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**CHILDREN'S THINKING IN FORMAL CONTEXTS:
ACCOMMODATING CHAOS AND COMPLEXITY IN
COGNITIVE INTERVENTION**

by

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It is only when we have descended to the depths of sorrow that we can understand the complexity of being human.

- Pam Brown

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SUMMARY

This study is about the conditions that may serve as prerequisites for the development of self-regulated learning (SRL). In the context of educational psychology, SRL is not only about the formal aspects of managing one's learning, but also the motivational and affective processes that drive learning, as well as the social and political arena which provide the context for learning. In this study, I will propose that personal, social and political factors can combine in complex ways to produce a learning situation which cannot be addressed adequately without addressing its inherent complexity.

I examine some current issues in cognition and cognitive intervention and begin by drawing attention to some problematic aspects concerning children's thinking from an educational and psychological point of view. I review the sociopolitical context in which the conceptualisation and implementation of outcomes based education (OBE) and Curriculum 2005 takes place in South Africa and I also discuss some issues pertaining to the study of cognition from a more psychological point of view. I also address issues of complexity by examining how the meaning of the word has changed in response to changing paradigms in science and psychology and suggest that complexity theory is a metaphor that best fits current knowledge about cognition and problem-solving.

Since this study is about the accommodation of complexity in cognitive intervention, an important feature of this study concerns a specific characteristic of complex systems, namely chaos. Chaos allows self-organisation in a complex system and is also the main reason why change in a chaotic system is non-linear and unpredictable. It is generally believed that complex systems need to be studied in an unrestricted context if one is to observe those features that lend the system its chaotic character. In the context of the present study, complexity and chaos are hypothesised to be necessary prerequisites for the development of children as self-regulated learners because they form the mechanisms by which cognitive change becomes possible.

The research was carried out in two phases. In Phase One of the research, classroom observations were made and the Mediation Behaviour Observation Scale (MBOS) was especially designed for this purpose. Phase Two of the research was carried out in an intervention context by means of a design experiment. Verbatim transcriptions were

made of the interaction between the researcher and the learners in nine group sessions which formed part of the design experiment. To enhance the reliability and validity of the data, re-coding and intra-coding consistencies were calculated before the data were analysed. The re-coding consistencies ensured that the subsequent analysis of patterns would enable reliable conclusions to be drawn, whereas the intra-coding consistencies helped to refine the MBOS by indicating which categories may have been flawed, poorly described or impure. As such, the examination of the intra-code consistencies could perhaps be likened to factor analysis which resulted in some codes being merged and others being rejected. These data were used to construct a revised and shortened version of the MBOS.

Some of the more important results of the data-analysis on the design experiment indicated that when complexity and chaos are encouraged in cognitive intervention, some of the mediator behaviours that are most likely to be observed are (i) guidance of the way in which learners execute tasks, (ii) attempts to engage learners in group discussions, (iii) modelling or requiring learners to explore tasks systematically, (iv) positive interactions such as acknowledging responses or praising learners, (v) modelling analytical thinking and (vi) probing of learners' responses.

KEYWORDS:

Cognition

Cognitive intervention

Complexity

Chaos

Qualitative research

Design experiment

ATLAS/ti

TABLE OF CONTENTS

CHAPTER ONE

Current issues concerning children's learning in formal contexts

1.1	THE SOCIOPOLITICAL CONTEXT OF COGNITIVE INTERVENTION ...	2
1.2	A THEORETICAL PERSPECTIVE ON CHILDREN'S THINKING IN FORMAL CONTEXTS	7
1.2.1	<i>Phases in the development of cognitive and learning theory</i>	7
1.2.2	<i>Information processing approaches to cognition</i>	8
1.2.3	<i>Constructivist approaches to cognition.....</i>	10
1.2.4	<i>Contextual approaches to cognition</i>	12
1.3	COGNITIVE INTERVENTION IN FORMAL CONTEXTS	16
1.3.1	<i>A definition of cognitive intervention.....</i>	16
1.3.2	<i>Formally structured cognitive intervention programmes</i>	17
1.3.3	<i>Context-dependent approaches to cognitive intervention.....</i>	19
1.3.4	<i>The current status of cognitive intervention</i>	22

