Structure of the thesis

Setting
the scene

Literature surveys and analysis of learning
theory and instructional systems design in practice

Derivation of the Hexa-C Metamodel
as an integrated framework

Case Studies: Evaluation of three learning events,
using the framework as a toolset

HCMm toolset: Insights from the case studies -
the dynamics of theory and practice

Chapter 1	Chapter 2	Chapter 3	Chapter 4	Chapter 5	Chapter 6	Chapter 7
Introduction	Theory	Practice	Synthesis	Evaluation	Reflection	Conclusion

Chapter 1 — Introduction

Research questions,
value, goals,
limitations, methods,
research design,
thesis structure
and content

Chapter 2 — Theory

- Behaviourism
- Cognitivism
- Constructivism
- General
- New paradigm
- Parallel study
- Discussion

Chapter 3 — Practice

- Behaviourism
- Cognitivism
- Constructivism
- General
- New paradigm
- Parallel study
- Discussion

Synthesis to isolate Metamodel

Chapter 4 — Synthesis

- Cognitive learning
- Collaborative learning
- Components
- Constructivism
- Creativity
- Customization

Application to practical evaluations

Answers Research Question 1:

Which theories and characteristics
arise when current learning theory
and practice are filtered through
effectiveness criteria?

Chapter 5 — Evaluation

- FRAMES
- RBO
- Mkambati 2000 Project

Draw conclusions about the elements of the tool and their interrelationships

Answers Research Question 2:

What do these theories and characteristics
reveal about the practice of effective learning?

Chapter 6 — Reflection

- Cognitive learning
- Collaborative learning
- Components
- Constructivism
- Creativity
- Customization

Answers Research Question 3:

What does the practice of
learning and instruction
reveal about these
theories and characteristics?

Chapter 7 — Conclusion
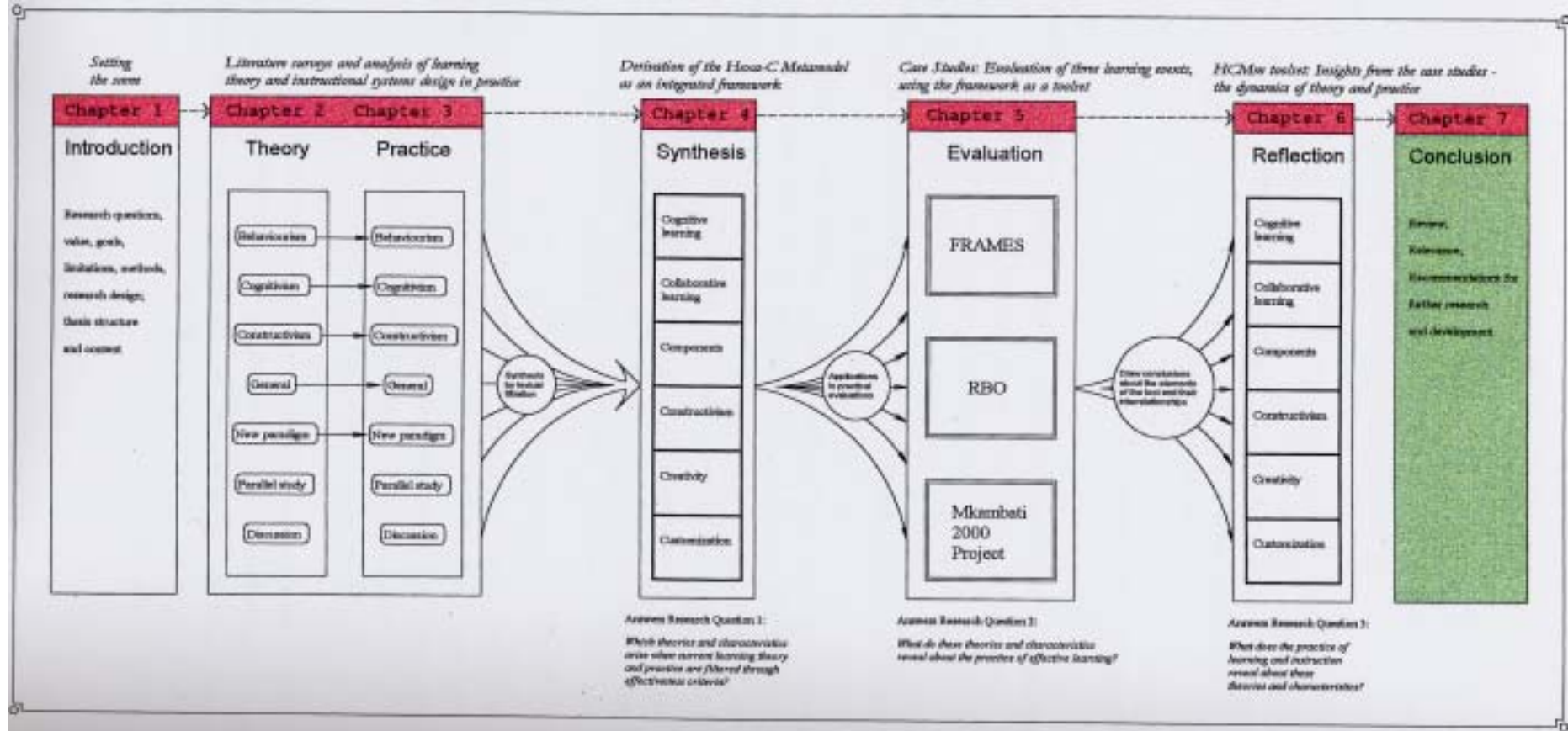
Review,
Relevance,
Recommendations for
further research
and development

