in the research notebook or research diary (Hatch, 2002) for later consideration. This helped the researcher to conceptualise the direction that the research was taking, and it also enabled the actual data analysis process to be smooth.

### **5.2.2 Data analysis process**

Figure 7 below illustrates the format and stages at which data was analysed in the study. Two key stages, namely, data analysis and interpretation, ran concurrently.

When the analysis of the data was done, the researcher also referred to the tables that contain the data in chapter 4, and the information from these tables was grouped in accordance to units of meanings they preserved. At the interpretation stages the researcher relied much on the theoretical frameworks of the study and the accompanying literature.

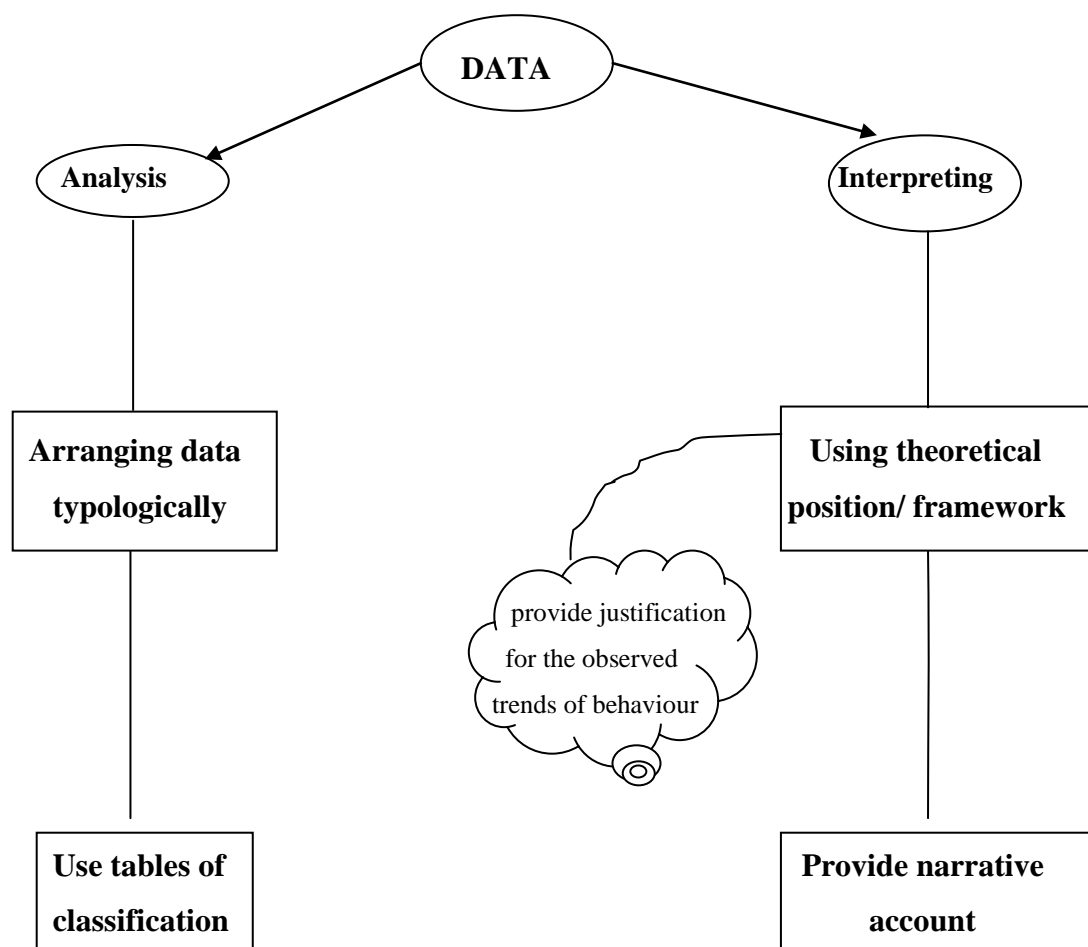


Figure 5: The analysis and interpretation of the data in chapter 5.

In the discussions that follow, the analysis of data is discussed in the following order: document analysis; concept maps analysis; teachers' comments analysis and interviews analysis.

### 5.3 Reviewing the theoretical framework

The theory of ‘situated learning’ (Lave and Wenger, 1991) framed this study (section 2.5). As illustrated in section 2.5, the objective for using this theoretical framework was to provide a justification that the transferability of knowledge and skills from one context of learning to another is problematic (Adler et. al., 2000). One could argue that this is a theory of learning, not that of teaching; and to further question its relevance to this study, in which focus was mainly placed on teachers not on learners. The researcher used this theory in view of the fact that teaching and learning are inextricably linked to each other. Learning, as an end-product, cannot be accomplished without teaching. Although this research was aimed at teachers, students are implicitly involved in this study because teachers were interrogated on their moves (Brodie, 2004) that culminated to learning. The theory of situated learning was therefore used to examine implicit factors that come to play when integrated teaching and learning take place, and this was achieved from the teacher’s perspective.

In addition to the situated theory the researcher also used Bernstein’s (1982) theoretical constructs of ‘classification’ and ‘framing’ (section 2.5.3). Bernstein uses these two concepts to define and analyse any type of a curriculum. Since ‘curriculum’ provided the main theoretical (empirical) field within which my study was placed, it came up that ‘classification’ and ‘framing’ would also be mentioned in the analysis of the data in this study. Bernstein also talks about two intuitive rules. He argues that those engaged in a similar pedagogic discourse should share the same *recognition rules* for a pedagogic communication to be effective and productive. This should be possible even if participants come from different contextual backgrounds. Using this notion, the researcher argued that teachers and students acquire different pedagogical codes (Bernstein, 1982) in mathematics as opposed to those acquired in Arts and Culture classes as a result of different cultural activities (Brown et. al., 1989) that could be associated with each subject. And because of these presumably different learning contexts, the process of knowledge sharing and skills transfer is hindered as subjects like Arts and Culture and mathematics are viewed as presenting completely distinct learning settings that present distinct learning cultures and educational activities.



Van Hiele's framework (section 2.5.2) was also incorporated into this study with a view to support recommendations generated from this study. Van Hiele's theoretical constructs provide a useful framework to argue that if learning takes place in a variety of forms, it can yield pedagogically desirable outcomes. The researcher also used this framework to argue that Arts and Culture, with its exciting visual drawings and artful designs, could present an exciting learning environment that could enhance the teaching and learning of mathematics.

#### 5.4 Document analysis

The researcher established codes to facilitate the process of document analysis. These codes were explained in section 3.7.

- **AC** : Arts and Culture;
- **MAT** : Mathematics;
- **AC-AC** : Integration within Arts and Culture as a subject;
- **AC-MAT<sup>9</sup>** : Integration of Arts and Culture with mathematics
- **AC-real/ life** : Integration of Arts and Culture with real life;
- **AC-subject** : Integration of Arts and Culture with any other subject except mathematics;
- **General** : Comment on integration is general, not specific (superficial).

The following general observations were made from the Arts and Culture curriculum document:

- The Arts and Culture curriculum document talks extensively about integration. These comments include all forms of integration (see table 5.1 below);
- Although the document commented on AC-MAT connections, most of the mathematics that is found in the document is not intended;
- Most of the integration that is advocated in the document is AC-AC, integration within Arts and Culture.

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<sup>9</sup> AC-MAT connection was the main focus of this study, hence much of the analysis occurred within this type of connection (integration).

The researcher had earlier established four areas of focus for analysing the document. These areas of focus enabled the researcher to evaluate whether the Arts and Culture curriculum document, in its content: (i) talks about integration; (ii) provides guidelines on integration for teachers; (iii) supports teachers on integration; and (iv) encourages integration as a teaching option for teachers.

#### 5.4.1 Document's comment on integration

Within this area of focus, all forms of integration (connections) advocated in the document were investigated. Using the codes that the researcher had established earlier on (section 5.4), the researcher managed to identify all forms of integration that appeared in the document. For each of the integration type that was identified the researcher used a differently coloured highlighter. The highlighting facilitated the counting process of various forms of integration that had been observed in the document. Table 5.1 below reflect on these findings:

	I N T E G R A T I O N					TOTAL
	within	a c r o s s		outside	not specific	
	AC-AC	AC-MAT	AC-subject	AC-real	general	
Number of occurrences	33	14	05	10	09	71
% of occurrences	46%	20%	7%	14%	13%	100%

Table 5.1: Types of integration in the grade 9 Arts and Culture curriculum document.

It was realized that AC-MAT connections had 20% instances of occurrence in the Arts and Culture curriculum. At an elementary level this seemed to suggest that the Arts and Culture curriculum document demonstrated higher intentions to advocate AC-MAT connections (higher in respect of other forms of integration, except AC-AC connections which claimed a 46% share, see table 5.1 above). The next step was to investigate the “20% AC-MAT connections” even further. The researcher established another category of analysis, in which the researcher investigated the “implicitness” and “explicitness” (see section 4.3 for the explanation of these terms in this regard) of

AC-MAT connections in the document. In this new category the implicit/ explicit nature of AC-MAT connections was investigated, focusing on how it was articulated in the Arts and Culture curriculum document. Table 5.2 below, which is almost a replica of table 4.1.2 in chapter 4, reflects on the findings in this area of investigation:

I N T E G R A T I O N		
AC-MAT	Nature of AC-MAT	Percentage of occurrences
12	Implicit	86%
2	Explicit	14%

Table 5.2: The nature of AC-MAT connections in the grade 9 Arts and Culture document.

From these results (table 5.2) the researcher realized that the grade 9 Arts and Culture curriculum document did not strongly advocate the AC-MAT connections. It was realized that from the 14 instances in which the document commented on AC-MAT connections, it was in only two of those instances where it explicitly commented on AC-MAT connection, thus making it clear that the document hardly encouraged AC-MAT connection.

#### 5.4.1.1 Implicit and explicit cases

The following examples drawn from the grade 9 Arts and Culture document illustrated these cases.

#### Examples of implicit AC-MAT cases in the document

*‘Educators need to be aware of barriers to learning and ensure that their teaching methods **reflect** (emphasis added) awareness of **multiple** intelligence and **different** ways of learning and knowing (bolded words are those which the researcher concluded had a potential to initiate a mathematics discussion)’ (p. 28).* Most of the implicit cases of AC-MAT connections depicted the same behaviour. It was realized that in these cases mathematics terms had been used, not with a purpose of deliberately incorporating mathematics in Arts and Culture, but rather for linguistic purposes. However, the researcher acknowledged that when a teacher reads through

such statements in the document there would be a possibility for him/ her to think of mathematics.

Another example was on page 38 of the document in which the researcher observed the phrase “*the **pattern reflects a certain order***”. This was another example of a case that was likely to stimulate a mathematical discussion. It was realized that in this case one was likely to think of ‘*sequences and series*’, which is a topic covered in mathematics. Like in the previous example, this example of AC-MAT connection was not likely to translate into a classroom discussion. It was actually not a compelling case of ‘Arts and Culture and mathematics integration’. What the researcher observed was that in these implicit cases the integration of Arts and Culture and mathematics was not likely to translate into classroom activity or discussion. It could only be observed by a teacher, who would not be compelled to explore it further at classroom level.

### **Examples of explicit cases in the document**

The following explicit cases were extracted from the grade 9 Arts and Culture curriculum document. The two examples discussed below were the *only two* cases of explicit AC-MAT connections that were discussed in table 5.2.

**Example 1:** *‘They (students) may have had some experience learning literacy, **numeracy** (emphasis added) or life skills through the arts .....’* (p. 36). Something worth noting came up in this explicit case of AC-MAT connection. Even though this activity appeared to be encouraging teachers to integrate mathematics and Arts and Culture, the document seemed to be suggesting that the mathematics that would be needed in this activity would have been dealt with in the previous classes, as suggested by the phrase *‘They may have had ...’*. So the Arts and Culture teacher, again, was not compelled to treat this aspect of mathematics in his or her lesson. This observation seemed to be in line with a response supplied by one of the teachers who were later interviewed on these issues. Mr Nkosi, for instance, when he was asked to describe AC-MAT connection, noted, ‘for example, I would be.... I would be asking for example maths teachers to teach maybe the ....what do you call them ... this ... ehh... the ... circles, rectangles, ...ehhh... what do you call them? *(trying to refer to*

*geometrical shapes*' (see appendix XII) . It seemed some of the teachers, and perhaps the Arts and Culture curriculum document, suggested that mathematics knowledge was not a prerequisite for an Arts and Culture teacher. These observations also raised critical pedagogical questions on the level of mathematical demands that the Arts and Culture curriculum document was imposing on its teachers, as was investigated by the first research question of this study. It appeared that the Arts and Culture document did not prioritise and recognize AC-MAT connections, mathematics was not viewed as a tool to facilitate the teaching and learning of Arts and Culture.

**Example 2:** *'Instead of 2-D art tasks such as painting and drawing, blind/ partially sighted learners may be able to sculpt clay model in 3-D' (p. 30)* . This activity had a potential to stimulate a mathematical discussion at classroom level. The teacher might be expected to discuss the topic of 2-D and 3-D in the class, however, this was also not a compelling statement by the document. The teacher would decide whether to pursue that discussion or not. This conclusion was also supported by the realization that the document did not provide examples or guidelines on how to deal with 2-D and 3-D situations, in view of the fact that Arts and Culture teachers were likely to grapple with these mathematical issues. The level of mathematics needed in these two examples of explicit cases was also not clearly demonstrated, or hence was low. See table 4.5, in section 4.3 of chapter 4, in which this analysis has been conducted.

From these examples the researcher realized that the document was relatively quiet on the issue of AC-MAT connections. It was only in two instances where the document explicitly commented on AC-MAT connections. It also emerged that even in these instances the document did not insist or emphasise that these observed cases of AC-MAT connections should be explored at classroom level. The document did not even provide Arts and Culture teachers with examples that would have demonstrated its advocacy for the incorporation of mathematics in its content. The document assumed a rather quiet position on the issue.

#### **5.4.1.2 Interpretations and implications**

It was realized that the grade 9 Arts and Culture curriculum document placed none of mathematical demands on its teachers. This was made explicit in its observed

exclusion of mathematics in its content, irrespective of numerous cases that suggested that mathematics and Arts and Culture are inextricably linked. This would have undesirable pedagogical consequences on both teachers and students. Generally, we view curriculum documents as the driving force of the curriculum, they are perceived as setting the pace for teachers and to a greater extent, have a potential to mould teachers' attitudes and methods of instruction. In this case, grade 9 Arts and Culture teachers have been made to view Arts and Culture as almost independent of mathematics, and this could discourage any attempt by teachers to incorporate mathematics in their teaching.

#### 5.4.2 Provision of guidelines to teachers on integration

In this area of focus guidelines on how the document demonstrated its willingness and purpose to help Arts and Culture teachers to successfully implement integrated teaching were investigated in the document. All types of integrations advocated in the document were investigated. In each of the observed cases the researcher further investigated whether the guidelines provided by the document were explicit (clearly observable) or rather implicit (superficial). The number of instances a particular guideline was provided on each of the integration types is also captured in table 5.3. The results in table 5.3 were obtained in conjunction with those in table 4.2 of section 4.2.

I N T E G R A T I O N				
Type	Implicit	Explicit	No. of implicit	No. of explicit
AC-AC		√	1	0
AC-MAT			0	0
AC-real			0	0
across	√		1	0
general	√	√	1	1

Table 5.3: Nature of integration in the Arts and Culture curriculum document.

From table 5.3 above, the following observations were made:

- Generally, the document did not provide sufficient guidelines on how Arts and Culture teachers should integrate;
- There were no guidelines for AC-MAT, this was predictable in view of the findings in table 5.2;
- The documents opted to generalize the issue of integration, rather than providing explicit and specific guidelines on integration;
- Although it was mentioned that there were no guidelines on AC-MAT, the document provided guidelines for AC-subject (across) integration, however, this also happened at an implicit level. Therefore, the document was failing to encourage integration across subjects at an explicit level, something it explicitly achieved with AC-AC (compare this with results in table 5.1).
- 

#### **5.4.2.1 Interpretations from the observations**

The document discussed integration on various occasions. This was observable from the number of instances in which this subject was covered in its content, all in all there were 71 observable instances where the document commented on integration (see table 4.1 in chapter 4). However, when the nature of these comments was closely investigated, it appeared that these comments were just meant to scratch the surface. Much of the integration advocated in the document was the one that took place within Arts and Culture as a subject. What this implied in terms of Bernstein's classification was that Arts and Culture curriculum did very little to 'fully collapse' (Adler, et. al., 2000) boundaries between its content and that of mathematics. This nullified any possibility of the existence of meaningful levels of mathematical demands within an Arts and Culture curriculum, mathematics was not fore-grounded in the document.

Integration of Arts and Culture with other subjects was given little attention, let alone with mathematics. There were no guidelines provided for the integration of mathematics and Arts and Culture. This was expectable in view of the fact that there were only two instances where the document commented on AC-MAT integration. As much as we could argue that integration is meant to weaken 'classification', in

Bernstein's terms, this was hardly the case with what the Arts and Culture curriculum document advocated. From this background, the researcher observed that the document took a position which seemed to suggest that grade 9 Arts and Culture teachers did not have the knowledge to integrate across learning field. For instance, Arts and Culture teachers were not encouraged to incorporate mathematics in their subject; hence there seemed to be no such a thing as 'mathematical demands' (RQ1) for grade 9 Arts and Culture teachers.

### 5.4.3 Provision of support to teachers on integration

In this area of focus, only the instances where the document was observed to be providing support to grade 9 Arts and Culture teachers were recorded in table 5.4. Like in other areas of focus, each of the observed instances was further investigated in terms of the 'explicitness' and 'implicitness' of the support provided by the document. Results of this investigation are reflected in the table 5.4 below:

I N T E G R A T I O N				
within	across	AC-real	Implicit	explicit
AC-AC			√	
	AC-subject		√	
	AC-subject		√	

Table 5.4: Information on teacher-support on integration.

Most notable was the exclusion of AC-MAT connections in table 5.4. Again, this was predictable in view of the findings in table 5.2. The grade 9 Arts and Culture curriculum document had already demonstrated its failure to incorporate mathematics in its content. Also, it was realized that there were only three instances where the document demonstrated its support for grade 9 Arts and Culture teachers on integration. However, all of these instances were 'implicit' cases, that is, the observed support by the document was not clearly articulated for Arts and Culture teachers. Actually, much of this observed support came up in a form of encouraging collaborative work amongst teachers who are teaching different subjects. In these instances, it was realized that the document acknowledged that Arts and Culture



teachers needed to be supported on integration. The document articulated this idea through encouraging teachers to plan together. However, the document did not clearly articulate its role and position on this issue, it left it upon teachers. The researcher then concluded that the kinds of support observed from the document were superficial. The following example drawn from the grade 9 Arts and Culture curriculum document illustrated this view.

**Example:** ‘In the case of integration across Learning Areas, this may include meeting with the teachers from other Learning Area(s) to ensure that the anticipated integration is workable’ (p.12).

In this example the researcher observed that the document encouraged teachers to support each other, but the support provided by the curriculum designers or policy makers was not mentioned in the document. This example was also considered to be a guideline on Arts and Culture teachers, see table 5.3 above. It was also regarded as an implicit case because the document did not commit itself on this issue, as explained. The issue was left in the discretion of the teachers.

#### 5.4.4 Provision of encouragement to teachers on integration

This was the final area of focus. Again, all types of integration that were advocated in the document were investigated. In each case when the investigated aspect was observed it was further evaluated in terms of the degree of its ‘explicitness’ and ‘implicitness’ on how it was articulated in the document. The findings in table 4.4 of chapter 4 were also considered and the following table of results was established:

I N T E G R A T I O N		
Type	No. of implicit	No. of explicit
AC-AC		5
AC-MAT		
AC-life		3
AC-subject		3
general		6

Table 5.5: Document’s support on Arts and Culture teachers regarding integration.

Again, it was notable that the grade 9 Arts and Culture document did not encourage AC-MAT integration. There were evidently no instances where the document encouraged the incorporation of mathematics in Arts and Culture. The document opted to encourage AC-AC integration or to be more general on the issue, as confirmed by the number of instances for each of these cases, 5 and 6 respectively. This continues to highlight the plight of the exclusion of mathematical content in the grade 9 Arts and Culture curriculum document. It was observed that support was provided in almost all other forms of integration in the document, but not on AC-MAT integration. This demonstrated the status that mathematics enjoyed within the grade 9 Arts and Culture curriculum document as well as the document's position on AC-MAT integration. From table 5.5 above it was realized that the document was quite explicit in encouraging teachers to implement integrated teaching, however, the document did little to support teachers on integration.

#### **5.4.5 General observations from the grade 9 curriculum document**

The following were observed from the Arts and Culture curriculum document:

- The document talked about integration quite extensively, but mostly not explicitly;
- The document advocated integration within Arts and Culture (AC-AC), and most of these connections were explicitly articulated;
- Integration between Arts and Culture and mathematics (AC-MAT) was given little attention. There was a lot of mathematics terminology in the document, which apparently was not for integration purposes. It was a co-incidental sharing of terms;
- There were only 14 instances where AC-MAT connection was commented on, however, only two of these instances were explicitly articulated;
- No demands for mathematics in the curriculum document;
- No guidelines for teachers on how to implement integrated teaching;
- The document acknowledged that for integration to be workable content knowledge of other subject is a prerequisite. The document noted, *'when planning it is important to take into consideration how well the teacher knows*

*the other Learning Area*' (p. 36). However most of the Arts and Culture teachers that were interacted with in this study also acknowledged that they grossly lacked mathematical knowledge that could encourage them to incorporate mathematics into their AC lessons;

- The document did not illustrate how the teachers were supposed to integrate, rather it left the matter to the teachers themselves, as it suggested in its content that teachers 'must apply their minds' (p. 11).

#### **5.4.6 Implications of the findings to the first research question (RQ1)**

At this point the researcher attempted to respond to the first research question, in which the researcher had to investigate mathematical demands within the Arts and Culture curriculum document. In tables 5.1 and 5.2 the researcher was able to observe that AC-MAT connections were not adequately addressed in the grade 9 Arts and Culture curriculum document. There were only 14 instances, out of 77 instances, in which AC-MAT connections were addressed in the document. Further investigation revealed that of the 14 AC-MAT connections that were mentioned in the document, only two proved to be explicit cases. Further investigation also revealed that even those two explicit AC-MAT connections did not involve a lot of mathematics (see the examples in section 5.4.1). Using the analysis in table 4.5, in section 4.3 of chapter 4 and those in tables 5.1 to 5.5, the researcher was able to draw a conclusion that the levels of mathematical demands in the grade 9 Arts and Culture curriculum document were very low and superficial.

#### **5.4.7 Interpretation of the findings from the document**

The researcher acknowledges that these observations could mean different things to different people with different contextual backgrounds. Hence in this discussion the researcher only reflected on the views which were largely influenced by the situated theory (Lave and Wenger, 1991). The researcher realized that the document generally advocated integration as a new teaching option. However, its approach to it was more political than practical. The document seemed to be naive of concepts such as 'classification' and 'framing', which should not be divorced from a curriculum make-up and its fundamental aspect of integration. The researcher also noted the document's emphasis of AC-AC (integration within) at the expense of other forms of

integration, particularly the integration of Arts and Culture with other subjects such as mathematics. There seemed to be little acknowledgement that classification between Arts and Culture and other subjects had been weakened.