CHAPTER TWO

The relationship between science, psychology and cognition

2.1	INTRODUCTION	29
2.2	PSYCHOLOGY AS A SCIENCE	32
2.2.1	<i>Definitions of psychology.....</i>	32
2.2.2	<i>A definition of cognition.....</i>	33
2.2.3	<i>The birth of psychology.....</i>	33
2.2.4	<i>Philosophical conceptions of cognition.....</i>	33
2.2.5	<i>Psychology and logic</i>	34

University of Pretoria, etd - Human, S

2.3	THE CLASSICAL PERIOD	35
2.3.1	<i>The nineteenth century Zeitgeist</i>	35
2.3.2	<i>Physics envy in psychology</i>	37
2.3.3	<i>Cognitive psychology and the study of cognition</i>	39
2.3.4	<i>Complicated versus complex</i>	41
2.3.5	<i>Cognition and technology</i>	42
2.4	THE MODERN PERIOD	44
2.4.1	<i>Quantum uncertainty and multiple realities</i>	44
2.4.1.1	<u>Introduction</u>	44
2.4.1.2	<u>1900 : The quantum hypothesis and the birth of non-linearity</u>	45
2.4.1.3	<u>1905 : The dual theory of light and the notion of conscious matter</u>	45
2.4.1.4	<u>1926 : Wave theory and multiple perspectives of reality</u>	46
2.4.1.5	<u>1927 : Heisenberg's uncertainty principle and multiple realities</u>	49
2.4.2	<i>Complex cognition: A classical and quantum perspective</i>	49
2.5	THE POSTMODERN PERIOD	51
2.5.1	<i>The new paradigm</i>	51
2.5.2	<i>Cognition and the science of change</i>	52

CHAPTER THREE

Accommodating principles of complexity and chaos in cognitive theory

3.1	INTRODUCTION	56
3.2	PSYCHOLOGY, COMPLEXITY AND CHAOS	58
3.2.1	<i>Complexity and chaos in psychology</i>	58
3.2.2	<i>Complexity and chaos in the study of cognition</i>	60

University of Pretoria, etd - Human, S

3.3	COMPLEXITY THEORY	60
3.3.1	<i>Definitions of complexity</i>	60
3.3.2	<i>Complexity in a postmodern context</i>	61
3.3.2.1	<u>Objectivism and relativism</u>	61
3.3.2.2	<u>Complexity and relativity</u>	62
3.3.3	<i>Universal features of complex systems and their relation to cognition</i>	63
3.3.3.1	<u>Open systems</u>	63
3.3.3.2	<u>Absence of equilibrium</u>	64
3.3.3.3	<u>Historical development</u>	65
3.3.3.4	<u>Number of elements</u>	65
3.3.3.5	<u>Dynamic interaction</u>	66
3.3.3.6	<u>Non-linearity</u>	67
3.3.3.7	<u>Short range interaction</u>	69
3.3.3.8	<u>Feedback loops</u>	70
3.3.4	<i>Mechanisms of cognitive change</i>	71
3.4	CHAOS THEORY	72
3.4.1	<i>Origins of chaos theory</i>	72
3.4.2	<i>The core principles of chaos theory</i>	73
3.4.2.1	<u>Sensitive dependence</u>	73
3.4.2.2	<u>Non-linearity</u>	74
(1)	Definition	74
(2)	Non-linearity and Vygotsky's psychology	74
(3)	Non-linearity and Vygotsky's zone of proximal development (ZPD).....	76
3.4.2.3	<u>Self-organisation</u>	77
(1)	Descriptions of self-organisation	77

University of Pretoria, etd - Human, S

(2)	Non-determinism.....	78
(3)	Dynamic adaptation	79
(4)	Dynamic non-linear relationships	81
(5)	Emergent property	82
(6)	Increasing complexity	82
(7)	The necessity of memory.....	83
(a)	Process versus objects.....	83
(b)	Explanation versus description.....	84
(8)	Functional description.....	84
3.4.3	<i>The relevance of chaos theory to the study of cognition</i>	85
3.4.3.1	<u>Chaos at all levels of the central nervous system</u>	85
3.4.3.2	<u>Implications for research : cognitive theory</u>	86
3.4.3.3	<u>Implications for practice : cognitive intervention</u>	87