Chapter Seven

Conclusion

This thesis has investigated the dynamics of theory and practice in instructional systems design, with the purpose of synthesizing a compact and concise, integrated framework of current cognitive learning theories and philosophies, instructional design theories and approaches, and effective practices - a framework intended to facilitate the tasks of:

- Designing and developing instructional systems and events to support effective learning;
- Examining and evaluating existing instructional and learning systems/events/environments from the viewpoint of instructional and learning theory; and
- Determining more about the dynamics of theory and practice in the design of instructional systems and learning events.

This chapter closes the study, as it briefly:

- Wraps up what has been achieved (Section 7.1);
- Reviews the research questions which drove this study, and their answers (Section 7.2);
- Undertakes a final brief review of the Hexa-C Metamodel (Section 7.3);
- Mentions the relevance of the study regionally in South Africa (Section 7.4); and
- Suggests directions for future research (Section 7.5).

7.1   What has been achieved?

Using meta-analysis and a process of criterion-based filtration of textual information, a framework was generated, the Hexa-C Metamodel - a model of models. The HCMm is relevant to a variety of instructional systems, resources and artifacts, interactive learning environments, and open-ended learning experiences. Case studies were undertaken in which the HCMm was applied to three technology-related learning events: a computer-based practice environment, an Internet course, and a fieldwork project using computers as tools. Furthermore, the study contributed to the inquiry into learning and instructional theories by undertaking an in-depth study of the elements of the integrated framework itself, investigating the ways in which they function in different contexts and contents.

The reader is referred to Figures 1.2 and 1.3 in Chapter One, which depict the chain of reasoning in this study and show how the content and output of each chapter serve as the starting point of the next. This thesis has described the generation of a synthesis of theory and effective practice (the metamodel), investigated the dynamics of theory and practice in instructional systems design by using it as a tool to apply theory to practice and determined, conversely, how practice informs theory.

7.2   Research questions and answers

The research embodied in this thesis makes three main contributions as it answers the research questions of Chapter One, reviewed in Table 7.1.

Table 7.1 Review of the Research Questions	
Research question	**Addressed in**
1. What theories and characteristics arise when current learning theory and practice are filtered through effectiveness criteria?	Chapter Four
2. What do these theories and characteristics reveal about the practice of effective learning?	Chapter Five
3. What, conversely, does the practice of learning and instruction reveal about these theories and characteristics?	Chapter Six

7.2.1 Response to Research Question One

Research Question 1 led to a concise integration of theory and practice in the HCMm framework.
Chapter Four describes how the Hexa-C Metamodel was derived and generated using a qualitative research process, which filtered textual information on learning and instructional theories/practice through nine effectiveness criteria – the purpose of the criteria being to select stances and characteristics that enhance both the learning process and the products of learning. The material used as *input* for this textual filtration process was the information from the extensive literature surveys of Chapters Two and Three. The synthesized framework, which was the *result* of the process, comprises three elements with theoretical orientations - **cognitivism**, **constructivism**, **components** and three which are characteristics of practice - **collaborative learning**, **creativity**, **customization**.

Although the HCMm is not proposed as the ultimate theoretical solution, nor as an all-embracing instructional design model or general evaluation checklist, it makes a contribution towards identifying salient features of the theory, design and practice of contemporary instructional systems.

7.2.2 Response to Research Question Two

Research Question 2 was answered by applying the HCMm as an evaluation toolset
The set of theories and characteristics integrated within the HCMm framework serve as an aid in instructional design and in the evaluation of existing learning systems, events, environments, and materials/resources. Within its three major sections for three case studies respectively, Chapter Five demonstrates how the framework was used as a versatile and valuable tool of inquiry in field research

for investigating the learning events from the viewpoint of learning theory. Data was triangulated by examining three very different designs for learning, selected for this study due to the researcher's close involvement with each, yet offering a further benefit in their eclecticism. The integrated and overlapping elements of the HCMm were used to investigate features intentionally designed into the learning events, as well as to reveal unanticipated factors - benefits, complexities and drawbacks.