The document was more concerned about Arts and Culture, however its expected dialogue with other subjects was relatively subtle, and this suggested that classification within Arts and Culture, as a learning field, was still strong. Most of the explicit integrations in the document were those of AC-AC, and this was a clear demonstration of the document's reluctance to encourage Arts and Culture teachers to integrate across other learning fields, let alone with mathematics. This was perceived as referring to the document's acknowledgement that integration of knowledge across different contexts of learning is problematic; the document seemed to be assuming that position by not explicitly encouraging Arts and Culture teachers to engage with other subjects. Consequently, the researcher viewed the document as failing to make attempts to weaken classification between Arts and Culture and other subjects such as mathematics. It was presumed this aspect resulted from the awareness and acknowledgement that teachers did not have the knowledge to integrate across subjects, hence transfer of knowledge across these different learning fields could be problematic (Lave and Wenger, 1991).

Of major concern was the observed fact that mathematics was seemingly divorced from Arts and Culture. This could be very discouraging to grade 9 Arts and Culture teachers who, in subsequent interviews, acknowledged that mathematics and Arts and Culture are inseparable. One of the teachers emphatically noted that 'maths is part of us', with "us" referring to Arts and Culture community. They actually gave numerous examples that pointed to natural links between the two subjects. So if the curriculum document kept quiet about these natural links (AC-MAT) between the two subjects, teachers were likely to run the risk of ignoring the mathematics that was embedded in Arts and Culture or if an attempt was made to incorporate mathematics in an Arts and Culture lesson, then that mathematics would tend to get lost (Adler et. al., 2000:5) as the lesson progressed. This could have undesirable consequences of depriving students of the possibilities to realize these exciting learning opportunities.

## 5.5 Concept maps analysis

The actual teachers' concept maps have been included in the appendices IV, V, VI and VII. In the discussions below the researcher has analysed each of the teachers' concept maps (tables 5.6 to 5.9 below). From these tables the researcher observed similarities and differences among the participants who had been selected on a similar demographic (all grade 9 Arts and Culture teachers). The information regarding the participants is also provided in table 4.6 of chapter 4. As illustrated in sections 1.7.1, 3.4 and 4.5 of chapters 1, 3 and 4 respectively, a concept mapping activity was administered on grade 9 Arts and Culture teachers (see this activity in appendix I). These activities were conducted both at the pilot and the main-study stages of this research and the results and findings discussed below have considered both of these stages.

### 5.5.1 Concept map results for teacher one: Pilot study

The following observations were made from this teacher's concept map. See table 5.6 on the next page.

Concept	C A T E G O R I E S		
	Pure MAT	Pure AC	Integration
Parallel			√
Positive			√
Colour		√	
Pattern			√
Design		√	
Dimension			√
Melody		√	
Percentage			√
Area			√
Dance		√	

Table 5.6: Concept map results for teacher one (pilot).

From table 5.6 above the researcher observed that this teacher was more inclined towards embracing integrated teaching approach. Most concepts were classified in the integration column (category). There were no concepts that this teacher identified as only belonging to mathematics (pure mathematics). This observation could be linked to the findings in the previous sections that the Arts and Culture curriculum document discouraged its teachers to pursue any pedagogical discourse that was mathematically orientated. This was also confirmed by the fact that this teacher chose to have concepts in the “pure AC” instead, not having even a single concept in a “pure MAT” section. For instance, this teacher could not identify colour, design, melody and dance as concepts that could also be found in mathematics (integrating concepts). Unfortunately the researcher could not engage this teacher any further because the interview with him could not materialized, due to time constraints.

### 5.5.2 Concept map results for teacher two: Pilot study

The following observations were made from this teacher’s concept map. See table 5.7 on the next page.

Concepts	C A T E G O R I E S		
	Pure MAT	Pure AC	Integration
Parallel			√
Positive			√
Colour		√	
Pattern			√
Design		√	
Dimension			√
Melody		√	
Percentage	√		
Area	√		
Dance		√	

Table 5.7: Concept map results for teacher two (pilot).

This teacher, Ms Sibanyoni (pseudonym), had also constructed a thought-provoking concept map. Fortunately, the researcher was able to engage with this teacher in an

interview (appendix XI). For instance when this teacher was asked about her views on the concept of ‘percentage’, which she argued could only be classified as a mathematics concept (see table 5.7 above), she replied, ‘in mathematics I talk about percentage, in Arts I don’t talk about percentage’.

**Researcher:** So in other words you are trying to say here the word percentage or the concept of percentage cannot be found within Arts and Culture?

**Ms Sibanyoni:** No, it cannot be found. As an educator of Arts and Culture, I have never ...come across percentage.

This teacher, as she strongly argued, would never imagine a concept of percentage as a shared concept between Arts and Culture and mathematics. This response suggested a lack of knowledge from the side of the teacher. However, another teacher, Mr Nkosi, who was interviewed later in the main study, acknowledged that in Arts and Culture they sometimes work with percentages. He cited an example in which Arts and Culture students were requested to collect information on the popularity of each and every music type. The Arts and Culture teacher could ask students to represent data graphically, and that the information (results) should be expressed in terms of percentages (appendix XII). So it was realized that there could be instances where the notion of a percentage could form part of a discussion within an Arts and Culture lesson, and with some of the Arts and Culture teachers not recognizing these integration opportunities. So the researcher observed that two teachers who were teaching the same subject, grade 9 Arts and Culture, had presented conflicting arguments.

### **5.5.3 Concept map results for teacher one: Main study**

The following observations were made from this teacher’s concept map. See table on the next page.

Concepts	C A T E G O R I E S		
	Pure MAT	Pure AC	Integration
Parallel			√
Positive			√
Colour			√
Pattern		√	
Design			√
Dimension			√
Melody			√
Percentage	√		
Area	√		
Dance			√
Angle			√

Table 5.8: Concept map results for teacher one (main).

Table 5.8 above is a summary of a concept map which was constructed by Mr Mokoena (appendix VII). This teacher also acknowledged that integrated teaching had taken over from the traditional teaching styles. He also clustered most concepts in the integration column, which was evidently an indication that he had also embraced integrated approach as a new teaching option. However, he strongly insisted that integration is a challenge to teachers and demonstrated this view through his diagram. His concept map depicted some of the challenges that most teachers are currently faced with, regarding integrated teaching. He also acknowledged that teachers have insufficient knowledge to integrate and as a result they often find themselves being confused, he used question marks to illustrate this (see the diagram in appendix VII). The issue of insufficient knowledge seemed to be topical throughout this study as it also emerged during the interviews with teachers.

#### 5.5.4 Concept map results for teacher two: Main study

The following observations were made from this teacher's concept map. See table on the next page.



Concepts	C A T E G O R I E S		
	Pure MAT	Pure AC	Integration
Parallel			√
Positive			√
Colour			√
Pattern			√
Design			√
Dimension			√
Melody			√
Percentage			√
Area			√
Dance			√
Angle	√		

Table 5.9: Concept map results for teacher two (main).

Like most of the other teachers, this teacher's concept map reflected awareness and acknowledgement of integration on the side of the teacher. Most concepts were classified under the "integration" column, and only one concept was classified under the 'pure mathematics' column. When this teacher was later probed on this concept, which had been lonely classified under the 'pure mathematics' column, it emerged that the teacher was not clearly decisive on this issue, he was not sure whether this concept could be integrated or not. He eventually associated the concept of 'angle' with mathematics.

Again, this observation resurfaced the issue of teacher knowledge for integration (Huntley, 1999). If teachers lacked this vital knowledge they would be confused, as acknowledged by one of the teachers in the interviews. The other possibility was that teachers would not be able to identify and acknowledge opportunities for integration, as noted by Huntley in his study, 'although some activities provided opportunities for development of both mathematical and scientific content, this potential was never realized' (p. 64). This was likely to be the result with Arts and Culture teachers. If they fail to recognize certain concepts as presenting opportunities for integration then they might not position themselves properly in order to implement integrated teaching properly.

### **5.5.5 General observations from the teachers' concept maps**

The following general observations were made from the teachers' concept maps:

- Teachers did not work together; they did not share common knowledge within their own subject. For instance, two teachers classified melody as a “pure Arts and Culture” concept and the other two teachers saw it as an integrating concept. The other example was that of the notion of ‘percentage’. Teachers’ responses differed on this aspect, actually their responses presented conflicting views;
- Teachers seemed to have acknowledged that integrated approach has replaced traditional style of teaching. The researcher noted this aspect from the way in which teachers constructed their concept maps, most of the concepts had been clustered in the integration column. However, their actual classroom teaching practices were not in line with this acknowledgement;
- Teachers did not have sufficient knowledge to integrate, and in some instances they were indecisive, not very sure whether a concept integrated or not. This was also revealed by the interview with Mr Mokoena (main) who had initially classified the term “area” as a concept that would only be found in mathematics. When he was later probed on this issue he somersaulted and ended up reviewing his initial position. This was Mr Mokoena’s reply when he was probed further on his diagram: “Yah... I think you are right, ... hmm ... yah ... the area on stage where we do the dance, yah ... so ... it’s also in Arts” (appendix XIII);
- Teachers had an intuitive understanding of integration. However, this was not translated into their actual classroom practice.
- 

### **5.5.6 Overall interpretation of the concept maps**

Teachers are still trapped in traditional ways of teaching. They have not transformed their identities to being the researchers; they are not pro-active in terms of finding new knowledge for themselves. Integration, to a greater extent, means sharing and engaging in teaching and learning activities collaboratively, however it seems these teachers work as individuals. In view of the theory of situated learning (Lave and

Wenger, 1991), this creates tension. Teachers turn to perpetually reside within the context of their subjects, and this is likely to discourage the negotiation of meaning across learning fields. This is also understandable as we have observed that the grade 9 Arts and Culture curriculum document does not encourage its teachers to extend their pedagogical dialogue beyond their specialized fields of knowledge.

Integration, in terms of Bernstein (1996), is a way of encouraging the sharing of pedagogical codes, which could facilitate and enhance a common pedagogical discourse, be it within or across domains of knowledge. Bernstein insists that a dialogue is facilitated in a pedagogic setting when the participants share similar pedagogical codes and recognition rules. Coming back to the teachers, tables 5.6 to 5.9 reveal that grade 9 Arts and Culture teachers seem not to be sharing the same recognition rules; they seem not to be sharing the same pedagogical codes. This observation highlights some of the dilemmas that most teachers are faced with. If teachers experience difficulty in integrating within their subjects it is then unlikely to imagine that possibility across other subjects. It seems, teachers need to be retrained in order to develop new pedagogical codes that could allow them to pursue negotiation of meaning across different subjects or learning fields.

The issue of teacher-training has also emerged in this activity. Teachers are still grappling with new teaching styles. This might be linked to the fact that teachers receive poor support from the Education Department, as this point was illustrated in section 5.4.3. Teachers need to be properly capacitated and that will allow them to regain their expected confidence. This view was also echoed by Mr Mokoena, who when he was asked to describe AC-MAT connection, noted ‘eh ... I think what it means is that ... eh ... all the Arts and Culture teachers need a maths workshop, to be well trained in maths for integration’.

Teachers have acknowledged that integrated teaching has replaced the traditional curriculum, however, their actual teaching practices suggest the opposite. This is a case similar to the one observed when the Arts and Culture document was analysed. The document is very vocal on integration, however, it says very little about its

support and guidance for the teachers. To both the teachers and the document, integration is more of a lip-service than anything else.

## **5.6 Analysis of teachers' comments**

Two teachers (one in the pilot study, teacher one, and another in the main study, teacher two) commented on the Arts and Culture activity that had been extracted from a grade 9 Arts and Culture textbook. These teachers, both of whom were teaching grade 9 mathematics, were requested to comment on the Arts and Culture activity which incorporated mathematical concepts such as 'positive' and 'negative' (see appendix II). The two teachers were supposed to comment on how they thought an activity such as this one could influence the way in which the students would respond to it. The following observations were made from the two teachers' comments:

### **5.6.1 Piloted study: Teacher one**

From 'teacher one' the following observations were made:

- The teacher appeared to be aware of AC-MAT links, hence she started her comments by saying '*this is a good example of how mathematics can be integrated with Arts and Culture*' (appendix VIII), possibly suggesting that there could be other examples that are not relatively as good;
- This teacher suggested that some of Arts and Culture activities have a potential to allow mathematics to emerge;
- The teacher's comments could also suggest that students could take the initiative to unearth mathematics in an Arts and Culture activity, without the teacher necessarily initiating that move. This could be picked up from the teacher's comments that such an activity could make '*learners to think of maths*', or that students '*might show*' or "*want to prove that they have maths background*";
- This teacher raised another talking point about integration. She seemed to be suggesting, implicitly, that integration (context) can derail the actual goal of instruction. She noted that students '*might think the teacher wants them to add*

*the apples*', which was not mainly the objective of the activity. Hence she further argued that the activity could end up becoming '*a maths discussion*', with mathematics overshadowing what should have been an Arts and Culture discussion.

### **Interpretations from teacher one's comments**

Teachers are aware of integrating opportunities across subjects, however, there are discouraging views such as the one that it might derail the actual goal of the lesson. In the case of AC-MAT integration, Arts and Culture teachers might avoid to pursue this integration option because of the fear that mathematics discussions might overshadow what was initially intended to be a predominant Arts and Culture discussion.

### **5.6.2 Main study: Teacher two**

From 'teacher two', the researcher observed one very important issue. This teacher used the phrase "context of use" in her comments. It seemed this teacher acknowledged that every student brings to the classroom his or her contextual background which, to a greater extent, influences the student's understanding of new knowledge, or determines how the student would learn. This could be picked up from the teacher's comment that '*it's a question of context ..., and every learner will choose his or her context*', possibly implying that students' contextual backgrounds are likely to impact on how they receive and eventually understand and interpret new knowledge. This comment was found to be in line with the 'situated theory' (Lave and Wenger, 1991), which presupposes that knowledge and learning are relational (Brown et. al., 1989). What we already possess as existing knowledge will, to a greater extent, determine what and how we will learn later, that is, how we receive and conceptualise the incoming new knowledge is greatly influenced by what we already have as existing knowledge.

### **Interpretations from teacher two's comments**

The comments from this teacher could be viewed from a situated perspective. This teacher raised an important point when she commented on the role of context in teaching and learning settings. The teacher seemed to acknowledge that students bring to class a variety of these contexts that make a process of teaching and that of learning

a complex experience. It is good to realize that some of the teachers take cognisance of this reality, and this is likely to encourage them to shape their teaching strategies in a manner that will address these challenges and minimise their negative effect in their teaching experiences.

### **5.6.3 Implications of teachers' comments to my study**

Both teachers have raised an important pedagogical issue, that teachers need to be always on the lookout for integration opportunities, and that these opportunities could spring up unintended, as it was explicitly made by 'teacher one'. Both teachers acknowledged that there is mathematics in Arts and Culture. 'Teacher two', for instance, noted that 'positive and negative are mainly maths', and 'teacher one' had already acknowledged that the activity was one of the examples in which mathematics is integrated with Arts and Culture. These comments seemed to suggest that both teachers acknowledged that there are inherent mathematical demands in the Arts and Culture, a view that seemed to be overlooked by the grade 9 Arts and Culture curriculum document.

Teachers also acknowledged that students can possibly change an Arts and Culture lesson into a mathematics discussion, as 'teacher one' indicated that students might *'want to prove that they have maths background'*. That could pose a mathematical demand and challenge on Arts and Culture teachers, as they might be called upon to play a mediating role which might demand of them to be in possession of mathematics knowledge. 'Teacher two' also raised the issue of the variety of contexts that students bring to the classroom. These contexts will influence students differently, and this will show in the ways in which they will respond to the activity at hand. 'Teacher two' noted, 'not all learners will give a maths example, learners will choose', thus supposedly implying that learners' response to an activity is influenced by the context that the activity invokes in them. However, the critical question is how teachers deal with these possible variations, which is what the second part of the research question was attempting to investigate.

## 5.7 Interviews

The process of interviewing the teachers was the most painstaking. There were quite a number of instances where things seemed to be going wrong. At times interviews had to be segmented when it was realized that the researcher was unable to get what would be regarded as the ‘intended data’, that is, what the researcher really needed to *pick up* from an interview. The researcher would then make a request to the interviewee and reschedule another interview. Fortunately, teachers were always willing to give the researcher the benefit of the doubt, they availed themselves for rescheduled interviews.

The steps suggested by Hatch (2002: 153) were considered when analysis of the interviews was done, although in most of the instances the researcher also improvised ideas which the researcher thought would make the analysis process feasible and workable. Before the interviews could start, the researcher had already compiled the set of questions that had been planned for the teachers. As it was mentioned in sections 3.6 and 4.6, the construction of these questions was largely influenced by the research question two (RQ2) and the research objectives (RO) that underpinned the research questions. Table 5.10 below summarises this process. This table will also assist in the identification of the questions which were asked by the researcher as well as providing a justification for asking each question (see table 5.11). Later on, table 5.12 will demonstrate how the typological analysis was conducted. It should be noted that table 5.10 is the revised version of table 3.1 in chapter 3.

### 5.7.1 Reviewing the research questions and research objectives

It was important to review the research questions and research objectives as they would be considered during the analysis of teachers’ interviews.

- **RQ1:** What are the mathematical demands of an Arts and Culture curriculum at grade 9 level?
- **RQ2:** Within the context of a new curriculum (Revised National Curriculum Statement), what connections does an Arts and Culture teacher make between mathematical concepts in Arts and Culture topic?
- **RO1:** To highlight pedagogical challenges for teachers;

- **RO2:** To evaluate progress made on AC-MAT integration;
- **RO3:** To highlight the existing gap between idealized and realized curricula;
- **RO4:** To raise issues of teacher training and development;
- **RO5:** To highlight the benefits of integration.

Interview Question	RQ or RO addressed	Typology
1. What is your understanding of integration?	RQ2/ RO1	Definition
2. What are your views on integration, is it a good idea or not a good idea?	RQ2	Positive/ Negative
3. As a teacher do you think you are ready for integration?	RQ2/ RO2	Ready/ Not ready
4. How do you plan for integration?	RQ2/ RO1	Individually/ Team
5. How often do you implement integrated teaching in class?	RO1/ RO2	Often/ Seldom
6. What is your understanding of AC-MAT integration?	RQ2/ RO1	Understands AC-MAT/ Does not understand AC-MAT link
7. How often does mathematics come up in your AC lessons?	RQ2	Incorporate MAT/ Does not incorporate MAT
8. How do you plan for AC-MAT?	RQ2/ RO1	Individually/ Consultative
9. How do you deal with AC-MAT in your lessons?	RQ2/ RO1/ RO3	Learners/ Colleagues/ Research
10. How do you rate your MAT knowledge, little, average, good?	RQ2/ RO2	Knowledge
11. What challenges do you face when forging AC-MAT?	RQ2/ RO1	Challenges
12. Do AC teachers get guidelines from curriculum documents?	RQ2/ RO3	Guidelines
13. Is there a difference between what you do in class and what the curriculum document suggests?	RO3	Gap
14. Is integration making progress?	RO2/ RO3	Progress
15. What should be done for improvement?	RO4	Way-forward

Table 5.10: Interview questions and their subsequent typologies.

It can be observed from table 5.10 above that the questions ranged between the continuum “general” and “specific”. The researcher started asking teachers generally about integration, eventually the questions narrowed down to more specific issues, entailing ‘the AC-MAT connections type’, which was central in this study. It should also be noted that at times, teachers were probed further on their responses, hence the interview fell within the continuum “structured” and “non-structured”. Actual



interview transcripts have been included in the appendices section (appendices XI, XII and XIII). Table 5.11 below provides a justification for the relevance of each question, that is, why a particular question was formulated and eventually posed to the teachers.

Question	Justification
1	Teacher's knowledge might determine the extent to which he/ she explores connections: RQ2 This question might also reveal challenges teachers face on integration: RO1
2	Teacher's views and attitude might influence his/ her reaction towards integration: RQ2
3	Teacher's readiness might be a determinant of how far he/ she would go with integration: RQ2
4	Level of planning might determine level of success of integrated teaching: RQ2 Like question 1, teachers might talk about challenges they face: RO2
5	The more they implement, the more they could get used to integrated teaching: RQ2
6	Knowledge of AC-MAT might determine the extent of AC-MAT integration: RQ2
7	This question might reveal teacher's awareness of AC-MAT links: RQ2
8	Same justification as in question 4.
9	This question might reveal how teachers forge AC-MAT links: RQ2 It might also reveal challenges teachers face when MAT emerges: RO2
10	His/ her knowledge of MAT might influence his/ her reaction towards AC-MAT: RQ2
11	Challenges might inhibit the process of implementing integrated teaching: RQ2/ RO2
12	If teachers are properly guided on integration, they might be positive about integration: RQ2
13	The response to this question might help us to address RO1
14	The response to this question might help us to address RO2 and RO3
15	The response to this question might help us to address RO4

Table 5.11: A justification for questions asked in the interviews.

The two tables above ensured that the interview questions were accurate, in terms of addressing the RQs and ROs. We should also note that most of the questions revolved around the RQ2, with RQ1 being notably excluded. RQ1 was addressed through the analysis of the grade 9 Arts and Culture curriculum document from the Department of Education (see section 5.4 above).

### 5.7.2 Analysis of the interviews

Three teachers were subjected to the interviews. The following teachers were interviewed, Ms Sibanyoni (pilot), Mr Nkosi (main) and Mr Mokoena (main). The

credentials of these teachers have been included in table 4.6. After the interviews the researcher listened to the tape repeatedly, and the interview material was classified according to the categories (typologies). Any comment (response) that was deemed to be addressing a particular category was noted and placed under the appropriate category. As was earlier explained, typologies were constructed through the research questions and research objectives. Hence classifying responses under these typologies was a way of trying to investigate how the interviews succeeded in addressing the RQs and the ROs. The following general observations were made from the three interviews:

- All teachers seemed to have embraced integration as a new teaching alternative. This aspect could also be observed through their adopted language of integration, for instance, they continually used terms such as ‘Learning Areas’ when referring to subjects;
- All teachers seemed not to be implementing integration properly;
- All teachers seemed to have a firm conceptual understanding of integration, however this understanding was not properly translated to classroom practice;
- All teachers acknowledged that there are inextricable links between Arts and Culture and mathematics, they provided numerous examples to support this claim;
- All teachers seemed to be struggling to incorporate mathematics in Arts and Culture;
- All teachers acknowledged that they have little knowledge of mathematics;
- Some of the teachers openly acknowledged that they sometimes deliberately ignore mathematics that is embedded in Arts and Culture activities;
- Teachers also acknowledged that teachers’ different understanding of parallel concepts between mathematics and Arts and Culture discouraged and undermined their efforts to forge links between the two subjects, mathematics and Arts and Culture;
- Teachers claimed that they do not get sufficient support and guidance from the Department of Education (DoE). They claimed that the grade 9 Arts and Culture curriculum documents are quiet about mathematics;

- Teachers acknowledged that they do not have proper knowledge for integration, hence they believe that they are not ready for integration;
- Teachers seemed to be relying mostly on their students for integration, they shared the belief that students know integration better and had a relatively better knowledge of mathematics than teachers;
- Teachers put the blame on the Department for integration not to be workable. They were reluctant to put a finger of accusation to themselves as well;
- Some teachers viewed integration as a government thing. They openly argued that they are doing it because it is forced on them by the Department (DoE).

Each of these interview outcomes has been discussed extensively in subsequent sections. The interviews have been analysed in relation to the pre-determined categories (section 5.7.1).