CHAPTER FOUR

Research design and preliminary data-analysis

4.1	THE ILLUSORY DISTINCTION BETWEEN QUALITATIVE AND QUANTITATIVE RESEARCH	92
4.2	CHARACTERISTICS OF THE RESEARCH	94
4.2.1	<i>Objectivity.....</i>	94
4.2.2	<i>Precision, verification and explanation.....</i>	96
4.2.3	<i>Empiricism, logical reasoning and conditional conclusions</i>	97
4.3	THE RESEARCH DESIGN	98
4.3.1	<i>The research purpose.....</i>	98
4.3.2	<i>Problem formulation.....</i>	99
4.3.3	<i>Research method.....</i>	102

University of Pretoria, etd - Human, S

4.3.4	<i>Constructing the learning environment</i>	105
4.3.4.1	<u>Careful selection of open problems</u>	105
4.3.4.2	<u>Instructional techniques</u>	107
4.3.4.3	<u>Culture of learning</u>	109
4.3.5	<i>Role of the researcher</i>	110
4.3.6	<i>Data collection</i>	112
4.3.7	<i>Reliability and validity</i>	114
4.3.8	<i>Data analysis</i>	128
4.3.8.1	<u>Phase One: Classroom observation</u>	128
4.3.8.2	<u>Phase Two: Design experiment</u>	133
4.3.9	<i>Design limitations</i>	143

CHAPTER FIVE
Data Interpretation

5.1	INTRODUCTION	147
5.2	THE GROUNDED THEORY APPROACH	148
5.2.1	<i>Theory building and testing</i>	148
5.2.2	<i>Assumptions about children's thinking</i>	149
5.2.3	<i>Assumptions about cognitive intervention</i>	155
5.3	DATA INTERPRETATION	156
5.3.1	<i>Introduction</i>	156
5.3.2	<i>Defining mediation in cognitive intervention</i>	157
5.3.3	<i>Mediating learning as self-organisation</i>	158
5.3.3.1	<u>Enhancing cognitive flexibility</u>	158
5.3.3.2	<u>Differentiating children's mental representations</u>	162
5.3.3.3	<u>Construing knowledge in an intersubjective space</u>	168

University of Pretoria, etd - Human, S

5.3.4	<i>Self-organisation in Vygotsky's Zone of Proximal Development</i>	171
5.3.5	<i>Mediation using concrete symbols and cultural signs</i>	174
5.3.5.1	<u>Mediating attention using concrete symbols</u>	174
5.3.5.2	<u>Mediating systematic learning behaviour using concrete symbols</u>	177
5.3.5.3	<u>Mediating memory with concrete objects</u>	181
5.3.6	<i>Language mediation</i>	185
5.3.6.1	<u>The link between language and cognitive development</u>	185
5.3.6.2	<u>Using language to mediate self-regulatory behaviour</u>	186
5.3.6.3	<u>Language, participation and self-esteem</u>	189
5.3.7	<i>Mediation and dynamic adaptation</i>	195
6.	SUMMARY	203

CHAPTER SIX

Summary and future directions

6.1	INTRODUCTION	208
6.2	SUMMARY	208
6.3	FUTURE DIRECTIONS	216
	REFERENCES	219

LIST OF TABLES AND FIGURES

LIST OF META-NARRATIVES

	Page number
Meta-narrative 1.1	1
Meta-narrative 1.2	27
Meta-narrative 2.1	28
Meta-narrative 2.2	31
Meta-narrative 2.3	54
Meta-narrative 3.1	55
Meta-narrative 3.2	57
Meta-narrative 3.3	90
Meta-narrative 4.1	91
Meta-narrative 4.2	132
Meta-narrative 4.3	145
Meta-narrative 5.1	146
Meta-narrative 5.2	150
Meta-narrative 5.3	207