The three evaluations, in which the researcher took a highly participatory role, showed clear occurrences of stances corresponding with most elements of the HCMm. Moreover, all three learning events resulted in effective learning processes, learner-achievement and -satisfaction, and educators who were satisfied with the progress of their learners. **It would appear that discerning application of the six C's enhances a learning experience or instructional system.**

As an evaluation approach, the HCMm provides a cognitive perspective to inquiry and identifies aspects *not usually revealed in evaluations*, since its framework relates more to the process and nature of learning than to the product/s used for learning. It provides insights into factors such as:
- Novelty of the learning experience, and the way it motivates/engages learners;
- Lasting learner-engagement, resulting in an affective-cognitive connection;
- The extent to which a learning event generates creativity within the learners themselves;
- Learning as constructed on a platform of prior learning, rather than as an isolated experience;
- The worth of teaching basic components as building blocks for subsequent integrated wholes;
- Active self-construction/interpretation of knowledge, rather than transfer of packaged knowledge;
- Learning as a continuous experience and contextual experience;
- Transfer and retention;
- Team learning and associated life skills;
- Relevance for and personalization to each individual learner;
- Learning that holds real-world added value;
- Application of technology that capitalizes on its unique capabilities, and
- Use of technology as a support, rather than as a structure itself.

Every instructional system or learning event has a particular, and sometimes even a unique, focus. Due to the consequent specialized nature of enquiries into different systems/events, the researcher has not proposed model evaluation instruments in this thesis. The HCMm represents a multi-faceted approach rather than a foundation for standardized proformas. Researchers or practitioners planning an evaluation can use elements of the framework to develop survey questions or checklists customized to the purpose of the particular artifact or learning event, i.e. they can apply the HCMm in a focused manner to record which theoretical issues are observed in practice.

7.2.3 Response to Research Question Three

Research Question 3 led to: learning more about the Hexa-C Metamodel framework itself

Chapter Six provides insights into the dynamics between theory and practice-in-action. Using the HCMm as a toolset to examine the practice of learning and instruction in three learning events also identified further information about the tool itself.   The diverse nature of the case studies - differing in purpose, content and context - enriched and broadened the study, and contributes towards its credibility. Information emerged that:

- Contributes to inquiry into learning and instructional theories;
- Has practical implications, as it identifies commonalities/ and complexities that should be considered in the design and practice of instruction;
- Raises salient issues regarding teaching and learning with technology;
- Adds to the existing knowledge on the six elements that comprise the HCMm framework;
- Distinguishes between implementation of the HCMm's theories/characteristics in well-structured (closed) and ill-structured (open) domains; and
- Shows strong, and generally harmonious, inter-relationships between theories and characteristics that comprise the framework.

This thesis avoids proposing explicit design guidelines and recommendations, since it would be at odds with the constructivist nature of the study. Nevertheless the HCMm can play a valuable role as a design aid by prompting designers and developers to pay cognizance to the six C-elements of contemporary learning theory and practice. When one is informed by theory, the appropriate practical implications can be observed.

In the pursuit of facilitating effective learning, increased understanding has been gained of the *internal dynamics* – relationships and interactions between elements of the framework; and of the *external dynamics* – the relationship between the framework and actual instructional design/practice. Ways in which the elements of the HCHm framework should be implemented within an instructional system or learning event would depend on the content, context, conditions and circumstances of the situation. They would even vary between different presentations/applications of a program, artifact or event, depending upon the particular dynamics of theory and practice.

In line with the discussion in Section 3.8.2, the research methods used in this study permitted the researcher freedom and flexibility to investigate promising and unanticipated avenues in an ongoing process of theory development.

7.3   Final review of the Hexa-C Metamodel

The tables in Chapter Six detail a comprehensive study of the HCMm, investigating each element, as well as the framework as a whole, distinguishing between instructional design and practice in well- and ill-structured domains. Any attempt to summarise the chapter briefly would tend to trivialize this study; however, a few further points not raised in previous chapters are briefly mentioned here. They relate particularly to some of the strengths and weaknesses of the HCMm in its two roles as an evaluation tool and a design aid, respectively.

7.3.1 Strengths of the HCMm

7.3.1.1 As an evaluation aid

As an evaluation aid, the HCMm differs from the instruments generally used to evaluate instructional products. Traditionally, these focus on the efficiency and consequences of learning and incorporate quantitative metrics. The HCMm, by contrast – investigating from the perspective of learning theories and instructional practice - makes explicit the less tangible aspects. Any investigation using some or all of the elements of the HCMm is intrinsically a contextualized investigation.