#### 5.7.2.1 Coding of interviews

All in all, the researcher established fifteen categories of analysis for the interviews. Each of the fifteen categories was allocated with a specific colour that was used to trace a teacher's response to a particular category. This method of analysis facilitated the process of interview analysis. Samples of the colour coding analysis of the collective interviews can be viewed in appendix XV. The following colour codes were used for respective categories:

Category	Colour code for the category
1. Definition	Definition
2. Attitude on integration	Attitude on integration
3. Teachers' readiness for integration	Teachers' readiness for integration
4. Planning for integration	Planning for integration
5. Frequency on integration	Frequency on integration
6. Description of AC-MAT integration	Description of AC-MAT integration
7. Students'/ Colleagues' dependency for integration	Students'/ Colleagues' dependency for integration
8. Other sources for integration	Other sources for integration
9. Mathematics knowledge/knowledge	Mathematics knowledge/ knowledge
10. Challenges	Challenges
11. Document	Document
12. Gap	Gap
13. Guidelines	Guidelines
14. Progress	Progress
15. Way forward	Way forward
16. Context	Context

Table 5.12: Colour coding system used for typological analysis.



teachers responded to particular questions, that is, some of the categories spontaneously emerged as the other categories were being addressed. For instance, when teachers were interviewed under the category of “readiness”, some of the teachers also addressed the “attitude” category as could be observed from this example of Mr Nkosi’s response: “We are just doing it because it is forced on us by the Department and facilitators, but I don’t think we are ready as teachers”. It could be observed that the first part of Mr Nkosi’s response could also be seen as also reflecting on his attitude regarding integration, despite the fact that the question was addressing the “progress” category.

The conversations with the three grade 9 Arts and Culture teachers tended to reflect more on the following issues:

- Challenges faced by teachers on integration;
- The existence of a gap between what is theorised about integration and what teachers are practically doing on integration in their classrooms;
- Teachers are more prone to suggesting a way forward on integration;
- **Context:** conversations with teachers revealed issues around the problematic nature of knowledge transfer across subjects;
- Teachers turn to rely more on their students for integration as opposed to other possible sources assistance.

#### **5.7.2.1.2 Interpretations of the observations in table 5.13**

**Challenge:** These observations could suggest that progress on integration is not going smoothly, and teachers are more than willing to engage in dialogues regarding challenges they are facing on integration.

**Gap:** Among other things, these observations could suggest that integration is not happening properly.

**Way forward:** These observations could mean that teachers need immediate intervention to what they regard as their pedagogical plight.

**Context:** Conversations with teachers tended to reveal issues around the problematic nature of knowledge transfer across fields of learning.

#### **5.7.2.1.3 Implications of these observations in table 5.13 to the study**

Almost all of these observations seemed to impact directly on the second research question (RQ2), because challenges, gaps and problems that the teachers encounter in their attempt to forge links between Arts and Culture and mathematics will eventually shape their methods and techniques of integration. Teachers will come up with alternative techniques that will counteract the effect of these challenges.

#### **5.7.2.2 Typological analysis of the teachers' interviews**

After the compilation of table 5.13, another table, table 5.14, was also compiled. Table 5.14 consisted of all teachers' interview responses, in respect of each category. Using these tables (tables 5.12, 5.13 and 5.14) facilitated the process of interview analysis. Table 5.14 on the next page indicates only the teachers' actual responses to each category. Interpretations and implications of these responses have been discussed in later sections of this report.

Category	Teachers' responses (interview extracts)
<b>1. Definition</b>	<p><b>Ms Sibanyoni:</b> Oh... integration is the linking or sharing of concepts between Learning Areas.</p> <p><b>Mr Nkosi:</b> Integration is something which actually all teachers of different Learning Areas ought to meet and say here and here it's something common, can meet at this angle, ... right, ... and unfortunately we don't talk about these things....</p> <p><b>Mr Mokoena:</b> Integration, it's .... eh .... I think you link, ... you combine subjects ..., from one subject to the other.</p>
<b>2. Attitude on integration</b>	<p><b>Ms Sibanyoni:</b> I think it's excellent, I think it's excellent ....integration should be stressed.</p> <p><b>Mr Nkosi:</b> Integration is good if, let's say we were working together, ...these different Learning Area educators. It would be interesting, but unfortunately, as we work as individuals, ...to me it's just boring, ...it's boring, for example I can't understand with maths, ...eh...those angles, how must I teach them. So that is the problem.</p> <p><b>Mr Mkoena:</b> I think... eh ... somewhere it's good but, the knowledge, ... I'm doing it because the Department wants us to do it, I do support it, ....</p>
<b>3. Teachers' readiness for integration</b>	<p><b>Mr Nkosi:</b> I don't think I am, ...actually most teachers are not ready. We are just doing it because it is forced on us by the Department and facilitators, but I don't think we are ready as teachers.</p> <p><b>Mr Mokoena:</b> I'm really not.... I'm always stuck when it comes to integration, .. I have to think, ... I have to think really, ...yah ... but I'm not ready.</p>
<b>4. Planning for integration</b>	<p><b>Mr Nkosi:</b> ...we work as individuals, ... proper planning is not happening, teachers don't work together. ... proper planning is not happening, teachers don't work together.</p> <p><b>Mr Mokoena:</b> Ehh ...I would say it doesn't happen much. Sometimes we want to do it as teachers but it does not happen properly, so it's happening but not the way I want it ...yah. It's not easy, it's really not easy. Yes sometimes we try to plan together. They say we must, ... team work will help us, but not always possible. It's not possible at school.</p>
<b>5. Frequency on integration</b>	<p><b>Mr Nkosi:</b> : S'bali integration is always there, whether you like it or not. I'm suppose to be doing it all the time, but like I said, I am not doing it properly, but it's everywhere in our teaching. In fact, ...eh ...integration is an old concept, it's not new. We've been doing it subconsciously from long ago, we do it all the time.</p> <p><b>Mr Mokoena:</b> My brother integration happens everytime in our teaching even if you are not aware. When I teach something in Arts and Culture I will always give an example from somewhere, I can take an example from the life in the street, from their home, or from another subject, and to me that's integration, ...so it happens all the time, sometimes I don't have to plan for it, but it will happen Arts and Culture lessons.</p>

<p><b>6. Description of AC-MAT integration</b></p>	<p><b>Ms Sibanyoni:</b></p> <p><b>Mr Nkosi:</b> Ok...for example, I would be.... I would be asking for example maths teachers to teach maybe the ....ehh ...what do you call them ... this ... ehh... the ... circles, rectangles,</p> <p><b>Mr Mokoena:</b> Eh ...integration of Art and maths means I talk about maths in my Arts and Culture class, I discuss maths, I count, I measure, I use angles and fractions, so I link maths with Arts and Culture.</p>
<p><b>7. Students'/ Colleagues' dependency for integration</b></p>	<p><b>Ms Sibanyoni:</b> ...the learners will provide you with information. They do help you. The learners will definitely help you. You can give them a problem, they will give you answers that you did not expect. They will integrate, they will give you integration with their answers. ...Sometimes you rely to the learners, sometimes you rely to other teachers...</p> <p><b>Mr Nkosi:</b> Sometimes we are helped by learners. These kids help us many times, they know more maths than us. We prefer them than teachers...</p> <p><b>Mr Mokoena:</b> ... so I went to one of the maths educators and asked her about this tessellation thing, but she couldn't answer me, she did not have any clue. So you see it's a problem, so it means teachers don't have a clue, don't know anything about this integration thing.</p>
<p><b>8. Other sources for integration</b></p>	<p><b>Mr Nkosi:</b> I had to make more research. Yah... I had to consult certain books....</p> <p><b>Mr Mokoena:</b> Yes there are many alternatives, I can go to the library, I can go to the internet, I can watch the TV (television) when maths is explained, but I don't have time. I cannot go to the library, I don't have the internet at my house, ...so it's difficult.</p>
<p><b>9. Mathematics knowledge/knowledge</b></p>	<p><b>Ms Sibanyoni:</b> ....yah my knowledge is just average, not little, but what I know is that maths deals with too much of numbers....</p> <p><b>Mr Nkosi:</b> Hmmm ....that's a difficult question ....(he laughs), ...eh... I think it's little s'bali, yah.. I think it's little. You know we struggle with maths, it's a difficult subject. I didn't do much maths at school, so my maths knowledge is little.</p> <p><b>Mr Mokoena:</b> Ahh..... it's little my brother, I don't have much maths knowledge. I don't have it truly. There is nothing much I can say about maths.</p>
<p><b>10. Challenges</b></p>	<p><b>Ms Sibanyoni:</b> Sometimes you don't feel comfortable, because you don't know what to do, but at the same time, the learners will provide you with information. They do help you.</p> <p><b>Mr Nkosi:</b> ..., but I'm not sure about angle, I take it as a maths term because I have not met it in Arts and Culture. ... The big problem is that this integration goes with a lit of paper work, so we end up not teaching but fixing the files, ...we are more like administrators than teachers. If these guys come (<i>referring to the DoE officials</i>), we just show them the files, and they are happy you know, but they don't know what is happening in class. ... for example I can't understand with maths, ...eh...those angles, how must I teach them. So that is the problem.</p> <p><b>Mr Mokoena:</b> Yah this integration thing ...eh... really confuse us, ...yah... it confuses me actually. ... Educator in trouble you can see, caring so many subjects ... it's too</p>



	<p>much. You can see on the left it's Arts and Culture, on the right it's maths, this means that we as educators we are carrying so many Learning Areas, and some of them we don't know how to deal with them. The knowledge, ... we lack knowledge. I for one do lack knowledge for integration. I'm doing it because the Department wants us to do it, but I'm not clear with it. I'm truly not clear with it.... They say you must integrate, but there is no integration you must see yourself what goes with what. So there is a problem, even the facilitators it seems they are empty themselves.</p>
<b>11 Document</b>	<p><b>Mr Nkosi:</b> Curriculum document is quite, it says nothing about this. We have to see to it ourselves as Arts and Culture teachers.</p> <p><b>Mr Mokoena:</b> No it doesn't, .... It doesn't, you will have to think if you have maths knowledge, then you will integrate, but if you don't have any knowledge in maths then you will have to see, but it's not clear at all, it's not. In fact there is no direction from the side of the Policy makers. They don't tell us exactly what to do. They won't give you any clue, they won't.</p>
<b>12. Gap</b>	<p><b>Mr Nkosi:</b> If these guys come (<i>referring to the DoE officials</i>), we just show them the files, and they are happy you know, but they don't know what is happening in class. ... integration is not happening right.</p> <p><b>Mr Mokoena:</b> They say we must, ... team work will help us, but not always possible. It's not possible at school. ... I'm doing it because the Department wants us to do it, but I'm not clear with it. I'm truly not clear with it....</p>
<b>13. Guidelines</b>	<p><b>Mr Mokoena:</b> No it doesn't, .... It doesn't, you will have to think if you have maths knowledge, then you will integrate, but if you don't have any knowledge in maths then you will have to see, but it's not clear at all, it's not. In fact there is no direction from the side of the Policy makers. They don't tell us exactly what to do, if they tell us it's patterns, it's patterns. They won't give you any clue, they won't.</p> <p><b>Mr Nkosi:</b> We don't get them, actually we've got the documents but they are not explicit.</p>
<b>14. Progress</b>	<p><b>Mr Nkosi:</b> ...integration is not happening right. ... we don't have the technique of integrating.</p> <p><b>Mr Mokoena:</b> I don't think there is success, for instance if you meet with other teachers from other schools, they complain about one thing, integration.</p>
<b>15. Way forward</b>	<p><b>Ms Sibanyoni:</b> I think more workshops should be provided.... Teachers should be trained on integration, on how integration works.</p> <p><b>Mr Nkosi:</b> You know I see other Learning Areas as a repetition, and sometimes some of them I feel alone they can do it without the integration of the others. For example with Arts and Culture, it's a Learning Area on it's own, right, a learner for example can specialize in Arts and Culture, without being interested in maths, ...</p> <p><b>Mr Mokoena:</b> The Department must do something. Their workshops are not eh ...up to standard ...they are not up to standard. So that's not enough ... I think more training is needed.</p>
	<p><b>Mr Nkosi:</b> Yes a concept can be understood differently .... and like I said we sometimes</p>

<p><b>16. Context</b></p>	<p>choose not to explain these maths concepts because they can cause confusion, so we don't explain them <i>sbali</i> even if we are aware of them.</p> <p><b>Mr Mokoena:</b> You know maths people, they have their own way of understanding things.... You know. And us as Arts and Culture educators we have our own understanding, ...and it's impossible to meet halfway because it will confuse the child.</p>
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Table 5.14: Categories and teachers' actual responses.

### 5.7.2.3 Interpretations from the categories

The following interview interpretations have not been confined to the interview extracts in table 5.14 above, the whole interview has been considered in each case.

#### (i) Definition

In this category three aspects of focus emerged, namely, '*definition of integration*', '*definition of a pure mathematics concept*' and '*definition of integration*'. Definitions from teachers reflected basic understanding of what each of these aspects meant. Mr Mokoena, when defining integration, used words such as 'link' and 'combine' to illustrate what integration means in terms of subjects. Five times in his definition, he used the word 'link', and this was particularly observable in view of the fact that the word 'link' was as central to this study as were the words 'integration' and 'connection'. Ms Sibanyoni also used the phrase "linking or sharing of concepts" when defining integration. These observations suggested that teachers have an intuitive understanding of integration, and as result one would expect that they would adhere to the demands and expectations of this teaching innovation. Teachers used contemporary terms such as Learning Area (Adler et. al., 2000) as opposed to conventional terms like 'subject', to suggest that they have embraced integration as a new teaching option. The notion of 'Learning Area' is more compliant with integration as it is perceived as a concept that encourages the combining of subjects (Adler et. al.). It was very important for the researcher to evaluate these areas of knowledge as this would later help the researcher to determining the gap between what teachers know (theory) and what they actually do in practice.

## **(ii) Attitude of teachers towards integration**

It emerged in this category that teachers are positive, and some optimistic, about integration. However, they were quick to point out that inadequate knowledge is a big problem to them. For instance, Ms Sibanyoni's reaction that 'it's excellent, I think it's excellent' was indicative of the fact that teachers have positively embraced integration, but as has already been alluded, the issue of teacher knowledge persistently coated their responses as could be observed in Mr Mokoena's response that integration 'it's good but, the knowledge, ...we lack knowledge'. This observation coincided with Czerniak's et. al., (1999) acknowledgement that teachers do not possess knowledge to integrate, and that knowledge of the other subject is a prerequisite in forging connections between subjects (Huntley, 1999).

Another interesting area of observation in this category was that, although almost all teachers displayed a positive attitude on integration, they hardly translated these views in their classroom instruction. Mr Nkosi, for instance, admitted that he implements integration because it is forced on teachers by the Department of Education and subject facilitators. This observation coincided with Czerniak et. al., (1999) findings that 'although teachers have positive perceptions about integrated curriculum, these perceptions do not carry over into practice' (p. 426). It can be realized that teachers are not well orientated with integration, they are not well positioned to implement this new teaching technique.

## **(iii) Teachers' readiness for integration**

As expected teachers indicated that they are not ready to integrate, and as a result they have resorted to other forms of integration as a way of responding to the Departmental (DoE) expectations on them. If teachers are not ready to deliver on integration, then integration will not be feasible (Adler et. al., 2000). It was important to make a follow-up on teachers' responses in this category as this would provide clues in terms of illustrating the manner in which teachers forge connections between Arts and Culture and mathematics, thus providing the researcher with a response to the second research question (RQ2).

## **(iv) Teachers' planning for integration**

In this category it emerged that teachers do not plan properly for integration, and this was also linked to lack of knowledge and teachers' inability to work collaboratively. In this category it also came up that teachers know exactly what should be done for integration to be

workable, however they chose to do something else. This could be picked up in responses such as ‘it doesn’t happen properly’ and ‘proper planning is not happening’. These kinds of responses seemed to suggest that teachers know what is proper or what should be done, but that is not happening. Teachers gave reasons for poor planning. Mr Nkosi, for instance, responded that as teachers they ‘don’t work together’. It should be highlighted that if teachers do not strive to work together they deprive themselves of ‘making rich ties’ between their subjects and those of others (Dossey, (1994), in McGinnis, Parker and Roth-McDuffie, 1999:11). Arts and Culture teachers need to improve on their techniques to integrate mathematics into their subject. Actually what the researcher observed was that Arts and Culture teachers do little to create what Huntley (1999) describes as ‘the classroom environment that supports opportunities for students to reason about and explore mathematical ideas’ (p. 63). This is likely to impact negatively on students who would possibly find themselves running the risk of not realizing exciting integration opportunities between mathematics and Arts and Culture.

#### **(v) Frequency of integration**

Teachers’ responses in this category were quite fascinating and also indicative of the fact that teachers have welcomed integration. Teachers acknowledged that integration occurred every time of the lesson, it is actually an ever-present feature of any lesson. Teachers argued that integration has always been there. Mr Nkosi went on to say ‘integration is an old concept, it’s not new. We’ve been doing it subconsciously from long ago, we do it all the time’. This view coincided with those espoused by Snyder (2000), who also argued that ‘the concept of an interdisciplinary approach has a long history within the profession and recently it has experienced a strong resurgence’ (p. 11). Czerniak et. al., (1999) have also noted that ‘integration of subject areas is not a new idea either’ (p. 424).

This was another case which demonstrated that teachers have positively embraced integration, however the question could be: *In view of the overwhelming evidence that teachers are positive about integration, what makes it not to be workable?* This question will be answered as we continue with this analysis.

#### **(vi) Description of Arts and Culture and mathematics integration**

Again, teachers in this category seemed to know what the connection between Arts and Culture and mathematics means. However, they seemed to differ in their illustration of how they would engage with fellow mathematics teachers on this issue. Mr Nkosi strongly maintained the view that the mathematics in Arts and Culture should only be explained by a mathematics teacher, whom he argued is trained for mathematics. He emphatically insisted that, 'that's his territory', referring to the mathematics teacher and mathematics. He continued, 'as an Arts and Culture teacher I only teach my part'. So it appeared that this teacher had attached relatively different perceptions to the notion of 'integration across subjects'. He strongly felt that as an Arts and Culture teacher it would not be necessary to have knowledge of another subject with which Arts and Culture would be integrated. However, this view was later contradicted by the same teacher (Mr Nkosi) in the concluding stages of the interview when he personally acknowledged that 'you need the knowledge of another Learning Area, because you cannot integrate with another Learning Area if your knowledge of that Learning Area is limited or is not there'. This latter comment by Mr Nkosi seemed to harmonise with the comments made by Mr Mokoena who argued that 'all Arts and Culture teachers need a maths workshop, to be well trained in maths for integration'. These types of conflicting statements, particularly in the case of Mr Nkosi, also highlight some of the major problems that teachers are faced with in their attempt to enact integrated teaching in their classrooms. They seem to be confused at times and this, to a greater extent, affects and influences the manner in which they integrate their subjects with other subjects.

#### **(vii) Teachers' dependency on students or colleagues for integration**

It emerged clearly that teachers depend, mostly, on their students for integration. Ms Sibanyoni acknowledged that 'you can give them (students) a problem, they will give you answers that you did not expect'. It appeared that this teacher subconsciously acceded to the view that teachers do not have answers (knowledge) for integration. She concluded by saying 'they will give you integration with their answers'. Mr Nkosi also acknowledged that 'we rely on these learners to help us'. In the later stages of the interview he once again acceded to this fact and replied, 'these kids help us many times, they know more maths than us'. What was also intriguing was the fact that the latter had seemingly gone to a point where he preferred students over fellow teachers, he noted, 'we prefer them (students) than teachers'. When this

teacher was probed further on this latter comment he responded, ‘we (teachers) differ, and that causes problems’.

In actual fact it was interesting to observe that the issue of students helping teachers surfaced in almost all the interviews with teachers. For instance, Mr Mokoena also acknowledged that ‘the learners do help us at times’. Teachers seemed to suggest that students know integration more than teachers, as Ms Sibanyoni noted ‘you rely to them, ... They can give you answers to the problem’. This observation further illustrates some of the pedagogical challenges that teachers experience in their respective classrooms. As much as we would appreciate that teachers adhere to the principle of learner-centeredness, which puts students in the driving seat of the learning process, teachers should also begin to realize the value of forging collaborative approaches that not only involve their students but also their colleagues. Huntley (1999) has also noted that ‘teachers of integrated mathematics and science often benefit by forging collaborative relationships with peers who share similar convictions’ (p. 66). It would be in the interest of Arts and Culture teachers to realize this fact because it is not always true that students can provide teachers with all answers, as Arts and Culture teachers seemed to have suggested.

#### **(viii) Other sources of assistance for integration**

Teachers mentioned libraries, books and internet in this category. However, it appeared that teachers seldom exploited the services offered by these resource materials. Mr Mokoena, for instance, argued that as teachers they do not have enough time to utilize these resources because the school schedule makes it difficult for them to have time. He argued that ‘there is no time, ... We do many things at school’. Teachers strongly felt that insufficient time was a major problem on their side and as a result they would not be able to explore other avenues to empower themselves for integration. Some authors have also reported on similar findings on the issue of time being reported by teachers as an obstacle in pursuing integrated teaching (Czerniak et. al., 1999, McGinnis, Parker and Roth-McDuffie, 1999). McGinnis et. al., (1999), for instance, have reported that ‘the mathematics teachers were concerned about the time required to integrate the disciplines’ (p. 9).

Because of time constraints, teachers have argued that they hardly get time to explore and utilize other educational resources relevant to integration. However, these responses also

highlighted issues around teacher identities. Teachers need to transform their identities and consider themselves as lifelong learners and researchers, and this will also help them not to depend entirely on their students for integration to take off.

**(ix) Mathematics knowledge and knowledge needed for integration**

Almost every teacher admitted he or she has insufficient mathematical knowledge for integration. They all rated themselves as ‘average’ in their mathematics knowledge. So this study revealed that grade 9 Arts and Culture teachers lack knowledge, particularly mathematics knowledge that is needed for integration. This lack of knowledge by Arts and Culture teachers undermined their efforts of integrating with loyalty across learning fields, hence they resorted to relying on their students whom they regarded as being more knowledgeable on integration and mathematics than themselves (teachers). The issue of teacher knowledge inevitably emerged during the course of these interviews with the teachers, and appeared to be one of the major barriers towards the success of integrated teaching. Huntley (1999) has noted that ‘a teacher’s capacity to capitalize on many connections between mathematics and science depends on the teacher’s mathematics and science content knowledge. Teachers with limited understandings of mathematics and science likely have limited capacity for making deep connections between the disciplines during classroom instruction’ (p. 64). The same can be said with grade 9 Arts and Culture teachers in relation to their attempt to integrate mathematics into their Arts and Culture lessons. As it appears, they cannot successfully achieve this as a result of their limited knowledge of mathematics which incapacitates them from forging these connections.

Teachers gave numerous examples to suggest that in Arts and Culture there is a lot of mathematics even though, as it appeared, the document does not make this point explicit. Mr Mokoena pointed out two activities from his Arts and Culture textbook (appendix XIV (b) and (c)) with which he confirmed links between Arts and Culture and mathematics. Mr Nkosi and Ms Sibanyoni also presented numerous cases, drawn from the Arts and Culture curriculum, to suggest that Arts and Culture and mathematics are strongly linked, in fact, Mr Nkosi used the phrase ‘maths is part of us’. But he (Mr Nkosi) persistently used phrases such as ‘we don’t express it’, ‘we avoid it’ and ‘we don’t tell them that they are learning what, mathematics’. So Arts and Culture teachers are quite aware of the fact that there is an excessive demand of mathematics within the Arts and Culture curriculum, however the

curriculum document does not dwell much on this issue. This places Arts and Culture teachers on a problematic situation as it seems that there is a mismatch between the envisaged curriculum and the realized curriculum. This dis-jointment or lack of alignment between the two curricular causes pedagogical tensions on grade 9 Arts and Culture teachers.