LIST OF FIGURES

Figure 2.1	An information processing model of learning	50
Figure 4.1	The flexibility of the research process	101
Figure 4.2	Vulture, flamingo and seahorse from the poster	103
Figure 4.3	Mediational Behavior Observation Scale	108
Figure 4.4	The researcher's involvement with participants	111
Figure 4.5	Sample from data source that shows the re-coding process.....	117
Figure 4.6	Day one: Intra-code consistency for selected codes	121
Figure 4.7	Day two: Intra-code consistency for selected codes.....	123
Figure 4.8	Day three: Intra-code consistency for selected codes	125
Figure 4.9	Merged codes on the MBOS	127

University of Pretoria, etd - Human, S

Figure 4.10	The revised version of the MBOS	128
Figure 4.11	Open and closed questions aimed at probing children's thinking.....	139
Figure 4.12	Selected KS2- and KS2+ questions in association with KS3+	141
Figure 4.13	Selected KS2- and KS2+ questions in association with CS3+	142
Figure 5.1	Grounded theory approach.....	149
Figure 5.2	The fractal complexity of human existence	151
Figure 5.3	The development of learning dispositions	153
Figure 5.4	The relationship between mediational levels and competency levels ...	196
Figure 5.5	Leopards and lions.....	199
Figure 5.6	Qualitative description of mediational levels	202

LIST OF TABLES

Table 4.1	Data collection time in hours	112
Table 4.2	Design experiment participants	113
Table 4.3	Data subsets (DS).....	113
Table 4.4	Sample for re-coding of researcher utterances in the design experiment.....	116
Table 4.5	Re-coding consistency rates for DS1 – DS9.....	119
Table 4.6	Day one: Intra-code consistency rates for DS1 – DS3	120
Table 4.7	Day two: Intra-code consistency rates for DS4 – DS6.....	122
Table 4.8	Day three: Intra-code consistency rates for DS7 – DS9.....	124
Table 4.9	Most frequently recorded teacher behaviours for each grade	131
Table 4.10	Participation of researcher and learners on the design experiment	133
Table 4.11	Frequencies of revised MBOS codes across all data subsets	134
Table 4.12	Association of positive and negative codes	135
Table 4.13	Association of KS1-, KS2-, KS3- with positive codes	136
Table 4.14	Open and closed questions associated with at least one other code....	138
Table 4.15	Distribution of open and closed questions across data subsets.....	138

LIST OF DIALOGUES

Dialogue 5.1	Cognitive flexibility	159
Dialogue 5.2	Differentiating concepts	163
Dialogue 5.3	Construing an understanding of the group process	168
Dialogue 5.4	Self-organisation and motivation	172
Dialogue 5.5	Mediating attentional processes	175
Dialogue 5.6	Mediating systematic behaviour	177
Dialogue 5.7	Mediating systematic behaviour – continued	180
Dialogue 5.8	Mediating memory	182
Dialogue 5.9	The importance of language in learning	187
Dialogue 5.10	Home language and self-esteem.....	189
Dialogue 5.11	Home language and group participation	192
Dialogue 5.12	Home language and language development	193
Dialogue 5.13	Levels of mediation	197
Dialogue 5.14	Levels of mediation - continued.....	199

PREFACE

It is not easy being an educational psychologist these days. To our colleagues in psychology, we are too educational, a disparaging label reflecting our interest in studying educationally relevant problems rather than contrived laboratory tasks. To our colleagues in education, we are too psychological, a disparaging label reflecting our interest in basing educational practice on scientific research methods and theories rather than relying on popular opinion and doctrine. We disturb psychology by failing to accept contrived artificial laboratory research as the ending-point for psychological research. We disturb education by failing to accept good intentions, expert opinions, and doctrine-based claims as the rationale for educational practices (Mayer, 2001, p. 83).

The situation described above leads Mayer (2001) to ask a very basic, yet significant question, namely: *What good is educational psychology?* Mayer (2001) goes on to answer his own question by saying that both education and psychology have contributed significantly to this “match in heaven that has had a somewhat difficult history here on earth”, firstly, through what Mayer (2001) terms the psychologies of subject matter and secondly, through the teaching of cognitive strategies for self-regulated learning (p. 84).

Self-regulated learning in educational and psychological contexts

In terms of the psychologies of subject matter, Mayer (2001) suggests that education saved psychology from becoming irrelevant by offering psychology the challenge of understanding how people learn in real school content areas. As far as cognitive strategy instruction goes, Mayer (2001) suggests that its main contribution to educational practice was that it helped to specify what knowledge and skills children need for various tasks. One particular area of research in cognitive strategies that has become an important area of research in educational psychology concerns self-regulated learning (SRL), which is described as children’s ability and propensity to be active participants in their own learning (Patrick & Middleton, 2002).

This study is about the conditions that may serve as prerequisites for the development of SRL. In the context of educational psychology, it is recognised that SRL is not only about the formal aspects of managing one’s learning, but it is also about the motivational and

University of Pretoria, etd - Human, S

affective processes that drive learning, as well as the social and political arena which provide the context for learning. In this study, I will propose that personal, social and political factors can combine in complex ways to produce a learning situation which cannot be addressed adequately without addressing its inherent complexity. Indeed, research on SRL in educational psychology has pointed to the importance of factors such as the nature of learning tasks, instructional contexts, and interaction and Patrick and Middleton (2002) suggest that qualitative research methods are particularly well-suited for the study of SRL because they involve rich, holistic descriptions, they emphasise the social settings in which phenomena are embedded and are oriented toward revealing complexity.

In an article in which they discuss 30 years' of research on SRL in educational psychology, Paris and Paris (2001) describe two models of SRL. The first is a "transmission" metaphor which emphasises the acquisition of strategies for SRL. The second metaphor focuses on "becoming" a self-regulated learner. The "transmission" metaphor of SRL is rather problematic because it cannot explain why all children do not become self-regulated learners once they have acquired the appropriate strategies through cognitive intervention. This is also the basic problem of the present study, namely that some factors inherent in the learning situation, whether they are connected to the participation of the learner or the teacher, or to the nature of the learning task (or more likely a mix of all of them), appear to be responsible for some children becoming self-regulated learners and others not.

Pulling all the themes together

In this preface I use SRL as a framework that provides relevant educational and psychological questions about children's thinking in formal contexts.

Using SRL as a framework to summarise the content of this study serves as a means of pulling together all the themes that influenced the direction of this study at one point or another. For example, when this study was conceptualised, the focus was less on an examination of children's thinking in formal contexts, and more on the development of materials for cognitive intervention. Even then, an important principle in the design of the cognitive intervention materials was that they should reflect the complexity of children's

University of Pretoria, etd - Human, S

environments so that children could learn to adapt to such complexity. It was only approximately a year later upon reading Briggs and Peat's (1999) *Seven life lessons of chaos* that I was eloquently reminded by the authors of what I was trying to achieve. I was also reminded of an earlier article that described how a chaos model of the brain could be used to effect therapeutic change. The article in point was Gary Flint's (1994) *A chaos model of the brain applied to EMDR*¹.

In the article, Flint (1994) describes how a chaos model of the brain could explain why clinicians who use EMDR can neutralise patients' traumatic memories in a very short space of time. As Flint (1994) describes, EMDR requires the patient to recall a traumatic memory while watching a therapist's finger move back-and-forth at eye-level and Flint (1994) claims that repetitions of such a process "have been shown to eliminate quite rapidly the painful qualities associated with a traumatic picture or feeling"(p. 120). Chaos theory is then offered as a theoretical framework to describe how a traumatic memory is represented by a specific pattern of neuronal activation, also called a neural network, and how by stimulating the patient's perceptual system visually, additional neurological activity is elicited in the brain, causing the neural network of the traumatic memory to be altered and consequently to be neutralised. The point was that a small, seemingly insignificant event that was unrelated to the trauma had the potential to produce a significant change in the patient's experience of a traumatic memory.

Flint's (1994) article introduced me to chaos theory long before it occurred to me that chaos theory could provide a plausible framework for studying children's thinking with a view to improving the practice of cognitive intervention. However, it was only later when *Seven life lessons of chaos* also introduced me to complexity theory that I felt it had become a necessity to examine the relevance of complexity and chaos theory to children's cognition to see whether it could be used to improve cognitive intervention practice and to provide guidance about the kind of interaction teachers and children need to engage in to promote self-regulated learning. At this point, my research focus changed from concerning itself with the development of a cognitive intervention programme to focusing more on examining the complex and chaotic nature of children's thinking and considering ways in which those aspects could be accommodated in

¹ EMDR is an abbreviation for Eye Movement Desensitisation and Reprocessing.