#### **(x) Challenges on integration**

This category was not specifically attached to a particular question, however during the course of the interviews it appeared that teachers are faced with a lot of challenges as they try to implement integrated teaching as envisaged. For instance, the popularised issue of teachers' lack of knowledge appeared to be an inhibiting factor for teachers to incorporate integrated activities in their instructions. It also emerged that teachers face a challenge of working as a team; this feature is evidently not a part of their instruction. They further acknowledged that group meetings are sometimes not productive as teachers would not have the knowledge or would end up arguing pointlessly. One of the challenges, as was raised by Mr Mokoena and Mr Nkosi, is that subject advisers, curriculum documents and workshops do not provide adequate and satisfactory support and guidance on integration for teachers. When Mr Mokoena responded on the issue of the guidelines that curriculum documents should be providing to Arts and Culture teachers, he noted that 'there is no direction. There are no examples', and when responding on the issue of workshops he argued that 'their workshops are not up to standard. You will go to a workshop for just an hour and they will expect you throughout the year to do the right thing'. Huntley (1999) has noted that 'a lack of clarity in curriculum design' is likely to result in 'conflicts and real tensions among teachers' (p. 58), and this seems to be case with grade 9 Arts and Culture teachers. They end up confused and arguing as a result of a lack of clarity from curriculum documents.

Mr Nkosi also highlighted the issue of increased workloads on teachers as a result of the introduction of the new curriculum, which upholds integration as its fundamental design feature. He argued, 'the big problem is that this integration goes with a lot of paper work'. As a practising teacher, the researcher has also observed that most teachers view integration as imposing more work on teachers. Lehman (1994), in McGinnis et. al., (1999) has also observed that 'for many practicing teachers, integration is seen 'as another add-on topic' (p. 11). These kinds of views and perceptions are likely to shape and influence teachers'



commitment on integration. Hence teachers will raise issues of time as defeating their noble intentions on integration.

The diagram constructed by Mr Mokoena, prior the interview, was also useful in depicting the plight of the teachers. Mr Mokoena lamented that ‘as educators we are carrying so many Learning Areas, and some of them we don’t know how to deal with them’. This type of a reaction seemed to suggest that some of the teachers believe that integration creates a lot of work for teachers, who are presumably overloaded. They found themselves having to interact with other subjects other than theirs, something that they perceive as creating a lot of work for them. Czerniak et. al., (1999) have also reported on ‘*obstacles to enacting integrated units*’, and they have observed that ‘some teachers had reservations about the time it took to infuse integration into an already packed curriculum’ (p. 426). Some of the teachers have raised scepticism regarding the success of integration in the mist of such concerns. Later on, Mr Mokoena also complained that integration also causes confusion and that sometimes they do it because the Department (DoE) wants to see it done.

#### **(xi) Arts and Culture curriculum document**

In this category teachers strongly felt that the grade 9 Arts and Culture curriculum document is quiet about mathematics, and that it is not giving them the much needed support and guidance for integration. Mr Nkosi noted, ‘we have to see to it ourselves’, the ‘curriculum document is quiet’, as he further expressed his views. Mr Mokoena insisted, ‘they don’t tell us exactly what to do’ and concluded by saying ‘there are no examples’. This exemplified Huntley’s (1999) raised concerns about ‘a lack of clarity in curriculum design’ (p. 21). These revelations also coincided with the previous findings in the grade 9 Arts and Culture curriculum document’s analysis that the level of mathematical demands in the grade 9 Arts and Culture curriculum is very low. This is confirmed by the teachers’ responses that the document is ‘quiet’ on mathematics, and as a result, there are no mathematics examples in the document. Teachers also shared the views articulated by the same Arts and Culture curriculum document that teachers must ‘apply their minds’ (p. 11). Mr Mokoena noted that ‘you will have to think’, and Mr Nkosi echoed the same sentiment and said, ‘we have to see to it ourselves as Arts and Culture teachers’.

From these observations it can be realized that teachers are actually left on their own, and to a greater extent, this contributes to rendering integration as a non-workable teaching tool. It had earlier been echoed, by teachers, that even the Arts and Culture subject advisers are seemingly failing to provide teachers with direction and guidance on integration.

#### **(xii) The gap between the intended and the realized curricula**

Teachers' responses seem to suggest that there is evidently a gap between what is presumably known about integration and that which is practically explored on integration. In a number of instances it seemed teachers know exactly what should be done in implementing integrated teaching effectively, however teachers are seen not to be '*abled*' to rise to the occasion. For instance, it came up that teachers know that they need to work collaboratively, but disappointingly it emanated that this aspect is not featured in their planning. To a certain extent one could be inclined to putting the blame on teachers as well. For instance, Mr Mokoena acknowledged that 'we always have something when it comes to do that', and later he noted that 'teachers can be a problem'. Mr Nkosi also made a controversial comment when he said, 'we are just doing it (integration) because it is forced on us by the Department and facilitators'. These kinds of responses highlight the issue of teachers' commitment in rendering integration as a workable teaching activity.

It was good to realize that teachers have nothing against integration, however this study has also revealed that teachers are still reluctant to take integration into their ownership, they seemed to perceive it as something that belongs to the Department of Education. When referring to the Departmental officials, Mr Nkosi noted, 'if these guys come, we just show them the files, and they are happy you know, but they don't know what is happening in class'. The latter part of Mr Nkosi's comment, that '*but they don't know what is happening in class*', raised eyebrows. Actually, it seemed to suggest that a lot of misdoings, that go unnoticed, are taking place within the four walls of the classroom. Teachers do not enact their professional teaching roles properly. This is likely to create an ever-increasing gap between the intended curriculum at plenary level and the realized curriculum at implementation level. Huntley (1999), in his study, also observed a similar gap. In conclusion he noted that 'these findings suggest a gap between integrated instruction in theory and practice' (p. 65).

#### **(xiii) Guidelines on integration**

It appeared that teachers feel that the grade 9 Arts and Culture curriculum document does not provide teachers with clear-cut guidelines on integration. Mr Nkosi argued, ‘we don’t get them’ and he accused the document of not being explicit in this regard. Other teachers equally shared the same sentiment. They unequivocally objected that the documents of Arts and Culture are not giving teachers direction in terms of integration.

#### **(xiv) Progress on integration**

Teachers felt that there is no progress that is taking place on integration. For instance, Mr Mokoena noted, ‘I don’t think there is success’. He based his argument on his personal experiences and also on the fact that most teachers are experiencing problems on integration, he elaborated, ‘for instance if you meet with other teachers from other schools, they complain about one thing, integration’. These kinds of responses continued to suggest that teachers also acknowledge that they do not implement integrated teaching properly.

#### **(xv) Way forward on integration**

Almost all teachers were able to suggest a way forward. They pleaded that the Department of Education should get its act together. Ms Sibanyoni recommended, ‘I think more workshops should be provided’. Mr Mokoena shared the same sentiment that ‘teachers need to be trained’. Mr Nkosi, on the other hand, seemed to suggest that the South African system of education should relapse into its old order and that integration should not be fore-grounded. He noted, ‘sometimes some of them (subjects) I feel alone they can do it without the integration of the others’.

What was mostly prominent in teachers’ responses in this category was that teachers seemed to be putting the blame only on the part of the Department (DoE), they could not perceive themselves as also blameworthy, to a certain extent. This observation says a lot about teachers’ mentality with regard to transforming their professional identities. Teachers need to realize that they also must cultivate and adopt new identities that would be compatible with the new pedagogical challenges of this age.

#### **(xvi) Context**

In this category the researcher was aiming at the responses that would suggest teachers' difficulties in transferring knowledge across subjects. These kinds of responses would allow the researcher to draw from the theory of situated learning (Lave and Wenger, 1991) within which this study had been framed. However, there were no particularly direct questions for this category, though some of the questions that were asked to teachers yielded responses that could be associated with this category. Questions like, *What do you think are the main problems that discourage teachers, like those of Arts and Culture and mathematics, to plan and work together as integration requires?* Table 5.14 contains some of the responses generated in this category. For instance, Mr Nkosi acknowledged that a concept can be understood differently, and possibly be interpreted differently, by different people. He further alluded to the fact that sometimes they 'choose not to explain these maths concepts because they can cause confusion', possibly acknowledging that shared knowledge (concepts) always carry with it a potential to allow multiplicity of interpretation as a result of it being located in different contexts of learning. This creates problems, as Mr Nkosi acknowledged, 'they can cause confusion'. Mr Mokoena also supported Mr Nkosi on this aspect and he noted that 'it's impossible to meet halfway because it will confuse the child'. The latter had earlier acknowledged that people 'have their own way of understanding things', possibly as a result of their different contextual background.

#### **5.7.2.4 Major observations from the interviews**

What came up very strongly from these interviews was the element of teacher's discontentment about a number of issues regarding integration. Although teachers strongly felt that integration is desirable as a teaching and learning tool, they strongly felt that they are not properly positioned to enact this teaching and learning innovation. This came up to be evident when teachers revealed that they have opted to resort to other forms of integration, like relying on their children to further the visions and goals of integration. Teachers kept on insisting that they lack knowledge for integration.

#### **5.7.2.5 Transferability of knowledge**

Lave (1993) has warned that the process of learning, which constitutes the transfer of knowledge and skills through internalisation, should not be construed as a 'straight pipe metaphor of knowledge channelled into learners' (p. 79). In contrast, Lave has described this

as a 'highly complex and problematic process' (p. 79). Lave and Wenger (1991), on the other hand, have also criticized and argued against the conventional views on learning and knowledge transfer, which, as Lave and Wenger sum it: 'view learning as a process by which a learner internalises knowledge, whether 'discovered', 'transmitted' from others, or 'experienced in interaction' with others' (p. 47). Like Lave (1993), Lave and Wenger (1991) have also criticized conventional views on learning and have strongly argued that the process of knowledge transfer is highly problematic, they have noted:

Learning as internalisation is too easily construed as an unproblematic process of absorbing the given, as a matter of transmission and assimilation. (p. 47)

Lave and Wenger render learning as a complex activity which implies 'not only a relation to specific activities, but a relation to social communities' (p. 33). They have argued that learning 'implies becoming able to be involved in new activities, to perform new tasks and functions, to master new understanding' (p. 51). They have further noted that 'activities, tasks, functions, and understandings do not exist in isolation; they are part of broader systems of relations in which they have meaning' (p. 53). From this background it can be realized that learning is quite a complex and delicate process which is informed and shaped by a number of factors. Lave and Wenger close their comments by reiterating their position that 'learning is never simply a process of transfer or assimilation' (p. 57), and they conclude, 'among the insights that can be gained from a social perspective on learning is the problematic character of processes of learning' (p. 57).

From this background there could be a basis to argue that the transfer of knowledge or the process of learning across contexts should also be as equally problematic and complicated. Adler et. al., (2000) have also commented on the "adaptability" of knowledge across different settings of learning. They have also argued that 'the learner will have developed different identities in each of these settings' (p. 11). This makes it difficult for students to fluently express knowledge in different contexts because, according to Bernstein (1982), they shall have developed different learning codes in each of these learning contexts. Adler et. al., (2000) have also used Lave and Wenger's framework to argue against the assumption that 'integration will promote transfer of learning' across different learning fields. Drawing from these publications the researcher has also used a similar framework to argue that integration,

as conventionally perceived to be a vehicle for knowledge and skills transfer between school subjects, is desirable in theory but problematic in practice. Hence the researcher has argued that integration between mathematics and Arts and Culture could be desirable but not feasible, particularly at grade 9 level as observed through this study.

This aspect has evidenced itself in the interview sessions with the grade 9 Arts and Culture teachers. Arts and Culture teachers acknowledged that fellow teachers from different subjects hardly come together to discuss integrating concepts, and when probed on this aspect they responded:

**Mr Nkosi:** Like I said..., we are like .... eh... sort of belonging to two camps, you see ... it's maths and it's Arts and Culture. We do our own thing and they do their own thing..., you know any concept is explained differently in different Learning Areas, ... so we differ... and that causes problems even to learners ... because we disagree and learners can see. ...a concept can be understood differently .... and like I said we sometimes choose not to explain these maths concepts because they can cause confusion, so we don't explain them ... even if we are aware of them.

**Mr Mokoena:** Very.... very difficult, because as educators we have different understandings of things .... and if we integrate things are worse sometimes ....., but sometimes its good, but the problem I cannot explain maths things like a maths educator.

Further on, Mr Mokoena noted, 'because we don't understand same things. For instance, a maths teacher will talk about this and Arts and Culture teachers will talk about ...you see. So it can cause confusion'. Later on, he emphasised that 'maths people, they have their own way of understanding things ...and if we integrate things are worse'.

These kinds of comments seemed to suggest that grade 9 Arts and Culture teachers acknowledged that multiple understandings can be assigned to a single concept, as Mr Mokoena noted, 'educators...have different understandings'. In respect of the conversation, Mr Mokoena was referring to different understandings of the same concept. Both teachers alluded to the fact that these multi-faced dimensions of understanding of a single concept could end up confusing the students. Arguing this point from Bernstein, one realizes that

teachers seem to be having different pedagogical codes and as a result they can attach different meanings to a single concept. They acknowledged that this might cause confusion (problems) to students. Mr Nkosi noted, ‘we sometimes choose not to explain these maths concepts because they can cause confusion, so we don’t explain them’, and the reason for this reaction, as he had alluded earlier, ‘a concept can be understood differently’. This observation seemed to support the position supported by the proponents of the situated theory that transferring knowledge from across contexts is problematic. Anderson, Reder and Simon, (1996) have also argued that:

...transferability of skills from one context to the next depends on factors such as the number of symbolic components that are shared. (p. 3)

Within the context of Arts and Culture as a distinct domain of knowledge, concepts are conceived and perceived in respect of the activities (participation), whose meaning is confined within the boundaries of the existing culture of the subject. Mathematics, on the other hand, could be viewed as pursuing its own *different* agenda (in respect of Arts and Culture), whose activities are relatively different to those pursued by the Arts and Culture ‘communities of practice’ (Lave and Wenger, 1991). Teachers in these two different subjects are perceived to be differently positioned. They have different pedagogical codes (Bernstein, 1982), and as a result they attach different meanings to concepts. From this background we could realize and understand some of the challenges that teachers face as they try to enact the new curriculum which is embodied within the notion of integration. Teachers need to transform their identities; they need to have new pedagogical codes that could enable them to negotiate meaning across different learning fields.

#### **5.7.2.6 Implications of these findings to my second research question (RQ2)**

In the second research question the researcher explored the kinds of connections that the grade 9 Arts and Culture teachers forged in view of the expectations of the new curriculum, which places integration as its cornerstone. The researcher needed to interact with teachers in order to see how they go about responding to integration opportunities, particularly those involving mathematics. The findings of the interviews, particularly those discussed in section 5.7.2.5 above, revealed that grade 9 Arts and Culture teachers experience problems in their attempt to enact the expectations and visions of the new curriculum. Among other things,

Arts and Culture teachers grossly lack mathematical knowledge that is required to facilitate integration between the two subjects and as a result they resort to relying more on their students whom they have acknowledged have more knowledge than themselves. It also emerged that grade 9 Arts and Culture teachers experience difficulties in their attempts to negotiate meaning either with their students or with their fellow teachers. They have argued that mostly these interactions have degenerated into pointless arguments that have eventually perpetuated confusion and misunderstanding.

These harsh realities have discouraged their efforts in trying to pursue connections between their subject and mathematics, despite the fact that they are particularly passionate about integration. Grade 9 Arts and Culture teachers are therefore not in a position to properly articulate the expectations of the new curriculum as envisaged by the demands of the new curriculum. From this background it can be argued that although integration of Arts and Culture and mathematics at grade 9 level is desirable, it is not feasible in the actual teaching and learning settings, as a result grade 9 Arts and Culture teachers turn to resort to alternative teaching techniques such as relying on their students to facilitate integration or relapsing into traditional ways of teaching that barely fore-ground the significance of integration in its instruction. Therefore, the integration of Arts and Culture with mathematics at grade 9 level is superficial.

## **5.8 Overall impressions from the analysis**

Two key points have emerged from the document analysis and the interviews. Firstly grade 9 Arts and Culture *teachers experience challenges in integrating mathematics* with Arts and Culture. These challenges are compounded by the fact that teachers have insufficient knowledge to integrate Arts and Culture with other subjects and the fact that the transfer of knowledge across learning fields is problematic. Secondly, it appeared that the Arts and Culture *curriculum documents do not explicitly articulate the mathematical demands that are inextricably linked to the Arts and Culture curriculum*. However, during instruction grade 9 Arts and Culture teachers experience a lot mathematical demands, and this causes tension between what the curriculum projects about Arts and Culture and what actually emanates in the classroom, in terms of the mathematics that is embedded in Arts and Culture. As a result



of this tension, Arts and Culture teachers have resorted to other forms of integration, such as relying on their students to assist them with integration.

## 5.9 Conclusion

In analysing the data and looking for patterns the researcher used the ‘etic’ perspective (McGinnis et. al., 1999), which is described as the way of ‘imposing the researcher’s theoretical framework on the data to develop the narrative’ (Van Maanen (1995), in McGinnis et. al., 1999:13). That has been the objective of this report, that is, to link the data to the theoretical framework (situated theory) and further allow it to be interpreted within this framework.

The analysis of the findings in this study, particularly those of the grade 9 Arts and Culture curriculum document and the subsequent interviews, has raised serious pedagogical issues about the feasibility (Adler et. al., 2000) of integration in the South African curriculum context. In section 5.4 the researcher provided an extensive analysis of the grade 9 Arts and Culture curriculum document, in which it emerged that the document did not prioritise the issue of AC-MAT connections in its content, despite existing evidence of a historical lineage of connection between the two subjects (Sriraman, 2005). the researcher realized that the curriculum document did not make visible the mathematical demands of Arts and Culture curriculum on grade 9 teachers. Section 5.4.6 illustrated the implications of these findings not only to this study but also to Arts and Culture teachers and the broader curriculum. In that way the researcher was able to respond to the first research question (RQ1), in levels of mathematical demands within the Arts and Culture grade 9 curriculum were investigated. Based on the findings of this study the researcher concluded that *the levels of the mathematical demands in Grade 9 Arts and Cultures curriculum were extremely low.*

In section 5.7 a discussion and analysis of the findings of the interviews was conducted. Based on the findings of the interviews the researcher was able to address not only the second research question (RQ2) but also the research objectives (ROs) set out for this study. The researcher observed that grade 9 Arts and Culture teachers were faced with numerous challenges in their attempt to positively respond to the demands of the new curriculum. Drawing from section 5.7.2.3 of this report, the researcher observed that this study was able

to establish that a number of undesirable factors has negatively impeded the process of proper curriculum articulation on the side of the grade 9 Arts and Culture teachers. Using the framework of situated learning the researcher was also able to realize and conclude that the integration of Arts and Culture and mathematics at grade 9 level is, although desirable, not feasible. These finding coincide with the observations made by Adler et. al., (2000), both theoretically and empirically. In section 5.7.2.6 extensive deliberations were made regarding this view, and a variety of previous studies were explored and discussions made in order to support the claim that integration of knowledge and skills across subjects of learning is potentially problematic, and as a result Arts and Culture teachers in grade 9 have resorted to alternative teaching approaches that seem to undermine the envisaged integrated forms of teaching. Subsequently, these empirical observations and the emerging arguments were able to help the researcher to respond, mainly, to the second research question, in which the researcher investigated how grade 9 Arts and Culture teachers integrated mathematics in their Arts and Culture lessons. The findings of this study have helped the researcher to respond to the second research question (RQ2) and to conclude that *the integration of mathematics and Arts and Culture at Grade 9 level is superficial.*

## **CHAPTER 6: Discussions, conclusions and recommendations**

### **6.1 Introduction**

The aim of the study was to explore how the grade 9 Arts and Culture teachers attempted to forge connections between their subject, Arts and Culture, and mathematics. The interest in this study was initiated from a realization that Arts and Culture and mathematics pose as fields of knowledge that are inextricably linked. Hence the main objective of this study was to investigate how Arts and Culture teachers succeeded in their attempts to incorporate mathematics in their Arts and Culture lessons, particularly in view of the fact that most of these teachers (Arts and Culture) lack basic background of mathematical knowledge that would be essential in forging these connections. Using a set of two research questions (section 1.4), the study was able to reveal a number of pedagogical challenges that Arts and Culture teachers faced in their classrooms. Prominent amongst these was the teachers' inadequate knowledge of mathematics, which impacted negatively in their pedagogical intents to integrate mathematics with Arts and Culture.

The following tools facilitated the collection of data that was needed in order to respond to the two research questions that had been posed earlier on. At the initial stages of this investigative study, teachers were given a concept mapping activity, which culminated into clinical interviews with them. Interviews served as a major tool in providing answers to some of the contentious issues that had emerged during the concept mapping activity. Two other teachers, who were teaching mathematics at grade 9, were also requested to comment on an Arts and Culture activity which incorporated mathematical concepts in it (appendix II). All of these activities played a significant role in providing meaningful responses, particularly to the second research question (RQ2). Also investigated in this study was a grade 9 Arts and Culture curriculum document. This document was analysed with the purpose of examining the levels of mathematical demands that the grade 9 Arts and Culture curriculum imposed

on grade 9 Arts and Culture teachers. Observations made through this analysis provided significant responses in answering the first research question (RQ1).

The study adopted the theory of situated learning (Lave and Wenger) as its theoretical framework. Bernstein's theoretical constructs, classification, recognition and realization rules, were also used in order to provide explanations for the observed ways in which the grade 9 Arts and Culture teachers tended to enact integration in their instruction. Van Hiele's framework was also incorporated in this study in order to advance a claim that differentiated teaching can enhance learning.

## **6.2 First research question**

The first research question was:

*What are the mathematical demands of an Arts and Culture curriculum at Grade 9 level?*

As already illustrated in the preceding chapters, this study revealed that the levels of mathematical demands in a grade 9 Arts and Culture curriculum were very low. The researcher observed that mathematics was not fore-grounded in the Arts and Culture curriculum document. This was at the curriculum specification level. The mathematics that was required was not made explicit. This meant that there was an expectation that teachers needed to unearth the mathematics that was required for effective learning of Arts and Culture, at the classroom level, however, the ability to unearth this mathematics was taken for granted. The position being taken in this study was that only experienced teachers would be able to succeed in doing this before they get to the classroom. The teachers (Arts and Culture) that were part of this study only encountered mathematics during their interaction with their students in the classroom. It was also observed that there were relatively fewer instances where the connections between Arts and Culture and mathematics were encouraged and discussed in the Arts and Culture curriculum. This was considered to be a further confirmation that mathematics is overlooked in the grade 9 Arts and Culture curriculum.

### 6.3 Second research question

The second research question was:

*Within the context of a new curriculum (Revised National Curriculum Statement), what connections does an Arts and Culture teacher make between mathematical concepts in Arts and Culture topic?*

Interactions with grade 9 Arts and Culture teachers, primarily through the interviews, enabled the researcher to establish types of connections forged by Arts and Culture teachers. Teachers acknowledged that they did not possess adequate and appropriate knowledge for integration, and as a result they tended to rely mostly on their students for integration. From these findings the researcher concluded that the kinds of connections that the grade 9 Arts and Culture teachers made with mathematics were superficial. This study revealed that this lack of knowledge for integration also limited possible interaction among teachers as they argued that such meetings turned out to be meaningless and less productive.

### 6.4 Research objectives

In section 1.2 of this report the research objectives (RO's) were outlined and further summarised in subsequent chapters (see table 3.1 and section 5.7.1 for the summary of these objectives). In total there were five research objectives stipulated for this study, namely:

- **RO1:** To highlight pedagogical challenges for teachers;
- **RO2:** To evaluate progress made on AC-MAT integration;
- **RO3:** To highlight the existing gap between idealized and realized curricula;
- **RO4:** To raise issues of teacher training and development;
- **RO5:** To highlight the benefits of integration.