University of Pretoria, etd - Human, S

cognitive intervention. Cognitive intervention is about change – cognitive development – and chaos theory is concerned about how change takes place in complex systems.

Children with special education needs (SEN)

The participants in this study were all young children in the first three years of school whose home language differ from English, their language of learning and teaching (ELoLT). They can be considered children with special education needs (SEN) because their limited language proficiency in ELoLT constitutes a barrier which prevents them from participating fully in learning opportunities. Frederickson and Cline (2002) suggest that children may encounter difficulties in school when they have grown up with a different set of conventions from those that they encounter at school, including speaking a different language at home. If children cannot participate in learning opportunities because of limited language proficiency their cognitive development may suffer as a result and their difficulties will become compounded (Hart, 2000).

Cognitive intervention by means of verbal interaction is an important aspect of cognitive intervention with young children, especially children with SEN as a result of language factors, because children are still in the process of internalising and transforming social speech to mental functions (Vygotsky, 1978). Perhaps a large portion of learners in South Africa could be described as learners with SEN, because even though learners have the right to be educated in their home language, more often than not this is not happening. It is in the nature of current South African classrooms that they show a great deal of linguistic diversity and in most cases the most pragmatic solution is to implement ELoLT. In such cases, it should also be considered that linguistic diversity is rarely a communication problem only, because it affects the healthy development of children's identities as competent learners and problem-solvers, and their development as self-regulated learners. This study directly addresses some aspects of SEN as they relate to language and communication by including them as a natural aspect of cognitive intervention.

It was specifically decided to discuss all children's cognitions in a complex learning environment without addressing children with SEN separately or making any other classifications that could be viewed as exclusionary or discriminatory. All children learn

University of Pretoria, etd - Human, S

and all children should benefit from cognitive intervention. If cognitive intervention practices accommodate complexity and chaos, it follows that all children's needs can be accommodated without the need to make exclusionary exceptions for children with SEN. In this sense, the accommodation of complexity in cognitive intervention is perhaps the same as the accommodation of diversity in cognitive intervention since complexity and diversity both recognise the multi-dimensionality of human nature. In terms of inclusion, the accommodation of complexity and chaos in cognitive intervention could play an important part in providing meaningful learning experiences to all learners, including those with SEN.

The use of meta-narratives

Many questions (some educational and some psychological) emerged over the course of the research and their process of development is reflected in the form of meta-narratives at the beginning and end of each chapter.

On the one hand, the purpose of the meta-narratives was to represent clearly the core problems and questions that informed the study and to reflect the complexity and flexibility of the research. On the other hand, the meta-narratives were regarded as a suitable tool to reflect the postmodern situatedness of the research by presenting research as an emerging narrative rather than a finished product. As such, the use of meta-narratives supports Agar's (1999) description of the qualitative research process². The emergence of the research questions was very much a meta-research process that evolved parallel to research activities. It was therefore important to me to report the research as an activity in which decisions were constantly shaped through a meta-level process as problems and questions arose in the course of the study.

The meta-narratives are intended to reflect the ongoing and open-ended nature of the entire research process. Research can never really be concluded, since new questions and concerns constantly arise. As one question is answered, the answer brings many new possibilities and avenues of investigation which the researcher must address. Inevitably, some questions are more pertinent to the original research question than others so that some questions have to be put aside momentarily. The research

University of Pretoria, etd - Human, S

questions that are generated in the course of this study are certainly not the only questions that may be asked, but they do represent the most pressing issues in the context of the main research question. True to its postmodern situatedness, the research narrative should therefore be regarded as only one of many viable narratives that could have evolved.

The meta-narrative is also a useful tool to reflect concerns that the researcher may have at a particular point and provides an innovative way of including the researcher's assumptions, beliefs and opinions so that the reader may decide to what extent the subjectivity of the researcher influenced the outcome of the results. As such, the inclusion of meta-narratives can significantly enhance the credibility of the research because a clear line can be drawn between the academic process of conducting scientific research and the reflective mental activity of the researcher.