This study was able to address these research objectives. It managed to highlight pedagogical challenges faced by grade 9 Arts and Culture teachers who were involved in this research. Key to these challenges was the fact that these teachers lacked knowledge to integrate mathematics in their subject (Arts and Culture). Because of this lack of knowledge among teachers, teamwork was not feasible and productive. Also observed was the fact that grade 9 Arts and Culture teachers did not receive adequate support and guidance from curriculum designers on integration. Teachers were left to fend for themselves, and this was a huge challenge to them.

Observations through this study also revealed that there was little progress made on integration. Some of the teachers that were interviewed registered a concern that most teachers were struggling with integration. They also raised a concern that workshops and meetings on integration were not productive, and as teachers they did not know exactly what they needed to do. This study was also able to uncover the gap between the idealized and realized curricular. It appeared that grade 9 Arts and Culture teachers knew exactly what they were supposed to do in order to enhance their methods for effective integrated teaching. However they were not able to translate this knowledge into actual classroom practice. For instance, teachers knew that they needed to be pro-active in terms of upgrading themselves with knowledge on how to integrate in practice, however, they did not make those moves.

The findings of this study have provided a justification to call for teacher training and development on issues related to integrated teaching. Teachers felt that they needed proper training for integration. The fact that it was observed that grade 9 Arts and Culture teachers could not successfully deal with the connections between mathematics and Arts and Culture reiterates the need to call for a speedy implementation of in-service programmes to enhance the capacity of teachers to integrate across learning areas. There could be pedagogical benefits for this.

### **6.5 Benefits of integrated teaching**

Filo, Grayfer and Yarkoni (2005), in Beckmann, Michelsen and Sriraman (2005), used van Hiele's theory of 'learning development in geometry' to argue that 'art can

serve as a powerful teaching and learning tool in an interdisciplinary curriculum' (p. 3), as it can provide visual aspects of what is learnt. During interviews, teachers acknowledged that mathematics and Arts and Culture are naturally linked. However this aspect was not made explicit in the Arts and Culture curriculum documents, which were meant to guide their teaching. 'Level 0' of van Hiele's levels of geometric thinking deals with the *visualization* aspect of learning in which students identify, name, compare, and operate on geometric shapes. At this stage, Arts and Culture can play an effective role in facilitating the comprehension of mathematics and also provide an enabling and exciting environment for the teaching and learning of mathematics (section 2.5.2). This form of instruction can assist to produce positive attitudes towards mathematics and improving students' achievement in both subjects (Lehman (1994), in McGinnis, Parker and Roth-McDuffie, 1999:11).

## **6.6 Recommendations**

From this study the following recommendations were made. They are concerned with recommendations for teaching, curriculum and research.

### ***Recommendations for teaching***

There is an urgent need to train teachers on integration. This is because incorporating mathematics into Arts and Culture requires Arts and Culture teachers to have knowledge of mathematics in addition to knowledge in a discipline in which they are officially expected to work – their official instructional discourse (Bernstein, 1996). This means that the identities of teachers need to shift in ways that consider Arts and Culture teachers to be seen also as teachers of mathematics. This is not usually the case. There are clear classifications of teaching roles and expertise in schools. There is a need to put in place training to re-orientate teachers in order to meet the ideals on integration. Teachers also need to be exposed to progressive approaches of instruction such as acknowledging the value of working as a team. Dossey (1994), in McGinnis et. al., (1999:11) noted that little contact between teachers prevents teachers from making rich ties to integrate their subjects with others. Stepanek (2002) has also argued that when teachers work together they stand to gain new insights and new ways of approaching familiar subject matter. However, as discussed previously, for

such pedagogical interactions to be effective teachers need to have basic knowledge and expertise needed in sustaining meaningful discussions related to the possible connections between subjects they themselves are assigned to teach and those of their colleagues. Teachers need to work towards building strong connections amongst themselves. When this happens, it could translate to pursuing connections between different learning fields such as Arts and Culture and mathematics amongst teachers.

### ***Recommendations for curriculum***

In the new curriculum, it is stated that:

Integration is achieved within and across subjects and fields of learning. The integration of knowledge across subjects and terrains of practice is crucial for achieving applied competence as defined in the National Qualifications Framework (DoE, 2003, p. 3).

It is clear from the above statement that integration is key in the curriculum. This statement is made at policy level. However, much remains about how statements that are made at policy need to shape what happens in practice. We need to ask the following related questions: *Who is expected to make visible the ways and means for making explicit how teachers translate policy into practice? Is it the duty of curriculum experts, the ones who put together policy documents such as the one quoted above? Or is it the teacher? Or is it teacher educators?* Whatever answer one might give to these questions, it is important to acknowledge that curriculum documents play a decisive role in shaping teachers' perceptions and approaches to instruction. This is because curriculum documents are one of the visible yardsticks that tell teachers what is expected of them. We can see these yardsticks in what is called "assessment standards" in the language of the new curriculum nationally in South Africa and internationally. It is suggested, based on the findings from this research, that curriculum documents need to provide explicit guidelines on how teachers should integrate '*within and across subjects and fields of learning*' as quoted above. However, this requires that such documents should be designed by academic experts who have both a theoretical and empirical eye on integration not only within a particular subject but of the entire curriculum. Such documents should be designed to



primarily address educational goals rather than the political-rhetorical ones; the later should not be emphasized at the expense of the former. Our curriculum needs to be placed in the “right” hands, here “right” needs to be understood in the context of ‘experts who have both a theoretical and practical eye on integration’, as mentioned above. The researcher has argued that it seems to be far from being the case at the moment. This can be seen from the content of the currently used curriculum documents. There is little explicit guidance on how the “integration” being proposed is going to be achieved in actual practice in real classrooms.

### ***Recommendations for research***

The research that the researcher has reported on here can be categorised as belonging to a small gazed into curriculum and how it is implemented at the school level. Experts in the field of curriculum might categorise such research as this one as ‘evaluation research’ (Hatch, 2002). It is suggested that mechanisms should be established in order to monitor and investigate gaps between the ‘idealized curriculum’ and the ‘realized curriculum’ (Ogunniyi, 1988). It is clear within the context of this study that there is a big gap that exists between the aspirations of the curriculum policy makers and what happens in practice. The review of the literature shown in chapter two indicated that not much work has been conducted in researching integration across learning areas. There appears to be a dominance of research on integration between mathematics and science, and little between mathematics and other subjects such as Arts and Culture. This study has made a small contribution to knowledge in this field of integration. Hence further research needs to be conducted with larger or more diverse samples of participating teachers in addition to those who are teaching Arts and Culture. Such research also needs to acknowledge the complexity involved in understanding the issue of practising teachers. On the one hand, they do not disagree that integration is a desirable teaching tool. However, it is clear that much preparation needs to happen on the part of teachers before they actually teach a topic in an integrated way. It would be a useful study to examine the extent to which teachers who actually prepare integration in their lessons, end up integrating in practice. The one other dimension of that research hinges upon what needs to be seen as mathematics on the part of those teachers who teach non-mathematical subjects. An individual might not notice that there is mathematics in a

certain topic in a non-mathematical subject depending on what that individual considers to be mathematics. We can support the relevance of this argument here by what we seem to see in the media concerning perceptions about *what counts as mathematics* in the new learning field called “Mathematical Literacy” (Christiansen, 2006, Venkat, 2007, Julie, 2006).

### **6.7 Reflections from the study**

This study has been useful in terms of providing empirical evidence regarding teachers’ experiences and challenges in their attempts to enact the notion of integrated teaching and learning. The researcher anticipates that the results of this case study, when disseminated, will also serve as a yardstick to measure the progress made since the inception of integrated teaching. In view of the findings from a grade 9 Arts and Culture curriculum document, one inevitably finds oneself asking such questions as: *In whose hands is our education lying?*

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## APPENDIX: I

### Concept mapping activity: Grade 9 Arts and Culture teachers.

Below you are provided with concepts that have been drawn from the Grade 9 Arts and Culture textbook, *Millennium Arts and Culture Grade9 Learner's Book*, which happens to be the prescribed textbook for your school. In this activity you are required to identify concepts which you think are either pure mathematics or pure Arts and Culture, and you should further indicate which of the given concepts can be integrated or connected between mathematics and Arts and Culture. You are requested to make use of a concept map to do this activity.

**Concepts:** *angle; area; colour; dance; design; dimension; melody; parallel; pattern; percentage; positive.*

## APPENDIX: II

### Grade 9 Arts and Culture activity for a Grade 9 mathematics teacher.

One Grade 9 mathematics teacher is given an activity from the Grade 9 Arts and Culture textbook, *Arts and Culture – Millennium Series*. The teacher is supposed to comment on how he/ she thinks students might respond to such an Arts and Culture activity, which has mathematics embedded on it.

**Textbook:** Millennium Arts and Culture Grade 9, Learner's Book.

**Activity:** “When you analyse something, someone or situations, you will realize that there can be positive and negative attributes involved. What can you identify as positive and negative in an apple?” (pg. 37)

**QUESTION:** This activity was extracted from a Grade 9 Arts and Culture textbook, *Arts and Culture, Teacher's Guide for the Development of Learning Programmes, Revised National Curriculum Statement Grades R-9, (2003)*. As you can realize, this activity has incorporated the notion of a ‘positive’ or ‘negative’ in it. As a mathematics teacher how do you think this notion of ‘positive and negative’ can influence students’ responses, who might have discussed these concepts in a mathematics class?

## APPENDIX: III

### Interview key (structured) questions: Main study.

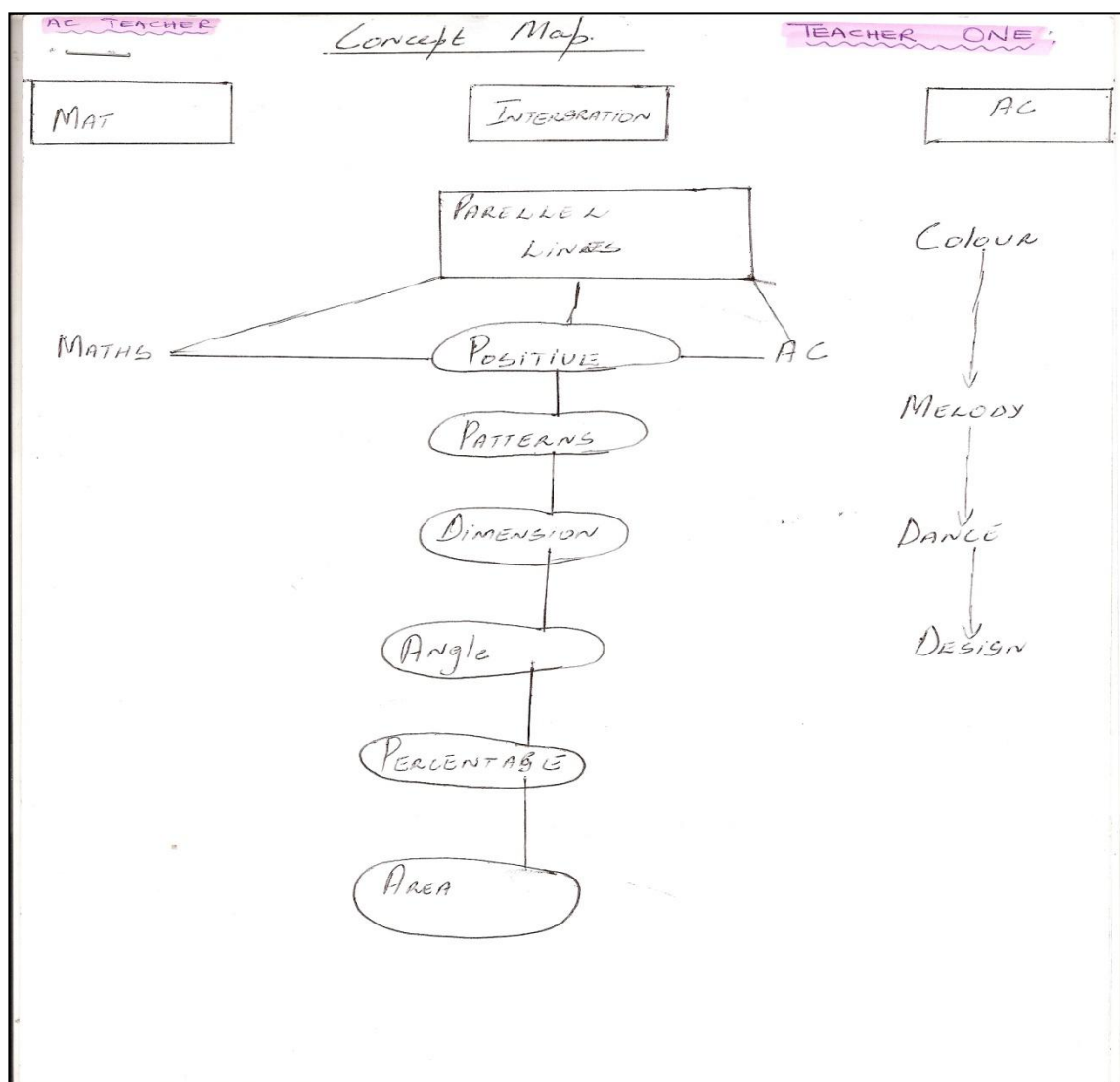
**NB:** It is important to note that although all interviewees were subjected to these questions, the questions were not necessarily asked in this order or in the same order. Probing, for instance, differed from one interviewee to another. The results of concept maps also played a part in the variation of questions from one participant to another, however, the following key questions maintained uniformity across all participants. The questions varied from general (integration) to specific (AC-MAT integration).

1. What is your understanding of integration?
2. What are your views on integration, is it a good idea or not a good idea?
3. As a teacher do you think you are ready for integration?
4. How do you plan for integration?
5. How often do you implement integrated teaching in class?
6. What is your understanding of AC-MAT integration?
7. How often does mathematics come up in your AC lessons?
8. How do you plan for AC-MAT integration?
9. How do you deal with AC-MAT integration in your lessons?
10. How do you rate your MAT knowledge, a little, average, good?
11. What challenges do you face when forging AC-MAT connections?
12. Do AC teachers get guidelines from curriculum documents?
13. Is there a difference between what you do in class and what the curriculum document suggests?
14. Is integration making progress?
15. What should be done for improvement?



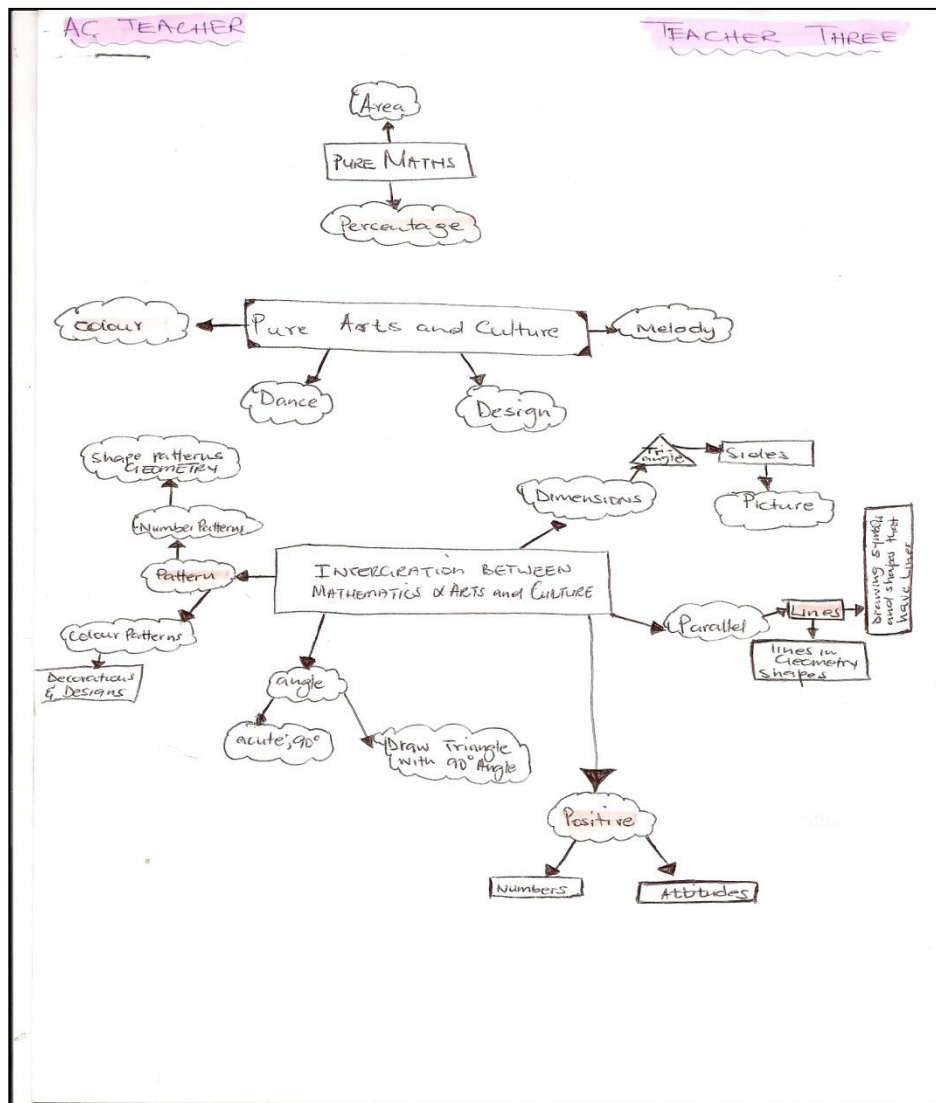
## APPENDIX: IV

### Concept map: Teacher one (piloted study).



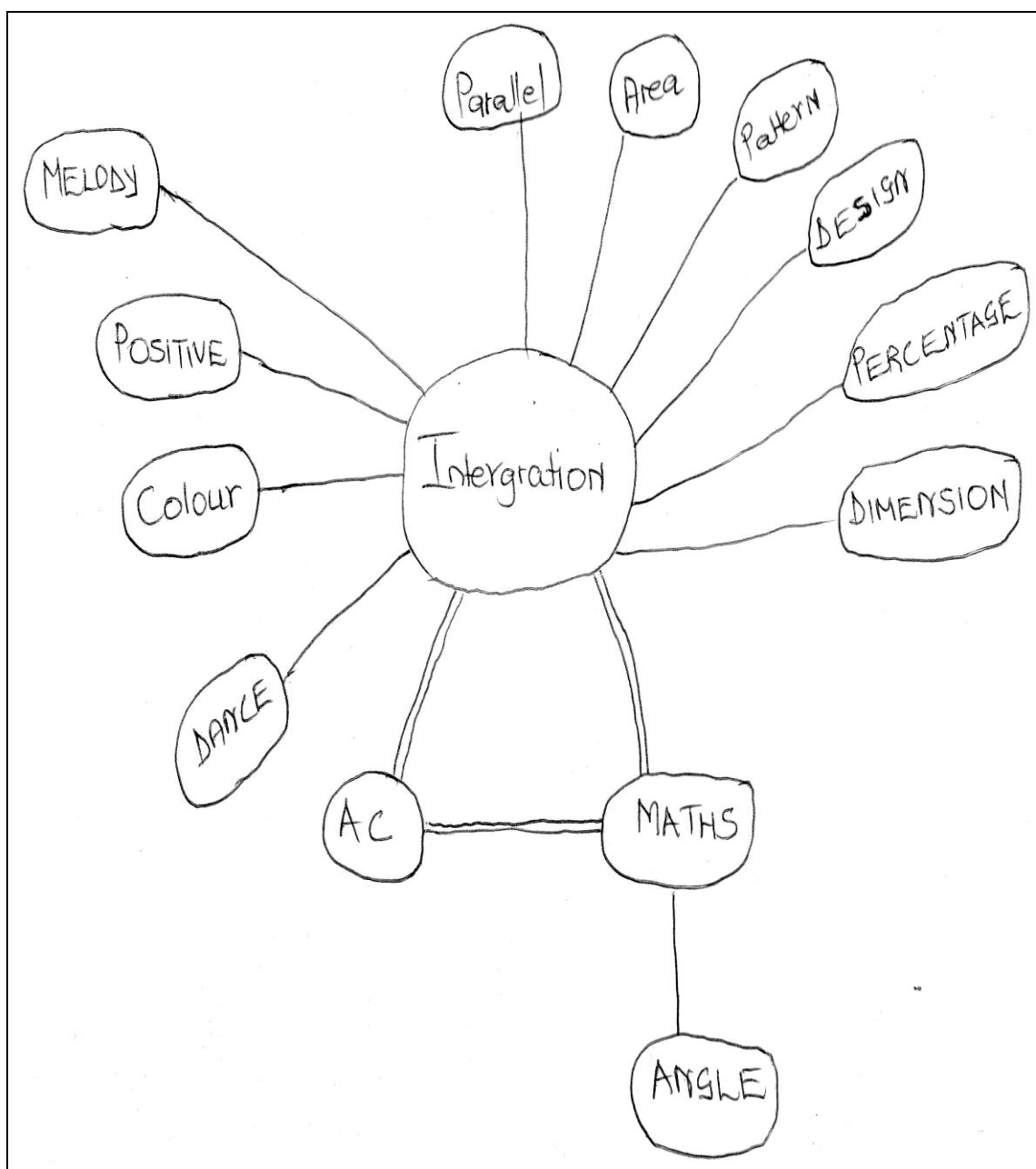
## APPENDIX: V

### Concept map: Teacher two (Ms Sibanyoni): Piloted study.



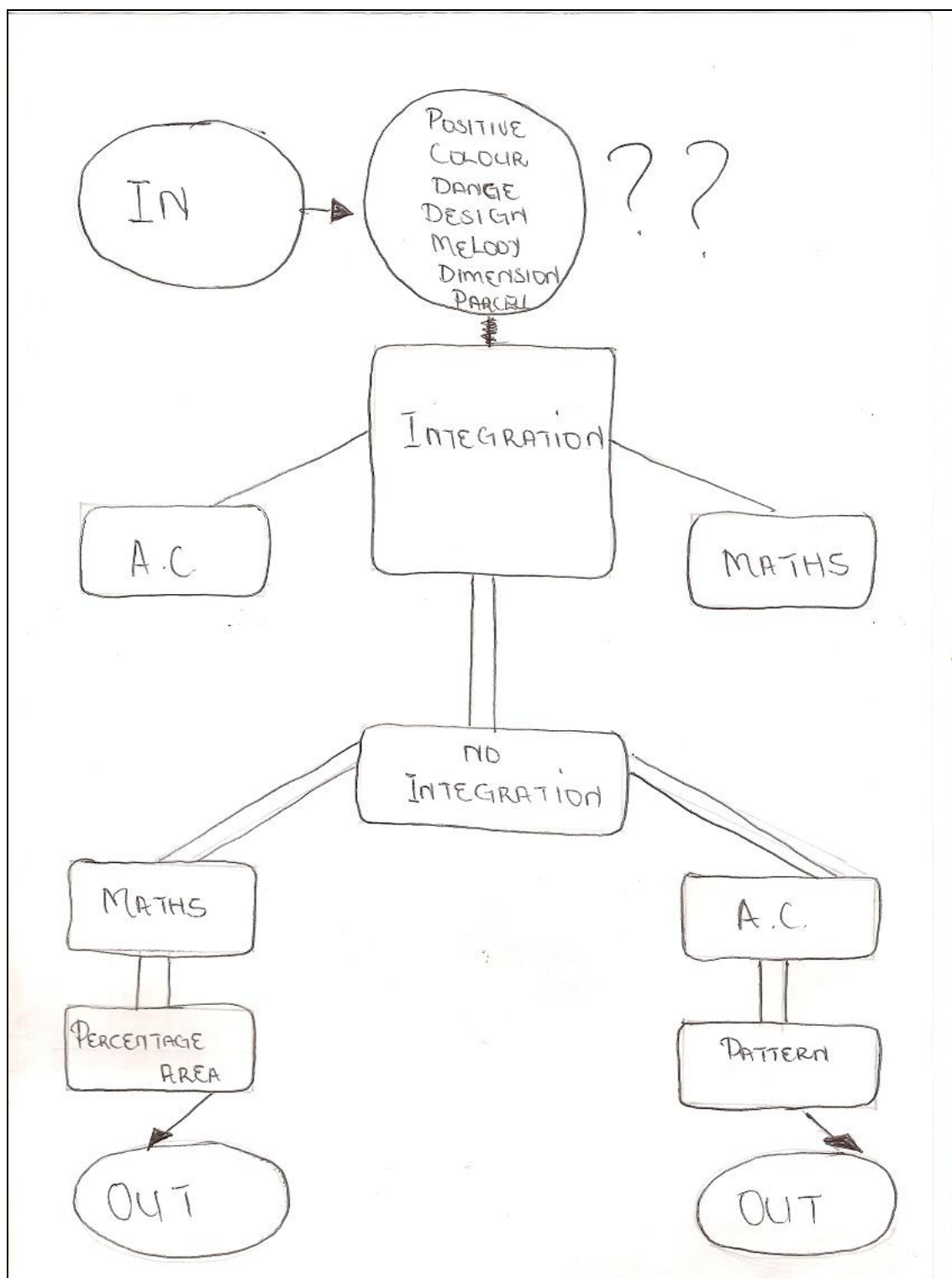
## APPENDIX: VI

Concept map: Teacher three (Mr Nkosi): Main study.