Primary themes in the present study

In *Chapter One* I examine some current issues in cognitive intervention and draw attention to some problematic aspects concerning children's thinking from an educational and psychological point of view. I mention issues related to the conceptualisation and implementation of outcomes based education (OBE) and Curriculum 2005 in South Africa and I also discuss some issues pertaining to the study of cognition from a more psychological point of view.

Concerning the metaphor of the learner in the process of becoming a self-regulated learner, Paris and Paris (2001) have the following to say:

In this view, self-regulation is a description of coherent behaviours exhibited by a person in a situation rather than a set of skills to be taught....Self-regulation in this view is not "acquired" as much as it is shaped and elaborated through participation in "zones of proximal development" according to tenets of sociocultural theories....In this view, SRL may be regarded not as the goal of students' learning but as the outcome of their pursuits to adapt to their unique environmental demands in a coherent manner (p. 96).

In the extract, Paris and Paris (2001) make several important points about SRL. Firstly, self-regulated behaviours are coherent, i.e. they are not a set of discrete skills that are

² See Chapter Four, p 97.

either purposefully or haphazardly chosen according to the learner's perception of the demands of the task at hand. Secondly, the behaviours that are associated with SRL are more likely to emerge as a result of dynamic interaction and adaptation between children and their environment rather than to be acquired as a result of direct instruction and thirdly, the dynamic interaction between the child and her environment must take place within a zone of proximal development. The features of SRL as discussed by Paris and Paris (2001) are addressed in the present study in accordance with two theories that are increasingly being used as metaphors to explain cognition, namely chaos theory and complexity theory.

In *Chapter Two* I address issues of complexity by examining how the meaning of the word has changed in response to changing paradigms in science and psychology and suggest that complexity theory is a metaphor that best fits current knowledge about cognition and problem-solving. Paris and Paris (2001) make a case for SRL as coherent behaviours that emerge through adaptation and complexity theory explains why this is plausible. However, instead of viewing adaptation as a passive reaction to information received from the environment, complexity theory views adaptation as active self-organisation in which the child is an open system not only influenced by the environment, but also capable of influencing her environment.

Chapter Three deals with a specific characteristic of complex systems, namely chaos. Chaos allows self-organisation in a complex system and is also the main reason why change in a chaotic system is non-linear and unpredictable. It is generally believed that complex systems need to be studied in an unrestricted context if one is to observe those features that lend the system its chaotic character. One of the more important reasons why complexity theory and chaos theory offer a promising framework to study the development of children's thinking in formal contexts as they become self-regulated learners, is studying cognition naturally. In the context of the present study, complexity and chaos are hypothesised to be necessary prerequisites for the development of children as self-regulated learners because they form the mechanisms by which cognitive change becomes possible. Chaos theory suggests that small, seemingly insignificant events (Butterfly effects) have the power to shape the development of an entire system in a fundamental way. Paris and Paris (2001) claim that an enduring research issue in SRL is the one of "hot cognitions and motivations" (p. 98) and the

University of Pretoria, etd - Human, S

specific reasons children may be motivated to develop SRL behaviours. Patrick and Middleton (2002) describe “hot” aspects of cognition as those associated with motivational and affective dimensions of learning, and “cold” aspects as the cognitive and metacognitive aspects of learning. Children not only construe meaning on a cognitive level, they also construe meaning on emotional and normative levels. The cognitive and emotional meanings that children construe as a result of their interaction with others in a learning environment may provide countless Butterfly effects as children develop the kind of identity that could help or hinder the development of SRL.

In a learning context, the events that can shape the meaning a child gives to her learning experiences are many and varied. These events can be connected to formal and social aspects of learning, to the social, cultural and political contexts in which learning takes place, factors within the child, the teacher as mediator or the dynamics of their relationship, and so on. For example, Paris and Paris (2001) suggest that SRL can involve a myriad of avoidance and approach behaviours that a child develops in order to preserve a healthy self-esteem. To examine which mediator behaviours may contribute towards the development of self-regulated learning in formal contexts, *Chapter Four* is devoted to an analysis of those behaviours by the mediator that may contribute to or constrain the development of SRL. To understand on a practical level how complexity and chaos may provide the conditions for the development of SRL, it was necessary to design a complex learning environment that would facilitate the emergence of complex cognition and *Chapter Four* describes how this was accomplished.