## APPENDIX: VII

Concept map: Teacher four (Mr Mokoena): Main study.



## APPENDIX: VIII

### Teacher's comments: Teacher one (piloted study).

**R:** This activity was extracted from a Grade 9 Arts and Culture textbook, *Arts and Culture, Teacher's Guide for the Development of Learning Programmes, Revised National Curriculum Statement Grades R-9, (2003)*. As you can realize, this activity has incorporated the notion of a 'positive' or 'negative' in it. As a mathematics teacher how do you think this notion of 'positive and negative' can influence students' responses, who might have discussed these concepts in a mathematics class?

**T:** This is a good example of how mathematics can be integrated with Arts and Culture.

**R:** What do you mean?

**T:** Positive and negative will make the learners to think of maths, and there in their answers they might show that they might want to prove that they have maths background of these terms.

**R:** So how will this background be revealed?

**T:** Eh... they might think of a positive as a plus ...neh..., and might think the teacher wants them to add the apples. So they might end up asking the teacher where are the apples that we must add or subtract, ...right ..., and this type of a reaction can easily become a maths discussion ... Yah ... this is how I see this activity as a maths educator.

## APPENDIX: IX

### Teacher's comments: Teacher two (main study).

**R:** This activity was extracted from a Grade 9 Arts and Culture textbook, Arts and Culture, Teacher's Guide for the Development of Learning Programmes, Revised National Curriculum Statement Grades R-9, (2003). As you can realize, this activity has incorporated the notion of a 'positive' or 'negative' in it. As a mathematics teacher how do you think this notion of 'positive and negative' can influence students' responses, who might have discussed these concepts in a mathematics class?

**T:** Eh... in my view positive and negative are mainly maths concepts, and when you mention them in any subject there is high possibility that maths could come, but, it is the context of use that will determine this.

**R:** What do you mean by this?

**T:** The diagram I have drawn (see Appendix ....) explain these contexts. A doctor, for an example, will talk about the positives and negatives of an apple in a context of diet or health, ...you see. This activity can also allow learners to talk about the taste of an apple, ...eh ..., for instance, I can say, ... eh, they can associate positive with good taste and negative with sour taste of an apple. In a relationship, for an example, people can talk about a bad apple that can spoil the whole bag, and to me that is a negative of an apple. In a maths class learners can also talk about many positives and negatives of an apple. They can look at it as representing a circle or a ball. They can use it to explain maths operations of addition, subtraction, multiplication and division. An apple, for an example, can be divided into fractions. If I say 'divide this apple into two halves', ....., that is maths, ... ok. So you see, it's a question of context *meneer*<sup>\*</sup>, and every learner will choose his or her context, and maths, as you say can also come in.

**R:** So for those students who would use a mathematics context, how do, you think they will respond to this activity?

**T:** Like I said *meneer*, ... yes, learners can talk about it from a maths context. They can say apples are positive when they are added, ... eh... because they increase. If you remove apples from a bag, you will be subtracting them, and that is negative, ... you see. So for these

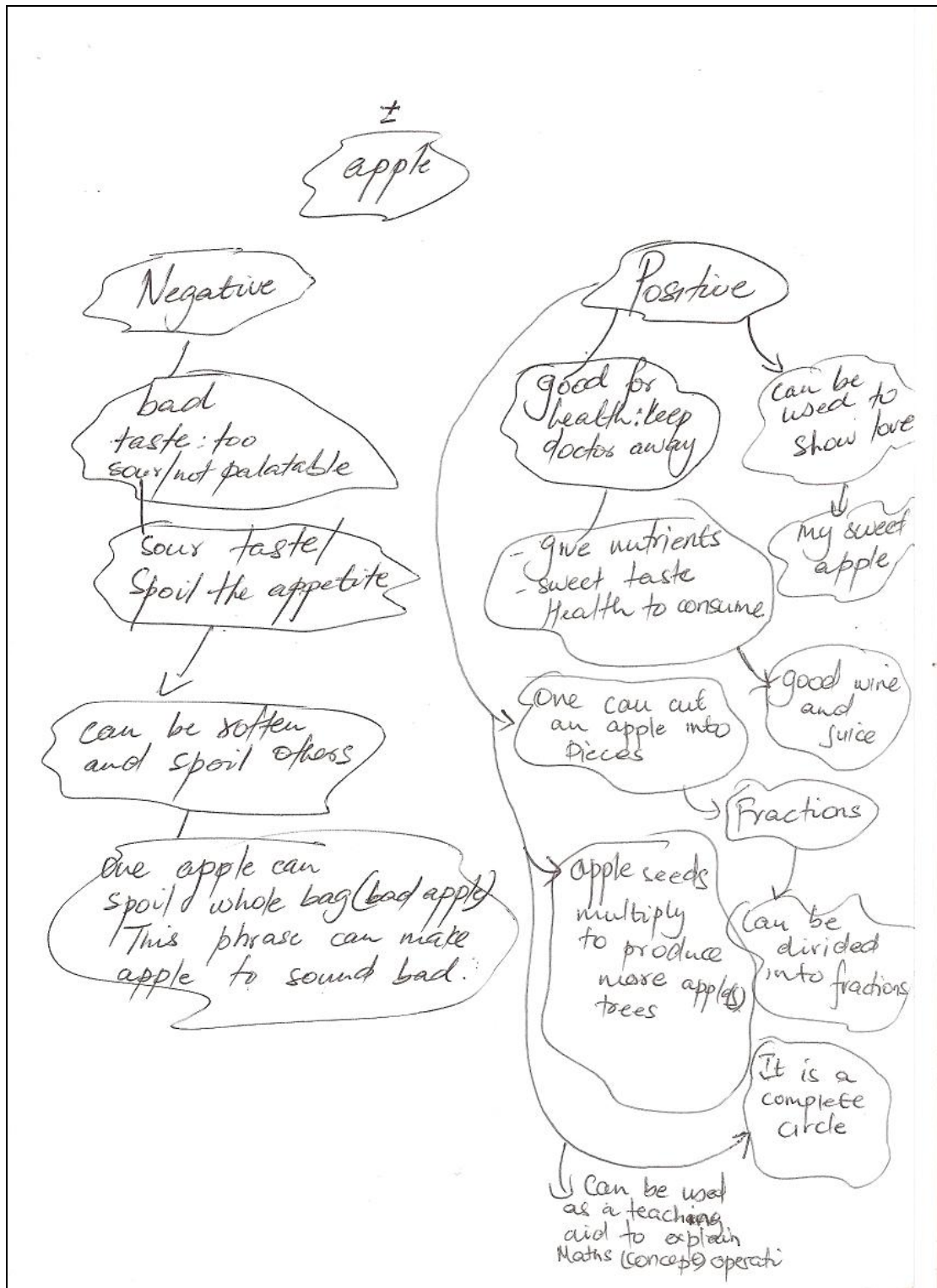
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<sup>\*</sup> The phrase 'meneer' is common amongst South African teachers. It is used in the context of referring to a colleague and also a way of showing professional recognition to a male teacher. It is of Afrikaans origin and could be translated as implying 'sir'. An equivalent of the term 'mam' is also used to a female colleague or teacher. It is taken from an English word 'madam'.

learners they will give a maths example. But like I said, not all learners will give a maths example, learners will choose.

## **APPENDIX: X**

**Grade 9 mathematics teacher's mind map: Teacher two (main study).**



## APPENDIX: XI

### Teacher's interview transcript: Teacher two (piloted study).

Indicators: R: Researcher (Mr. JJ. Dhlamini).



**T:** Teacher Three (Ms. Sibanyoni - pseudonym).

**R:** Ms. Sibanyoni, it's a pleasure for me to be talking to you, I just want to ask you a few questions in connection with that activity which I gave to you, ..eh... where you were supposed to, identify concepts which are integrating between Arts and Culture and mathematics. Eh.. maybe we can start by first ..eh... trying to find out what is your understanding of integration?

**T:** Oh... integration is the linking or sharing of concepts between Learning Areas.

**R:** Ok, so, it means a concept can be shared between two ....

**T:** ...Learning Areas.

**R:** .....yah, can you maybe give me an example of what you mean by that?

**T:** Take for an example, in mathematics, I talk about measurements, in Arts and Culture I can measure like when I do my drawings I measure, so they link. I talk about measurements, measuring of picture, I talk measurement. I can measure ...eh... a distance. I think that's it.

**R:** Ok. Thank you very much. So that is your understanding of integration ....

**T:** Yah, that's my understanding ....

**R:** .... Ok, now I just want to refer from your concept map ....eh... activity. Eh... you have classified ...eh... your concepts into three, there are those that are pure mathematics, there are those that are pure Arts and Culture, and there are those that are integrating between the two Learning Areas, for instance you talk of a percentage as a pure .....

**T:** .... mathematics.....

**R:** .....mathematics concept, what do you mean by that?

**T:** In mathematics I talk about percentage, in Arts I don't talk about percentage.

**R:** Ok, so how would you describe a concept that is pure mathematics?

**T:** With pure, it's about mathematics, what I mean it's pure mathematics. A concept is about mathematics, not any other Learning Area.

**R:** So it cannot go to ....

**T:** ....it cannot, I cannot take it and say I integrate it, .... but it's mathematics.

**R:** So in other words you are trying to say here the word percentage or the concept of percentage cannot be found within Arts and Culture.

**T:** No, it cannot be found. As an educator of Arts and Culture, I have never .....

**R:** .....come across ....

**T:** ....come across percentage.

**R:** Ok, now ...le... ...le... let us go to the ones which you have described as being pure Arts and Culture, for instance you have a dance there, you have melody, you have design and you have colour. So taking it from your explanation, so the suggestion here is that these concepts again cannot go to mathematics.

**T:** No they cannot.

**R:** They cannot, ok, let's just make an example. What if I use a concept for instance like colour, let's say ...eh... in a , in a mathematics problem, for instance in geometry. Then I say to my kids colour ...eh... a certain angle, colour a certain something, but it's within a mathematics class. Wouldn't you regard that as integrating this concept of colour into mathematics?

**T:** I can't say it's integration, because I need language in mathematics, I don't only use numbers, but I need language. So I use that as art of language to make my learners to understand the instruction.

**R:** Ok, so the use of the word colour there would not be within a mathematics ...eh... context, but it will only be .....

**T:** ...borrowed.

**R:** Ok ...

**T:** ...I have borrowed.

**R:** For linguistic reasons ...

**T:** ...for linguistic reasons.

**R:** Ok, so that is not integration between the two ....

**T:** I can't say it's integration.

**R:** Ok, then if I look at those concepts which you think are integrating between the two, I think ...eh... there seems to be a suggestion from your concept map that there is quite a number of instances, ....there is high possibility of integrating Arts and Culture and mathematics, would you agree?

**T:** Yah, yah there is a lot of integration .....

**R:** ...between the two ...

**T:** ...subjects.

**R:** Ok, eh ... maybe you can give other examples.

**T:** Let's take for instance patterns, in mathematics I talk about number patterns, I can talk about shape patterns. Also in Arts and Culture I can talk about shape patterns, I talk about design, those are patterns. I talk about decorations, those are patterns. I talk about decorations, those are patterns, so you can see that there's lot of integration there.

**R:** Ok, so there are those concepts which you can find .....

**T:** ...in maths and in Arts.

**R:** ...and also in Arts and Culture.

**R:** So let's look at it from a curriculum perspective now, so would you say even the curriculum encourages integration between

**T:** Take for instance LO9 in Grade 9, ...eh... it talks about and the AS number 9, it talks about the positive and the negative effects, it can be of television or radio. So when you talk about the negative and the positive, in mathematics also you talk about the negative and the positive. We usually use that in maths, and take for instance, ...eh... in Arts and Culture there is dance, we talk about body movements, you can make straight line using your body movement. Take for an example a picture, you can measure sides of a picture and in maths also we do measurements. So that's integration, at least the curriculum is supporting this integration.

**R:** Ok, so in other words you saying that an Arts and Culture teacher will always find herself having to deal with certain concepts that come from mathematics .....

**T:** ....yes....

**R:** ....within an Arts and Culture classroom?

**T:** Yes

**R:** So as a teacher, if I were to go back to your practice now, as a teacher do you feel comfortable with this integration?

**T:** I think it's excellent, I think it's excellent because like for an example we talk about measurements in maths and we talk about measurements in Arts. Already once you are in an Art classroom talking about measurements, you measure say from this line 40cm, already you have numbers, which is mathematics. So the learner will grab two things at the same time.

**R:** So he will be learning two subjects ....

**T:** ....yes...and the learner measures a picture, but at the same time he uses numbers, so there are numbers there, and he enjoys also maybe the drawing of that picture and the measuring of that picture. The size of the picture, ....

**R:** ....ok...

**T:** ....so the learner will learn two things at the same time.

**R:** Yah, now as an Arts and Culture teacher ...eh...sometimes when you find yourself having to deal with these maths concepts, do you always feel comfortable?

**T:** Sometimes you don't feel comfortable, because you don't know what to do, but at the same time, the learners will provide you with information. They do help you.

**R:** The learners?

**T:** The learners will definitely help you. You can give them a problem, they will give you answers that you did not expect. They will integrate, they will give you integration with their answers.

**R:** So in other words you're trying to say here there are cases at times where you find yourself that you are not very quite conversant or familiar with a certain concept of mathematics which you are supposed to be using in your Arts and Culture lesson .....

**T:** ...yes...

**R:** ...yah, so you turn to rely to....

**T:** Sometimes you rely to the learners, sometimes you rely to other teachers.....

**R:** ...ok...

**T:** ...teaching the very same subject or the maths, you rely to them, so it can be educator that you rely to them or learners that you rely to them. They can give you answers to the problem.

**R:** Ok that is very interesting, so now if for instance as a teacher, especially an Arts and Culture teacher, I were to ask to rate your maths knowledge would you say it's a lot of knowledge, or would you say it's an average knowledge or would you say it's little knowledge?

**T:** I think I'm average.

**R:** You think you're average?

**T:** Yah I think I'm average.

**R:** Ok, and... why do you think so?

**T:** You know maths, I think it's got a lot but still I know little.

**R:** .....yes....

**T:** ....yah my knowledge is just average, not little, but what I know is that maths deals with too much of numbers....

**R:** ....too much of numbers yah....

**T:** ...but even with that kind of background you'll still be able to deal with those integration situations. Yah, I think it is very clear maths is straightforward, so I don't think I can have that much of a problem when integrating maths and Arts, Arts is also straightforward, so I don't think there can be any, any difficulties in integrating maths and Arts.

**R:** Ok, if maybe you were to provide your expert advice to the curriculum designers for instance, ...eh... what would you say would be a thing for them to do in order to make it a point that this integration becomes a success? Maybe in terms of training teachers, what would you give as a word of advice?

**T:** I think ...eh... integration should be stressed, I think they are doing quite well but I think it should be stressed. I think more workshops should be provided.

**R:** So you feel teachers should be trained.

**T:** Teachers should be trained on integration, on how integration works. It's there, it's there...

**R:** So would you say all of us as teachers or maybe some of the teachers that you work together with within your school, do you understand integration in the same way?

**T:** I don't think so, because some of my colleagues are still struggling with integration.

**R:** Ok....

**T:** Some are still struggling but with teamwork, sometimes we do understand.

**R:** Ok, teamwork is the key

**T:** Teamwork is the key.

**R:** Ok, ok, ....anyway thanks a lot Ms. Sibanyoni.

## **APPENDIX: XII**

### **Teacher's interview transcript: Teacher one (main study).**

**Indicators:**    **R:** Researcher (Mr. JJ. Dhlamini).

**T:** Teacher Two (Mr. Nkosi - pseudonym).

**R:** Thank ...eh... Mr Nkosi, it's a pleasure to be talking to you again. I wish to talk to you about your concept map. I can see from your diagram that you strongly feel that most of these concepts integrate between mathematics and Arts and Culture, is that correct?

**T:** Yes that is correct, but I'm not sure about angle, I take it as a maths term because I have not met it in Arts and Culture. All other terms we do them in Arts and Culture.

**R:** So would you agree with me that mathematics and Arts and Culture are strongly linked, or that there is a lot of mathematics in Arts and Culture?

**T:** Yes, maths is part of us but we don't express it or it does not come out clearly.

**R:** What do you mean by that?

**T:** For an example when I teach my learners about the wheel of colours (*he showed me the picture of the wheel of colours from the textbook, see appendix .....*), we don't tell the learners, for example to ....., when they draw the wheel of colours, the primary colours here, ought to make 60% of the colours in the circle, whereas other colours, tertiary colours and relative colours they must make about 40%. We just tell them to draw wheel of colours. We don't talk about the measurements or the measures which are supposed to be used or you apply in constructing or in drawing that will of colours.

**R:** If I may make a follow-up to the point you have just raised Mr Nkosi, what is it that you should be telling your learners in this particular activity?

**T:** Eh.... For example I should be explaining the mathematics in this task..... What are percentages and how to change numbers to percentages, ..... but as an Arts and Culture educator I don't have enough knowledge to explain percentages to my learners.

**R:** So then what do you do?

**T:** like I said, we don't express maths in these activities, we just give them instructions to do the activity, ..... and as for mathematics we avoid it.... we just avoid it, unless if learners insist.

**R:** Hmm ... that's interesting, so tell me, except the example you have just provided, Mr. Nkosi, can you give another example of an Arts and Culture topic that can also involve mathematics?

**T:** For example when you tell kids about the dance, for example with the steps they must count the number of steps they are making if they go right and left, but we don't tell them this is mathematics, you are learning maths, you are learning the bit and the movement. We don't tell them it's four steps, we just tell them this is a dance, this is a kind of music and how do you dance. Kwaito,<sup>\*</sup> is it having three bit or what bits, they just count the bits, automatically maths comes in, but we don't tell them that they are learning what, mathematics.

**R:** In general what would you say is integration, how would you explain integration?

**T:** Integration is something which actually all teachers of all the Learning Areas ought to meet and say, here and here it's something common, can meet at this angle, ... right, ... and unfortunately we don't talk about these things.... If for example we tell ourselves that we must teach AIDS, we teach AIDS in different forms, but we don't come together and say, ...for example let's use maths to teach AIDS, ...right... Can we go to somebody of Arts and Culture and teach about AIDS, how will it be relevant the AIDS in mathematics, .... How will it be relevant in Technology, but we don't come together as teachers. It's something that is theoretically there but in practice it's not happening.

**R:** So you are saying integration is a situation where teachers need to come together when they are teaching a certain topic?

**T:** Yes... they meet in order to discuss and say this is how I can teach this.

**R:** Coming back to Arts and Culture and mathematics, how would you explain integration between these two subject? If we are saying we are integrating Arts and Culture and mathematics, what is it that we would be doing?

**T:** Ok...for example, I would be.... I would be asking for example maths teachers to teach maybe the ....ehh ...what do you call them ... this ... ehh... the ... circles, rectangles, ...ehhh... what do you call them?

**R:** Oh ... the geometry ....

**T:** Yah! If you are teaching kids about shapes, for example in Arts and Culture you will tell kids, ...can you demonstrate maybe a circle by dancing, ...right, we know when we demonstrate a circle, we demonstrate it like this (*he makes a posture that demonstrated a circle*), right, and then they will tell you how can you dance in a circular form, right, we would dance as kids in a circular form, right, how would you show me a rectangle or a three corner ...what ....what do you call it?

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<sup>\*</sup> Kwaito is a kind of music that is mostly played in black South African township. It is mostly associated with black music artists.

**R:** It's a triangle....

**T:** ...a triangle, how would you demonstrate a triangle, right, and the child will stand like this (*opening his legs and standing triangularly*), then I would know this is a triangle, ...in Arts and Culture.

**R:** But then as you said, the child must first learn these things in a mathematics class...

**T:** ...in a maths class, so that he or she must demonstrate the understanding of that concept. So when a concept is learned in a maths class it will facilitate understanding in an Arts and Culture class, so I don't have to go deeper.

**R:** So are you suggesting these mathematics concepts, which happen to be part of Arts and Culture at times, should be taught and explained by a mathematics teacher?

**T:** Yes of course, that's his territory, ...you see, ...that's his job. As an Arts and Culture teacher I only teach my part, right, I don't have to teach maths, ...I'm not trained for maths. For an example with Technology I tell my kids for example ...ehh ...can you make a sketch, a sketch in a hall when you make the performance, ...right, I would expect a kid to make a graph (*possibly referring to a diagram*), I would tell the kid 'just make a diagram showing me where the stage is, where the lights are, and then down there write numbers'. Number ONE for example I know it's a stage, number TWO it's lights, number THREE it's gametes, number FOUR could be cameraman, right. So automatically the kids, they know for example with cameras they will draw a circle, with the stage they will draw a rectangle, with the gametes they just draw also a rectangle, where the clothes are just being put, right, with the table they can draw a square. So if they know those terms they can just draw.

**R:** So as you indicated, this team-work thing is not happening...?

**T:** Yah it's not, if I give kids to make a drawing I don't tell them whether to indicate the stage as a rectangle or whatever, because I'm not used to these terms, these terms are new to me, ...rectangle, triangle, ect., they are new. They learn them even in instruments, we ask the kid 'how would you describe a tambourine, ...how do we describe the African drums, right. Are they round? Are they in the rectangular form, or what? How would you describe a guitar, ...right? Is it in a rectangular form or is it round in a circular form? Now if I don't know these terms ...then what?' But if kids know these terms from maths, then they will be able to describe those instruments. So in that way we rely on these learners to help us because they have learned these concepts in a maths class.



**R:** While we are still commenting on this subject, may I ask you to rate your mathematics knowledge, would you say “it’s a lot”, would you say “it’s average” or would you say “it’s little”, how would you rate yourselves?

**T:** Hmmm ....that’s a difficult question ....(he laughs), ...eh... I think it’s little s’bali, yah.. I think it’s little. You know we struggle with maths, it’s a difficult subject. I didn’t do much maths at school, so my maths knowledge is little.

**R:** If I may also ask Mr Nkosi, would you say it’s necessary to train Arts and Culture teachers to teach mathematics?

**T:** No I don’t think so, ...you know why I’m saying this *s’bali*, ...it’s because integration is not happening right. Because if we work together a maths teacher should help me to explain this maths concept, so there is no need for me to learn maths because we are a team, right, ... I can even call him to my class to explain maths, you see, but unfortunately we don’t have the styles of integrating these Learning Areas.

**R:** What do you mean by ‘styles of integrating’?

**T:** The technique of integrating

**R:** What about the curriculum documents, don’t they articulate these techniques for teachers?

**T:** We don’t get them, actually we’ve got the documents but they are not explicit ...(he laughs).

**R:** Yourself as a teacher, Mr Nkosi, how do you feel about integration or what is your view on it?

**T:** Integration is good if, let’s say we were working together, ...these different Learning Area educators. It would be interesting, but unfortunately, as we work as individuals, ...to me it’s just boring, ...it’s boring, for example I can’t understand with maths, ...eh...those angles, how must I teach them. So that is the problem.

**R:** In view of what you have just said Mr Nkosi, would you consider yourself ready to implement integrated teaching?

**T:** I don’t think I am, ...actually most teachers are not ready. We are just doing it because it is forced on us by the Department and facilitators, but I don’t think we are ready as teachers. The big problem is that this integration goes with a lot of paper work, so we end up not teaching but fixing the files, ...we are more like administrators than teachers. If these guys come (*referring to the DoE officials*), we just show them the files, and they are happy you know, but they don’t know what is happening in class.

**R:** Now with this background, as an Arts and Culture teacher, how often do you integrate in your lessons?

**T:** S'wali integration is always there, whether you like it or not. I'm suppose to be doing it all the time, but like I said, I am not doing it properly, but it's everywhere in our teaching. In fact, ...eh ...integration is an old concept, it's not new. We've been doing it subconsciously from long ago, we do it all the time.

**R:** So what is missing is proper planning for it?

**T:** Yes, proper planning is not happening, teachers don't work together.

**R:** Mr Nkosi earlier on you indicated that at times learners may insist in making a follow up on a mathematics concept, so tell me what happens if a learner inquires about a certain mathematics concept in an Arts and Culture class?

**T:** You know sometimes when we learn about these terms, I was not aware for example that it's maths terms. I went to a certain guy Makgathule (*referring to a mathematics teacher at his school*) for example, and ask him how are parallel lines, because I wanted to explain to the learners but I didn't know what are the parallel lines, because I wanted to explain to the learners but I did not know what are the parallel lines, I got the first term in Arts and Culture because I did not learn maths. So he had to explain to me what is a parallel line and what is a vertical line before I go to the learners, before I present what, a lesson. Because I must tell them, for example if there's music, the sound is wavelike ...neh..., the bits, they are making waves, so I don't know myself, is that maths or what, and these waves have numbers, and there's getting down and getting up, we count up and down for the bits, and that is waves.

**R:** Except going to a mathematics teacher, what else would you do to deal with this problem?

**T:** I had to make more research. Yah.... I had to consult certain books. Because sometimes you know when kids for example there's project of kids making research of music, right, they are to draw a graph, ..right..., representing all kinds of music. In those graphs there are numbers, they must check for example, so many salons are using for example kwaito music. In class we ask them how many salons play kwaito music, kids will raise hands and they will give numbers, we also ask them about gospel music, they we will go to a graph and make some representation. That is mathematics. If I had to make a follow up on those numbers I had to change them into percentages, of which I am not familiar myself with.

**R:** Mr. Nkosi you have given numerous examples to prove that there is a lot of mathematics in Arts and Culture, in fact you seem to have suggested that in most of the topics in Arts and

Culture mathematics comes in. Now I want to know, how does an Arts and Culture curriculum document inform Arts and Culture teachers of this mathematics.

**T:** Curriculum document is quite, it says nothing about this. We have to see to it ourselves as Arts and Culture teachers. Sometimes we are helped by learners.

**R:** What would you have expected the curriculum document to do in this regard?

**T:** At least it must tell us about the mathematics in our subject, for example, it must explain what is a circle, what is a rectangle, what is a triangle, because we need these terms when we draw a stage in a theatre. We make a rectangle, for example, for the stage, we use a circle to represent the cameraman and a square for tables, but I don't know these terms, so I just tell my kids to make a drawing, that's it.

**R:** You have also mentioned the issue of learners coming in to help a teacher, how often does this happen in your class?

**T:** These kids help us many times, they know more maths than us. We prefer them than teachers.

**R:** Why would you prefer to go to a learner than seeking assistance to a maths teacher?

**T:** You know other teachers they see teachers of Arts and Culture as somebody who is not challenging, ...eh .... who's not a thinker ...right.... (*he laughs*) .... you are a dwarf, you are not a giant. If you teach Arts and Culture you know, you're under general ... We're being labelled Mr Dhlamini, because you are teaching Arts and Culture. ....now unaware now that there are figures in Arts and Culture, there are angles, there are fractions, there are lines, unaware that there is maths involved in Arts and Culture. So even the teachers they become demotivated, because even the government talks about maths, it is compulsory. What about other Learning Areas, ..... are they not relevant?

**R:** Hmmm... that is another very interesting subject ....., but I just want to take you to the issue of mathematics and Arts and Culture teachers. You seem to be suggesting that mathematics and Arts and Culture teachers do not work together. I just want to find it out clearly what is it that prevents these teachers from working together.

**T:** Like I said s'bali (*a township term referring to a friend*), we are like .... eh... sort of belonging to two camps, you see ... it's maths and it's Arts and Culture. We do our own thing and they do their own thing..., we don't have the technique of integrating.

**R:** Meaning you cannot go to a mathematics teacher for clarity seeking questions.

**T:** It happens, but not the way it should happen, and the other thing that determines everything is how much you are used to a person, like myself I always go to my friend Makgathule because he is a friend.

**R:** When you discuss with a mathematics teacher, does it happen that at times you experience a deadlock, that is, you have points of disagreement over a certain concept that runs parallel between Arts and mathematics?

**T:** Yes it happens, ... you know any concept is explained differently in different Learning Areas, ... so we differ... and that causes problems even to learners ... because we disagree and learners can see.

**R:** So you say a concept can be understood differently in different Learning Areas?

**T:** Yes a concept can be understood differently .... and like I said we sometimes choose not to explain these maths concepts because they can cause confusion, so we don't explain them *sbali* even if we are aware of them.

**R:** So tell me Mr Nkosi, what is it that should be done for integration to work, what is the way forward?

**T:** You know I see other Learning Areas as a repetition, and sometimes some of them I feel alone they can do it without the integration of the others. For example with Arts and Culture, it's a Learning Area on it's own, right, a learner for example can specialize in Arts and Culture, without being interested in maths, but at the same time a child can be skilled in maths because he would be knowing numbers through Arts and Culture. For example when we design a portrait, you must have numbers you must have the sides measuring them, so you won't be able to make a frame if the sides are not equal, they are not even designed in the same manner of fashion, right, even maybe the texture is not the same as that one. For example there's a relationship between texture, ...right, the feeling, which maybe is taught in LO (*referring to Life Orientation as a subject*), ...right. So I think that sometimes integration is good but is not good because is not implemented. We need to be trained, and sometimes the problem is this, we are trained by our own colleagues, who have just gone to the college to learn Arts and Culture, not being a specialist. But we need somebody who has been trained, who knows what is meant when we talk about integration, .....because they are going to tell you that integrate Arts and Culture with language, when the person does not know the language, does not even know maths.

**R:** So you need the knowledge of another Learning Area....?

**T:** Yes you need the knowledge of another Learning Area, because you cannot integrate with another Learning Area if your knowledge of that Learning Area is limited or is not there. I feel kids are overloaded, it would be better if kids were specializing.

**R:** Mr Nkosi I can see that this discussion is becoming more and more interesting, unfortunately we have to end it right here. Thanks a lot Mr Nkosi it was quite interesting to talk to you.

**T:** Thanks.

## **APPENDIX: XIII**

### **Teacher's interview transcript: Teacher two (main study).**

**Indicators:**    **R:** Researcher (Mr. JJ. Dhlamini).

**T:** Teacher Three (Mr. Mokoena - pseudonym).

**R:** Mr Mokoena, it's a pleasure to be talking to you, ...eh... I just want to ask you a few questions in connection with the concept map which you have just constructed. I'm very much impressed with it and it's actually a thought-provoking diagram which you have made. So I just want to ask you, why especially a diagram of a human being, ...orr... what's happening?

**T:** Eh... this ...eh... diagram it's me actually, ...

**R:** ...Oh... that is you?

**T:** Yah, ...eh... the educator.

**R:** Oh ... ok..., so why the educator, what's happening because I see there are question marks there, and the.... Can you explain it to me?

**T:** Yah. ...eh... firstly let's start with my.... Can you see there inside my head, there are so many concepts there ...

**R:** Oh yes I see, I see...

**T:** These concepts, is ...eh... something that I think about daily, because here we talk about ....., there is this thing of integration. So I'm really thinking about that every time, the question mark there, that means confusion. Once you see a question mark it means you don't understand.

**R:** So are you trying to say ...eh... you are confused?

**T:** Yah this integration thing ...eh... really confuse us, ...yah... it confuses me actually.

**R:** Ok ... ok... Then I see you also have a portion there where you wrote "IN" and there's a portion somewhere down there, you have "OUT". Could you also explain that?

**T:** Yah ... eh ... this "IN" that I've written there, that means integration, I said I'm thinking about it. So the "IN" is ..., the arrow, ... yah...it's there on my head. So that means, this integration is in. The language we teaching now is integration, so it's in we can't run away from it, we must live with it. And the "OUT" there, you can see, in my feet there, I wrote "OUT", and this "OUT" means, ...eh..., anything that does not integrate is going out. We talk about integration, so if you don't integrate you don't teach anymore.

**R:** Oh that's good. And in the hands there, there is a carrying ... of .....

**T:** You can see on the left it's Arts and Culture, on the right it's maths, this means that we as educators we are carrying so many Learning Areas, and some of them we don't know how to deal with them.

**R:** So in essence we can say this is an educator who is in trouble?

**T:** Educator in trouble you can see, carrying so many subjects ... it's too much.

**R:** Now coming back to the way in which you have classified these concepts, I see as you have indicated in the diagram again that ...eh... there are concepts which you thought ...eh... are non-integrating, for instance we have the percentage there, and area there as concepts which you have classified as only belonging to mathematics. Then you have ...eh... a pattern as a concept which you, again, thought or you classified as an Arts and Culture concept. Could you account for that, for instance let's start with a percentage.

**T:** Yah percentage is a maths thing, and then in Arts and Culture we deal with patterns. We don't do percentages in Arts and Culture and they don't do patterns in mathematics, so that's why I say these two ... there is no integration between the two ... so maths is maths and Arts and Culture is Arts and Culture, so they don't integrate, percentage in maths and patterns in Arts and Culture.

**R:** So what about the concept "area"? It's also only mathematics?

**T:** Area ... ehmm..., in maths they talk about area, ....eh.... (*waits for a while*) ... in Arts and Culture, we don't talk about it.

**R:** So there is no area in Arts and Culture?

**T:** No... no! It's only in maths. Yah ... in Arts and Culture we don't talk about it.

**R:** Now let me just give an example, say for instance ...eh... eh ... because you know in Arts and Culture you do a lot of dancing. You sometimes perform on stage, now wouldn't you regard that space where you do your performances as area?

**T:** Hmm... Yes I can, I can... I can. Oh.. that's integration, the area, yah ... I think yah....

**R:** So in other words it is the concept that can belong to both Learning Areas?

**T:** Yah... yah... yah... I think it can, because it's an area, space is an area. Yah I think they do integrate maths with Arts and Culture.

**R:** So there is integration?

**T:** There is, yah ...

**R:** Now I just want you to also explain to me this concept of "pure maths", when we say a concept is pure maths for example, what do we mean?

**T:** Yah by pure maths I think eh ..., like now we talking of area we have it in maths we have it in Arts and Culture, so when we talk about “pure maths”, we only talk about maths there. There is no integration with any other Learning Area. Like in Arts and Culture if I talk about the patterns like I said, that’s only in Arts and Culture, it doesn’t integrate with other subjects.

**R:** So it’s a concepts that can .....

**T:** ....belong to that particular Learning Area only, I think, that’s how I understand it.

**R:** Ok. Then may I also ask you to explain to me what is integration? How would you define integration?

**T:** Integration, it’s .... eh .... I think you link, ... you combine subjects ..., from one subject to the other. If I talk about something in Arts that will come with the concept that is in maths, that is integration, you link the two, you get me ...yah... that’s how I understand it, you link the two.... You talk about the area like you said, it’s in both, ... so it links, it goes in maths when you are in Arts and Culture, but you are also linking it to maths, that’s integration.

**R:** Ok, so it’s like a connecting kind of a situation, so this subject connects with another subject through these concepts that would run parallel through these Learning Areas. So that is what we mean by integration?

**T:** Yah...

**R:** So you are saying at the moment in South Africa, for instance, the new curriculum is encouraging integration?

**T:** Yah... integration is a big thing now.

**R:** So with it being so popular in the new curriculum, as you also indicated, how often do you do integration in your lessons?

**T:** My brother integration happens everytime in our teaching even if you are not aware. When I teach something in Arts and Culture I will always give an example from somewhere, I can take an example from the life in the street, from their home, or from another subject, and to me that’s integration, ...so it happens all the time, sometimes I don’t have to plan for it, but it will happen automatically in my lessons.

**R:** In terms of planning directly for it, how often does this happen in your Arts and Culture lessons?

**T:** Ehh ...I would say it doesn’t happen much. Sometimes we want to do it as teachers but it does not happen properly, so it’s happening but not the way I want it ...yah.



**R:** So if maybe I were to ask you to give you to give your views on this integration. How would you give your views on it? Is it a good teaching innovation or is it a bad teaching innovation?

**T:** I think... eh ... somewhere it's good but, the knowledge, ... we lack knowledge. I for one do lack knowledge for integration. I'm doing it because the Department wants us to do it, but I'm not clear with it. I'm truly not clear with it.

**R:** ... but at the same time you support it?

**T:** I do support it, because like the example we talked about, it makes sense, but I don't have knowledge of integration, I'm still lacking.

**R:** So given this background, would you say you are ready, to implement integrated teaching?

**T:** I'm really not. You know when I make my lesson preparation I always stuck when it comes to integration, .. I have to think, ... I have to think really, ...yah ... but I'm not ready.

**R:** What would you say is the reason for you to get stuck?

**T:** The thing is eh.... Sometimes you guess, I'm empty ... I'm empty, I'm not sure... you see... so it's difficult.

**R:** ...but I think integration also means approaching other teachers in Arts and Culture or in other Learning Areas, or alternatively speaking to your subject advisor, is that option not available?

**T:** It's not easy, it's really not easy. Yes sometimes we try to plan together. They say we must, ... team work will help us, but not always possible. It's not possible at school.

**R:** Why not possible?

**T:** Eh... you know when we meet others will tell you they don't have time, they don't understand it, we always have something when it comes to do that.

**R:** So one of the major problems is the fact that teachers also lack knowledge?

**T:** This is a serious problem, ... meeting with the other Learning Areas teachers can be a problem. You know in Arts and Culture we were dealing with drawing, shapes and patterns, so there was eh..., one of shapes involved this thing of tessellations, so I knew that in maths they do these things, so I went to one of the maths educators and asked her about this tessellation thing, but she couldn't answer me, she did not have any clue. So you see it's a problem, so it means teachers don't have a clue, don't know anything about this integration thing. So I'm a Arts and Culture teacher and I want to integrate this thing of tessellation, you

ask it to the next teacher, she knows nothing about it that, then ....? Where will I get help? That is a problem.

**R:** So in other words that also highlight the issue of teacher training on integration, what is your take on that?

**T:** Yes teachers need to be trained, because I depend.... As an Arts and Culture teacher I depend on the next educator, so if he doesn't know then....

**R:** Then what type of training would you expect for an Arts and Culture teacher to be able to understand the mathematics in Arts and Culture?

**T:** Eh... I think what it means is that ...eh... all the Arts and Culture teachers need a maths workshop, to be well trained in maths for integration.

**R:** Now tell me the Curriculum Document or the Policy Document of Arts and Culture, does it come out clearly about including mathematics in Arts and Culture lessons?

**T:** No it doesn't, .... It doesn't, you will have to think if you have maths knowledge, then you will integrate, but if you don't have any knowledge in maths then you will have to see, but it's not clear at all, it's not. In fact there is no direction from the side of the Policy makers. They don't tell us exactly what to do, if they tell us it's patterns, it's patterns. They won't give you any clue there of maths or give you an example, they won't. There are no examples in fact.

**R:** So they just leave it to you as a teacher ...

**T:** ... they leave it to you as a teacher, even the facilitators when they come they will say try to make activities with that AS (*referring to Assessment Standards*), they don't care how will you manage, how will you integrate? They say you must integrate, but there is no integration you must see yourself what goes with what. So there is a problem, even the facilitators it seems they are empty themselves.

**R:** So it means the support is .....

**T:** ... not enough. Like they give you a one hour or two hour workshop, they'll read the book. The one you do have, so I can't say that's training, that's not training. We still struggle with integration I'm telling you, we struggle a lot. So the Department must do something.

**R:** Now tell Mr Mokoena, how do you plan for integration?

**T:** We sometimes meet with other teachers, they say we must work as a team, ...eh... team work will help...

**R:** Does it help?

**T:** Ehh ....., sometimes yes, sometimes no. Sometimes we end up confused because we argue as educators.

**R:** Why do you argue?

**T:** Because we don't understand same things. For instance, a maths teacher will talk about this and Arts teachers will talk about. ... you see. So it can cause confusion.

**R:** Mr Mokoena I seem not to be following you, why do you get confused when in actual fact you are talking about the same thing. For instance when talking about a concept of a "line" or "area" with a maths teacher, what confusions are likely to come up?

**T:** You know maths people, they have their own way of understanding things..., you know, those things, ...eh... area for example, they will explain it differently and use it differently in maths, that is why I said area is a maths concept. And us as Arts and Culture educators we have our own understanding, ...and it's impossible to meet halfway because it will confuse the child.

**R:** So in essence you are trying to say integration is a difficult way of teaching?

**T:** Very.... very difficult, because as educators we have different understandings of things .... and if we integrate things are worse sometimes ....., but sometimes its good, but the problem I cannot explain maths things like a maths educator.

**R:** Maybe out of interest Mr Mokoena, what if I were to ask you to rate your mathematics knowledge, would you say "it's a lot", would you say "it's average" or would you say "it's little", can you please rate yourself?

**T:** Ahh..... it's little my brother, I don't have much maths knowledge. I don't have it truly. There is nothing much I can say about maths.

**R:** So in Arts and Culture do you have instances where mathematics comes in, during your lessons?

**T:** Yah.... yah.... You mean when I teach Arts and Culture ...neh...?

**R:** Yes...

**T:** Like for example let me take this textbook of mine. (He takes a textbook and opened a picture where a diagram of a face had been drawn). There is this example, this is a diagram of a face. If you look at this diagram, I must know my positions and proportions for my eyes, my mouth, my nose, ... my ears. And proportions is all about fractions, so you must know where to put what and that is fractions, once you talk about proportions you talk about fractions. So you see that is that integration thing. The proportional positions of the eyes, the mouth, ... that is fractions.

**R:** I see, ..... so there is mathematics....

**T:** There is maths, there's another one ... eh .... Take for an example this picture of a dancer (*pointing to another picture in the textbook*). This dancer is standing in a certain position, and if you look at this position of this dancer, there are shapes, ... if you look at this dancer there are shapes, geometric shapes, that's what you talk about in maths, geometric shapes. There's circle, squares, rectangle, triangle, so there is maths in Arts and Culture. The dancing position, the geometric shapes again, so that's it.

**R:** So if I were to ask you Mr Mokoena, how would you describe the integration of mathematics in Arts and Culture, what is meant by this integration, what does it mean to you as an Arts and Culture teacher?

**T:** Eh ...integration of Art and maths means I talk about maths in my Arts and Culture class, I discuss maths, I count, I measure, I use angles and fractions, so I link maths with Arts and Culture.

**R:** So would you say that happens in your class, do you talk about mathematics in your class, do you calculate, do you count, as you said?

**T:** Ohmm ...sometimes yes sometimes no.

**R:** What do you mean?

**T:** I mean I only talk about the maths that I know, something I don't know, it's difficult, ...yah...

**R:** So if I may ask, how do you then plan lessons that involve mathematics?

**T:** It depends, sometimes we plan sometimes we don't. If something is too difficult what do I do? So it depends, if I know it I will plan for it... you see, ... that's that.

**R:** What if this mathematics comes up spontaneously during the course of the lesson? What do you do then, that is, it comes up unintentional?

**T:** Hey, ... it's difficult, it's truly difficult. The learners do help us at times. At times you plan a lesson and learners will give more examples you didn't expect. They will give you integration themselves.

**R:** So learners sometimes help you as a teacher?

**T:** They do help us as teachers, the educators also help us sometimes, ...they do help, because if I don't understand I have to go out. So the learners and educators will assist you at times.

**R:** So except going to the learners or other colleagues for help, do you have other alternative where you can go and collect the information?

**T:** Yes there are many alternatives, I can go to the library, I can go to the internet, I can watch the TV (television) when maths is explained, but I don't have time. I cannot go to the library, I don't have the internet at my house, ...so it's difficult.

**R:** But why don't you give yourself time to go to the library?

**T:** There is no time, you see. We do many things at school. We cut and paste, we are busy photocopying for our learners, ...there's a lot of paper work, so we don't have time, in fact I'm stressed up.

**R:** If I were to ask you to suggest a way-forward, what would you say should be done?

**T:** I think the Department needs to think about this seriously. Their workshops are not eh ...up to standard ...they are not up to standard. You will go to a workshop for just an hour and they will expect you throughout the year to do the right thing. So that's not enough ... I think more training is needed.

**R:** So teachers need to be incapacitated?

**T:** Yah ...they need to be trained. Truly this is new and you can see the Department is right on top of us, they want this to be implemented.

**R:** If I were to ask you to evaluate the progress that integration has made since its inception, what would be your analysis?

**T:** I don't think there is success, for instance if you meet with other teachers from other schools, they complain about one thing, integration.

**R:** Thank you so much Mr Mokoena, it was nice talking to you.

## APPENDIX: XIV

Pictures from Arts and Culture textbooks used by the teachers during the interviews.


### (a) Mr Nkosi: The wheel of colours.

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m is not

d free  
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second

3.  
tograph.

Do you remember the colour wheel?




We have three primary colours, namely:  
red            yellow            blue

We make secondary colours by mixing the primary colours:

red	+	blue	=	purple
blue	+	yellow	=	green
yellow	+	red	=	orange

Can you still remember how to mix tertiary colours? Can you name them as well?  
On the back of the second A4 sheet of paper, draw the complete colour wheel.  
You can use any media you wish. Include primary, secondary and tertiary colours.

 Keep both the completed A4 sheets of paper as part of your preparation material for this activity.