The coherence of children’s behaviours, especially the behaviours that are associated with SRL, is particularly important within a theoretical framework that emphasises complexity and thus self-organisation, because it draws attention to the fact that children’s behaviours are guided by the meaning they construe from their experiences. Paris and Paris (2001) point out that SRL is viewed as the integration of skill and will, and that children’s identities play an important role in the emergence of SRL. Children’s identities are formed by many different experiences over time in which children make judgements about their abilities and skills. Specifically, Paris and Paris (2002) suggest that “striving to enact identity, fueled by desires to be recognized and validated as a specific kind of self, provide coherence to a person’s actions” (p. 97). In *Chapter Five* I offer some suggestions on how such coherency may be achieved as a result of

University of Pretoria, etd - Human, S

children's appraisals of formal and social aspects of a learning situation and I also suggest that these appraisals are guided by personality, cognitive preferences and emotional styles which have emerged through a dynamic interaction between genetic/hereditary aspects and the sociocultural environment. Chaos theory is essentially about processes of change. In the context of the present study, the focus is on cognitive change and how mediators could bring about such change through cognitive intervention. The accommodation of chaos in cognitive intervention is about creating the conditions necessary for children as complex human beings to change through self-organisation. One of the prerequisites for change in a complex system is sufficient complex interaction between different elements of the system. In the case of children's thinking, complex interaction between the child and her physical and social environment is required to ensure that cognitive change is an open and flexible process. Cognitive intervention must also accommodate interaction between the child's personality and her emotional and cognitive processes.

Specific attention is also paid to the themes that can arise in complex learning environments that do not focus on the instruction of specific skills, but that emphasise a natural process in which children become self-regulated learners. Perhaps one of the main points that I want to make clear in *Chapter Five* is that learning environments that accommodate chaos and complexity in cognitive intervention do not have to imply directionless, unfocused activity in which the teacher and her learners have a good conversation but little or no learning is accomplished. Through well-considered questioning and mediation on the part of the teacher, a wide variety of issues can be accommodated that are very relevant to the development of healthy identities and the kind of "hot cognitions" that Paris and Paris (2001) believe to be important in SRL.

Another area of research that Paris and Paris (2001) suggest requires more research, is the question of exactly how children become self-regulated learners. They suggest that SRL can develop through a combination of direct induction (from experience), direct instruction and elicited actions (through participation in tasks that require SRL), but exactly how this is thought to happen is still unclear. Paris and Paris (2001) further suggest that SRL can be promoted through "directed reflection", "metacognitive discussions", "reflective analyses" and so on. Yet, what remains elusive is exactly how such practices are supposed to be managed by the teacher, how they should be

structured, for what purposes, and how they should be conducted. For example, reflective analyses of a learning task can involve anything from an analysis of the participation of the learner, her demonstrated abilities and skills, personal experiences [or lack thereof] with similar tasks, other children's contributions, transcendental aspects such as the importance of a particular task, its meaning within a broader context, and so on.

The themes which are addressed in *Chapter Five* begin to answer some of these questions by examining how metacognitive discussion and reflective analysis are used specifically to address (i) learning as self-organisation by enhancing psychological and cognitive flexibility, (ii) mediation of self-organisation through the use of concrete materials and cultural signs, (iii) mediation of language as a means of promoting cognitive development, (iv) self-regulatory behaviour, (v) group participation and (vi) self-esteem. *Chapter Five* also offers a detailed description of the characteristics of the mediator and the learner when different levels of mediation is provided. These characteristics can be of significant practical relevance because, instead of providing vague and abstract descriptions, they describe to teachers the kinds of practical behaviours they need to engage in in their efforts to promote SRL.

Chapter Six contains a summary of the main themes in the study. Some issues that remain problematic in the study of children's thinking within a context of complexity and chaos are discussed. Practical suggestions about the accommodation of chaos and complexity in classroom settings are offered. Directions for future research are also addressed.