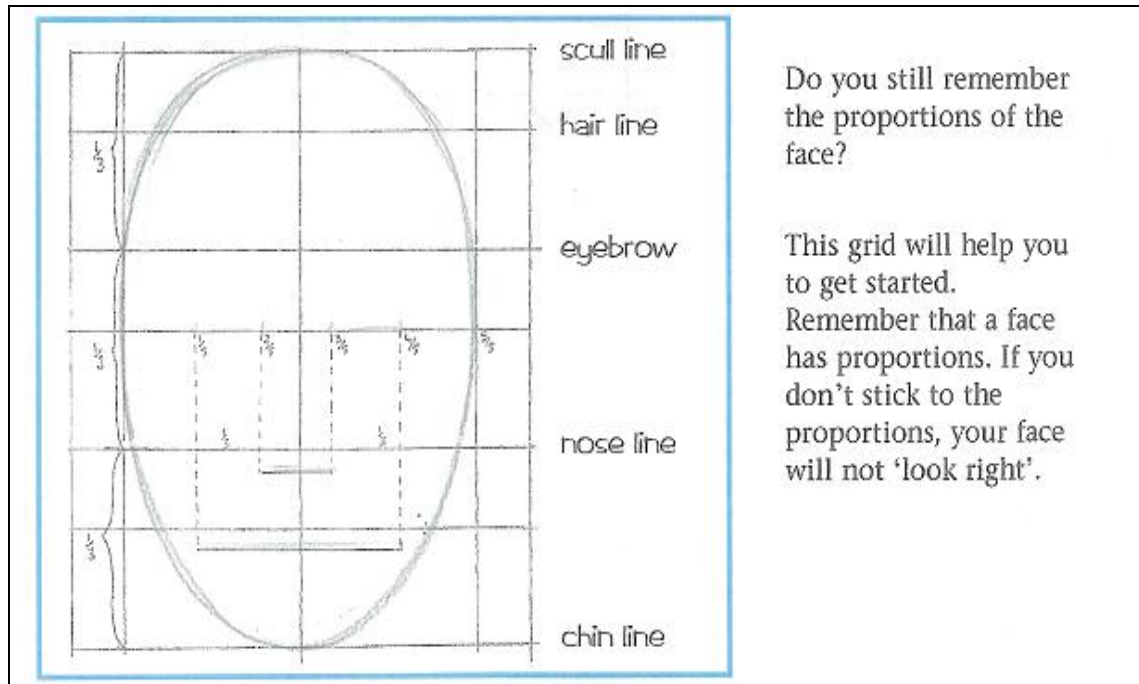
**Extension activity**  
We will be looking at *mandalas* in this activity.

**WORD HELP**

**Mandala** a Sanskrit word meaning 'sphere of essence'; the mandala is an example of an ancient art form where colour plays an important part; the artist uses all colours, starting with the primary colours, blending into secondary colours and then melting into tertiary colours; the artist may use different tints and tones in the final product

15

**(b) Mr Mokoena: Face diagram with proportions.**



(c) **Mr Mokoena: Geometrical positions of a dancer.**

We can divide shape into geometrical and free form. We only need to think about geometry when we need to identify geometrical shapes. Free form is not confined to any shape or plan. It goes where it wants to.

Look at the picture below. You can probably see geometrical shapes and free form shapes. Now divide the second A4 sheet of paper into two sections. In the first section, draw the geometrical shapes exactly as they occur. In the second section, copy the free form shapes as they appear.



Your shapes need to serve as guiding lines for further drawing. They will form the skeleton of a completed drawing of the photograph.





## APPENDIX: XV

### Samples of the colour coded analysis of the Arts and Culture teachers' interviews.

#### Interview One: Pilot

**R:** Researcher (Mr. JJ. Dhlamini)

**T:** Teacher Three (Ms. Sibanyoni - pseudonym)

ween Arts and Culture and mathematics. Eh.. maybe we can start by first ..eh... trying to find out what is your understanding of integration?

**T:** Oh... integration is the linking or sharing of concepts between Learning Areas.

**R:** .....yah, can you maybe give me an example of what you mean by that?

**T:** Take for an example, in mathematics, I talk about measurements, in Arts and Culture I can measure like when I do my drawings I measure, so they link. I talk about measurements, measuring of picture, I talk measurement. I can measure ...eh... a distance. I think that's it.

**R:** Ok, so how would you describe a concept that is pure mathematics?

**T:** With pure, it's about mathematics, what I mean it's pure mathematics. A concept is about mathematics, not any other Learning Area.

**R:** So it cannot go to ....

**T:** ....it cannot, I cannot take it and say I integrate it, .... but it's mathematics.

**R:** Ok, eh ... maybe you can give other examples.

**T:** Let's take for instance patterns, in mathematics I talk about number patterns, I can talk about shape patterns. Also in Arts and Culture I can talk about shape patterns, I talk about design, those are patterns. I talk about decorations, those are patterns. I talk about decorations, those are patterns, so you can see that there's lot of integration there.

**R:** So as a teacher, if I were to go back to your practice now, as a teacher do you feel comfortable with this integration?

**T:** I think it's excellent, I think it's excellent because like for an example we talk about measurements in maths and we talk about measurements in Arts. Already once you are in an Art classroom talking about measurements, you measure say from this

line 40cm, already you have numbers, which is mathematics. So the learner will grab two things at the same time.

**R:** Yah, now as an Arts and Culture teacher ...eh...sometimes when you find yourself having to deal with these maths concepts, do you always feel comfortable?

**T:** Sometimes you don't feel comfortable, because you don't know what to do, but at the same time, the learners will provide you with information. They do help you.

**R:** The learners?

**T:** The learners will definitely help you. You can give them a problem, they will give you answers that you did not expect. They will integrate, they will give you integration with their answers.

**R:** ...yah, so you turn to rely to....

**T:** Sometimes you rely to the learners, sometimes you rely to other teachers.....

**R:** ...ok...

**T:** ...teaching the very same subject or the maths, you rely to them, so it can be educator that you rely to them or learners that you rely to them. They can give you answers to the problem.

**R:** Ok that is very interesting, so now if for instance as a teacher, especially an Arts and Culture teacher, I were to ask to rate your maths knowledge would you say it's a lot of knowledge, or would you say it's an average knowledge or would you say it's little knowledge?

**T:** I think I'm average.

**R:** You think you're average?

**T:** Yah I think I'm average.

**R:** Ok, and... why do you think so?

**T:** You know maths, I think it's got a lot but still I know little.

**R:** .....yes....

**T:** ....yah my knowledge is just average, not little, but what I know is that maths deals with too much of numbers....

**R:** Ok, if maybe you were to provide your expert advice to the curriculum designers for instance, ...eh... what would you say would be a thing for them to do in order to make it a point that this integration becomes a success? Maybe in terms of training teachers, what would you give as a word of advice?

**T:** I think ...eh... **integration should be stressed**, I think they are doing quite well but I think it should be stressed. **I think more workshops should be provided.**

**R:** So you feel teachers should be trained.

**T:** **Teachers should be trained on integration, on how integration works.** It' there, it's there...

**R:** Ok....

**T:** Some are still struggling but with **teamwork**, sometimes we do understand.

**R:** Ok, teamwork is the key

**T:** **Teamwork is the key.**

## **Interview Two: Main**

**R:** Researcher (Mr. JJ. Dhlamini)

**T:** Teacher Two (Mr. Nkosi - pseudonym)

**R:** What do you mean by that?

**T:** For an example when I teach my learners about the wheel of colours (*he showed me the picture of the wheel of colours from the textbook, see appendix .....*), we don't tell the learners, for example to ....., when they draw the wheel of colours, the primary colours here, ought to make 60% of the colours in the circle, whereas other colours, tertiary colours and relative colours they must make about 40%. **We just tell them to draw wheel of colours. We don't talk about the measurements or the measures which are supposed to be used or you apply in constructing or in drawing that will of colours.**

**R:** If I may make a follow-up to the point you have just raised Mr Nkosi, what is it that you should be telling your learners in this particular activity?

**T:** Eh.... For example I should be explaining the mathematics in this task..... What are percentages and how to change numbers to percentages, ..... but **as an Arts and Culture educator I don't have enough knowledge to explain percentages to my learners.**

**R:** So then what do you do?

**T:** like I said, we don't express maths in these activities, we just give them instructions to do the activity, ..... and as for mathematics we avoid it.... we just avoid it, unless if learners insist.

**R:** Hmm ... that's interesting, so tell me, except the example you have just provided, Mr. Nkosi, can you give another example of an Arts and Culture topic that can also involve mathematics?

**T:** For example when you tell kids about the dance, for example with the steps they must count the number of steps they are making if they go right and left, but we don't tell them this is mathematics, you are learning maths, you are learning the bit and the movement. We don't tell them it's four steps, we just tell them this is a dance, this is a kind of music and how do you dance. Kwaito, is it having three bit or what bits, they just count the bits, automatically maths comes in, but we don't tell them that they are learning what, mathematics.

**R:** Like you said, at times learners may insist, so tell me what happens if a learner inquires about a certain mathematics concept in an Arts and Culture class?

**T:** You know sometimes when we learn about these terms, I was not aware for example that it's maths terms. I went to a certain guy Makgathule (*referring to a mathematics teacher at his school*) for example, and ask him how are parallel lines, because I wanted to explain to the learners but I didn't know what are the parallel lines, because I wanted to explain to the learners but I did not know what are the parallel lines, ...

**R:** Except going to a mathematics teacher, what else would you do to deal with this problem?

**T:** I had to make more research. Yah.... I had to consult certain books....

**R:** .... Now I want to know, how does an Arts and Culture curriculum document inform Arts and Culture teachers of this mathematics.

**T:** Curriculum document is quite, it says nothing about this. We have to see to it ourselves as Arts and Culture teachers. Sometimes we are helped by learners.

**R:** You have also mentioned the issue of learners coming in to help a teacher, how often does this happen in your class?

**T:** These kids help us many times, they know more maths than us. We prefer them than teachers.

**R:** .... I just want to find it out clearly what is it that prevents these teachers from working together.

**T:** Like I said sbali (a township term referring to a friend), we are like .... eh... sort of belonging to two camps, you see ... it's maths and it's Arts and Culture. We do our own thing and they do their own thing..., we don't have the technique of integrating.

**R:** Meaning you cannot go to a mathematics teacher for clarity seeking questions.

**T:** It happens, but not the way it should happen, and the other thing that determines everything is how much you are used to a person, like myself I always go to my friend Makgathule because he is a friend.

### Interview Three: Main

**R:** Researcher (Mr. JJ. Dhlamini)

**T:** Teacher Three (Mr. Mokoena - pseudonym)

**R:** Oh ... ok..., so why the educator, what's happening because I see there are question marks there, and the.... Can you explain it to me?

**T:** These concepts, is ...eh... something that I think about daily, because here we talk about ...., there is this thing of integration. So I'm really thinking about that every time, the question mark there, that means confusion. Once you see a question mark it means you don't understand.

**R:** So are you trying to say ...eh... you are confused?

**T:** Yah this integration thing ...eh... really confuse us, ...yah... it confuses me actually.

**R:** Oh that's good. And in the hands there, there is a carrying ... of .....

**T:** You can see on the left it's Arts and Culture, on the right it's maths, this means that we as educators we are carrying so many Learning Areas, and some of them we don't know how to deal with them.

**R:** So in essence we can say this is an educator who is in trouble?

**T:** Educator in trouble you can see, caring so many subjects ... it's too much.

**R:** Now I just want you to also explain to me this concept of "pure maths", when we say a concept is pure maths for example, what do we mean?

**T:** Yah by pure maths I think eh ..., like now we talking of area we have it in maths we have it in Arts and Culture, so when we talk about pure maths, we only talk about maths there.

There is no integration with any other Learning Area. Like in Arts and Culture if I talk about the patterns like I said, that's only in Arts and Culture, it doesn't integrate with other subjects.

**R:** So it's a concepts that can .....

**T:** .... belong to that particular Learning Area only, I think, that's how I understand it.

**R:** Ok. Then may I also ask you to explain to me what is integration? How would you define integration?

**T:** Integration, it's .... eh .... I think you link, ... you combine subjects ..., from one subject to the other. If I talk about something in Arts that will come with the concept that is in maths, that is integration, you link the two, you get me ...yah... that's how I understand it, you link the two.... You talk about the area like you said, it's in both, ... so it links it goes in maths you are in Arts and Culture but you are also linking it to maths, that's integration.

**T:** Ok, so it's like a connecting kind of a situation, so this subject connects with another subject through these concepts that would run parallel through these Learning Areas. So that is what we mean by integration?

**R:** So if maybe I were to ask you to give you to give your views on this integration. How would you give your views on it?

**T:** I think... eh ... somewhere it's good but, the knowledge, ... we lack knowledge. I for one do lack knowledge for integration. I'm doing it because the Department wants us to do it, but I'm not clear with it. I'm truly not clear with it.

**R:** ... but at the same time you support it?

**T:** I do support it, because like the example we talked about, it makes sense, but I don't have knowledge of integration, I'm still lacking.

**R:** So given this background, would you say you are ready, to implement integrated teaching?

**T:** I'm really not. You know when I make my lesson preparation I always stuck when it comes to integration, .. I have to think, ... I have to think really, ...yah but I'm not ready.

**R:** What would you say is the reason for you to get stuck.

**T:** The thing is eh.... Sometimes you guess, I'm empty ... I'm empty, I'm not sure... you see... so it's difficult.

**R:** ...but I think integration also means approaching other teachers in Arts and Culture or in other Learning Areas, or alternatively speaking to your subject advisor, is that option not available?

**T:** It's not easy, it's really not easy. Yes sometimes we try to plan together. They say we must, ... team work will help us, but not always possible. It's not possible at school.

**R:** Why not possible?

**T:** Eh... you know when we meet others will tell you they don't have time, they don't understand it, we always have something when it comes to do that.

**R:** So one of the major problems is the fact that teachers also lack knowledge?

**T:** This is a serious problem, ... meeting with the other Learning Areas teachers can be a problem. You know in Arts and Culture we were dealing with drawing, shapes and patterns, so there was eh... one of shapes involved this thing of tessellations, so I knew that in maths they do these things, so I went to one of the maths educators and asked her about this tessellation thing, but she couldn't answer me, she did not have any clue. So you see it's a problem, so it means teachers don't have a clue, don't know anything about this integration thing. So I'm a Arts and Culture teacher and I want to integrate this thing of tessellation, you ask it the next teacher she knows nothing about it that, then .... Where will I get help? That is a problem.

**R:** So in other words that also highlight the issue of teacher training on integration, what is your take on that?

**T:** Yes teachers need to be trained, because I depend.... As an arts and Culture teacher I depend on the next educator, so if he doesn't know then....

**R:** Then what type of training would you expect for an Arts and Culture teacher to be able to understand the mathematics in Arts and Culture?

**T:** Eh... I think what it means is that ...eh... all the Arts and Culture teachers need a maths workshop, to be well trained in maths for integration.

**R:** Now tell me the Curriculum Document or the Policy Document of Arts and Culture, does it come out clearly about including mathematics in Arts and Culture lessons?

**T:** No it doesn't, .... It doesn't, you will have to think if you have maths knowledge, then you will integrate, but if you don't have any knowledge in maths then you will have to see, but it's not clear at all, it's not. In fact there is no direction from the side of the Policy makers. They don't tell us exactly what to do, if they tell us it's patterns, it's patterns. They won't

give you any clue there of maths or give you an example, they won't. There are no examples in fact.

**R:** So they just leave it to you as a teacher ...

**T:** ... they leave it to you as a teacher, even the facilitators when they come they will say try to make activities with that AS (*referring to Assessment Standards*), they how will you manage, how will you integrate? They say you must integrate, but there is no integration you must see yourself what goes with what. So there is a problem, even the facilitators it seems they are empty themselves.

**R:** So it means the support is .....

**T:** ... not enough. Like they give you a one hour or two hour workshop, they'll read the book. The one you do have, so I can't say that's training, that's not training. We still struggle with integration I'm telling you, we struggle a lot. So the Department must do something.

**R:** Now tell Mr Mokoena, how do you plan for integration?

**T:** We sometimes meet with other teachers, they say we must work as a team, ...eh... team work will help...

**R:** Does it help?

**T:** Ehh ....., sometimes yes, sometimes no. Sometimes we end up confused because we argue as educators.

**R:** Why do you argue?

**T:** Because we don't understand same things. For instance, a maths teacher will talk about this and Arts teachers will talk about. ... you see. So it can cause confusion.

**R:** Mr Mokoena I seem not to be following you, why do you get confused when in actual fact you are talking about the same thing. For instance when talking about a concept of a "line" or "area" with a maths teacher, what confusions are likely to come up?

**T:** You know maths people, they have their own way of understanding things.... You know. And us as Arts and Culture educators we have our own understanding, ...and it's impossible to meet halfway because it will confuse the child.

**R:** So in essence you are trying to say integration is a difficult way of teaching?

**T:** Very.... very difficult, because as educators we have different understandings of things.... and if we integrate things are worse sometimes ....., but sometimes its good, but the problem I cannot explain maths things like a maths educator.

**R:** Maybe out of interest Mr Mokoena, what if I were to ask you to rate your mathematics knowledge, would you say it's little, average or a lot?



**T:** Ahh..... it's little my brother, I don't have much maths knowledge. I don't have it truly. There is nothing much I can say about maths.

**R:** So if I may ask, how do you then plan lessons that involve mathematics?

**T:** It depends, sometimes we plan sometimes we don't. If something is too difficult what do I do? So it depends, if I know it I will plan for it... you see, ... that's that.

**R:** What if this mathematics comes up spontaneously during the course of the lesson? What do you do then, that is, it comes up unintentional?

**T:** Hey, ... it's difficult, it's truly difficult. The learners do help us at times. Sometimes you plan a lesson and learners will give more examples you didn't expect. They will give you integration themselves.

**R:** So learners sometimes help you as a teacher?

**T:** They do help you as a teacher, the educators also do help sometimes, ...they do help, because if I don't understand I have to go out. So the learners and educators do provide you with integration.

**R:** If I were to ask you to suggest a way-forward, what would you say should be done?

**T:** The Department must do something. Their workshops are not eh ...up to standard ...they are not up to standard. You will go to a workshop for just an hour and they will expect you throughout the year to do the right thing. So that's not enough ... I think more training is needed.

**R:** If I were to ask you to evaluate the progress that integration has made since its inception, what would be your analysis?

**T:** I don't think there is success, for instance if you meet with other teachers from other schools, they complain about one thing, integration.

## **APPENDIX: XVI**

### **Consent letters: To the principal, and to the grade9 mathematics and Arts and Culture teachers.**

#### **(a) To the principal**

UNIVERSITY OF WITWATERSRAND

MATHEMATICS RESEARCH PROJECT

Dear Principal

My name is Jabulane Dhlamini. I am currently doing my MSc degree in mathematics education. As part of my final year I am conducting a research on how connections are explored between mathematics and Arts and Culture by Grade 9 teachers. This research will focus on two Grade 9 Arts and Culture teachers and one Grade 9 mathematics (MLMMS) teacher. I therefore ask for your permission to allow me to use your school as a cite for this research to be carried out, and the permission to work with the three teachers mentioned above.

The three teachers will be interviewed during the course of the research and these interviews will be video-recorded so that I make sure that I make accurate record of what the teacher ill be saying during the interviews. The interviews will only be conducted after contact time, that is, between 14H00 and 15H00. You will also be provided with the transcript of these interviews. The names of he school and teachers will not be exposed; the school and participants will be referred to by a pseudonym.

After reading this letter you have a right to agree or not to agree. The participation of your school in this project is voluntarily and should you wish to withdraw at any stage of the research you are free to do so.

Should you wish to get more information, my telephone number is: 076 495 0067.

Hoping to hear from you soon.

Mr. Jabulane Dhlamini

**(b) To a Grade 9 mathematics teacher**

UNIVERSITY OF WITWATERSRAND  
MATHEMATICS RESEARCH PROJECT

Dear Grade 9 mathematics teacher

My name is Jabulane Dhlamini. I am currently doing an MSc degree in mathematics education at the above-mentioned institution. As a second year student I am expected to conduct a research in which I will be exploring mathematics and Arts and Culture connections that Grade 9 Arts and Culture teachers do. In one of the activities that will be given to Arts and Culture teachers you will also be requested to comment and give your views on the activity. This will be done in a form of an interview which I also intend to video-record in order to ensure that I preserve everything that would be said during the interview. After some time the video-recorded material will be destroyed with fire.

After reading this letter you have an option to agree or not to agree. Participation is strictly voluntary and there would be no incentives for participation and no penalty for non-participation. You also have an option to withdraw your participation during any stage of the research, if needs be, and your decision to withdraw will not affect any of your future dealings with the University of Witwatersrand. Your anonymity will be protected. The transcript from the interview will be availed to you for verification.

Should you wish to get more information, my telephone number is: 076 495 0067.

Hoping to hear from you soon.

Mr. Jabulane Dhlamini

**(c) To an Arts and Culture teachers**

UNIVERSITY OF WITWATERSRAND  
MATHEMATICS RESEARCH PROJECT

Dear Grade 9 Arts and Culture teacher

My name is Jabulane Dhlamini. I am currently doing an MSc degree in mathematics education at the above-mentioned institution. As a second year student I am expected to conduct a research in which I will be exploring mathematics and Arts and Culture connections that Grade 9 Arts and Culture teachers do. As an Arts and Culture teacher I wish to involve you in my research. I plan to give two Arts and Culture teachers a concept map activity in which they will demonstrate how mathematics concepts integrate with those of Arts and Culture, there will be a questionnaire that will be accompanying this activity. The concept map activity will be followed by interviews which I intend to video-record in order to ensure that I preserve all the statements which were said during the interview.

After reading this letter you have an option to agree or not to agree. Participation is strictly voluntary and there would be no incentives for participation and no penalty for non-participation. You also have an option to withdraw your participation during any stage of the research, if needs be, and your decision to withdraw will not affect any of your future dealings with the University of Witwatersrand. Your anonymity will be protected. The transcript from the interview will be availed to you for verification.

Should you wish to get more information, my telephone number is: 076 495 6700.

Hoping to hear from you soon.

Mr. Jabulane Dhlamini

## APPENDIX: VII

### Consent forms: To the principal and to all the participating teachers.

I ..... (please print your name in full) the principal/ a mathematics teacher/ an Arts and Culture teacher agree to be a participant in the research conducted by Jabulane Dhlamini in which he will be exploring connections between mathematics and Arts and Culture in a selected Arts and Culture textbook.

I give consent to the following:

- To do a concept map activity.

Yes ☐ or No ☐ (use a cross to indicate your selection)

- To be interviewed.

Yes ☐ or No ☐ (use a cross to indicate your selection)

- To be tape-recorded.

Yes ☐ or No ☐ (use a cross to indicate your selection)

Signed : .....

Date : .....

## APPENDIX: XVIII

### Letter of approval: University of the Witwatersand, Ethical Committee.



Mr JJ Dhlamini  
138 Hendrick Verwoerd Str  
Nigel  
1491  
South Africa

Faculty of Science  
Private Bag 3, WITS, 2050  
Fax: (011)717 6029  
Tel: (011)717 6006

Reference: Mrs A Sarawan  
E-mail: Ashina.Sarawan@wits.ac.za  
18 September 2007  
Person No: 9401961W  
PAG

Dear Mr Dhlamini

**Master of Science (Coursework and Research Report): Approval of Title**

We have pleasure in advising that your proposal entitled "*Exploring mathematical connections in a selected topic in arts and culture learning area.*" has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

A handwritten signature in black ink, appearing to read "Sarawan".

Mrs Ashina Sarawan  
Faculty Registrar  
Faculty of Science

## APPENDIX: XIX


### Letter of approval: Gauteng Department of Education (GDE).

4. A letter / document that outlines the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.
5. The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, and chairpersons of the SGBs, teachers and learners involved. Persons who offer their co-operation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.
6. Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal (if at a school) and/or Senior Manager (if at a district/head office) must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.
7. Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year.
8. Items 6 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.
9. It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.
10. The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.
11. The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations.
12. On completion of the study the researcher must supply the Senior Manager: Strategic Policy Development, Management & Research Coordination with one Hard Cover bound and one Ring bound copy of the final, approved research report. The researcher would also provide the said manager with an electronic copy of the research abstract/summary and/or annotation.
13. The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned.
14. Should the researcher have been involved with research at a school and/or a district/head office level, the Senior Manager concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards

Tom Waspe  
CHIEF INFORMATION OFFICER

The contents of this letter has been read and understood by the researcher.	
Signature of Researcher:	
Date:	30/07/2007