7.3.1.2 As a design aid

The findings of the evaluations provided new and enriched information about the elements of the HCMm in use. Ways of implementing them in varying domains and circumstances are tabulated, and can be used by instructional designers and instructor-designers towards the formulation of guidelines appropriate for the product or program under construction, varying them according to the domain, the target group, and the stage of learning. The framework of the HCMm can support designers and practitioners in a multi-faceted angle of approach.

Instructional systems and learning programs **developed explicitly in the ethos of the HCMm** may result in learner-artifacts that have real-world worth. This holds particularly in the case of adult learners who benefit from spinoffs and added value in real-life, as products developed for academic purposes offer value in the market place, in policy decisions, and in their professions.

The role of technology in design is deliberately not over-emphasized in this study (see also 7.3.2.2). Technology serves as a powerful medium and/or tool and must indeed be effectively and creatively operationalized. However, the intention is that learners 'learn less *from* the computer and more *with* the computer' (Mehl & Sinclair, 1993:13).

7.3.2 Weaknesses of the HCMm

7.3.2.1 As an evaluation aid

The interrelated and overlapping nature of the six elements results in over-investigation of certain aspects, for example, the close connections between cognitivism and customization, between cognitivism and constructivism, and between constructivism and collaborative learning.

Furthermore, redundancy may occur, since not all of the six elements are applicable to all investigations or instructional design situations. For example, two of the three case studies - RBO and Mkambati 2000 - lie beyond component-based instruction. The HCMm serves differing functions within different learning events in different situations.

7.3.2.2 As a design aid

The HCMm has a valuable role to play as a design aid, as it focuses attention on the importance of learning theory in design and development and in instructional practice. As was mentioned in Section 7.1.3, it should support designers of instruction in paying cognizance to the six C-elements. However, the HCMm is not a design environment nor is it an automated instructional design system, but it can be used in a supplementary role to such.

Findings of the evaluations hold useful information for designers as they develop new events and artifacts. Yet the specifics of technology (which is the 'hub' of the hexagonal metamodel depicted in Figure 4.1 in Chapter Four) are possibly under-addressed within the evaluations. This may be more of an omission in the surveys and questionnaires than in the HCMm itself; however, the open-ended nature of the questions provided learners with the opportunity to address technological issues and aspects.

Technology, though positioned graphically as a hub, due to its relationship with all six elements, is not paramount within the HCMm (see 7.3.1.2). It is viewed as a medium and not the message - and should not carry the same status for instructional designers and instructor-designers as the actual content or problem-context of the learning situation.

7.4 Relevance to South Africa

In the current phase of national development in South Africa, transformation is a priority in the process of redressing the legacy of *apartheid*. Unfortunately, provincial and local authorities have limited funding for research to complement these processes, therefore expectations are increasingly turned on tertiary institutions to generate research that can be applied practically.

In this respect, the Hexa-C Metamodel can offer a contribution to the current educational situation in South Africa, due to its compatibility with outcomes-based education (OBE). OBE is proposed by the national Department of Education and Training as the way forward in the New South Africa (South Africa, 1998; South African Qualifications Authority, 2001).

OBE is part of a mission to achieve educational parity and to build a culture of meaningful learning within a body of learners with an historic dichotomy, spanning the spectrum from:
- Disadvantaged origins to privileged backgrounds; and
- Those who are recipients of poor education to those with excellent foundations.

OBE is founded on seven critical outcomes (South Africa, 1998; South African Qualifications Authority, 2001:5), these 'critical outcomes' being qualities that educators must aim to develop in students within the education and training process, regardless of the area or content of learning:

1. *Problem-solving skills*
   Identifying and solving problems in which responses show that responsible decisions have been made, using critical and creative thinking.
2. *Teamship*
   Working effectively with others as a member of a team, group, organization, or community.
3. *Self-responsibility skills*
   Organizing and managing oneself and one's activities responsibly and effectively.
4. *Research skills*
   Collecting, analyzing, organizing and critically evaluating information.
5. *Communcation skills*
   Communicating effectively using visual, mathematical and/or language skills in the modes of oral and/or written persuasion.
6. *Technological and environmental literacy*
   Using science and technology effectively and critically, showing responsibility towards the environment and health of others.
7. *Developing macrovision*
   Demonstrating an understanding of the world as a set of related systems by recognizing that problem-solving contexts do not exist in isolation.

The ethos and elements of the Hexa-C Metamodel are closely related to these seven intended educational outcomes. All except the seventh are aims explicitly incorporated within the HCMm framework as shown in Figure 7.1, and the seventh could well be achieved as a secondary consequence of the experiential and holistic thinking entailed in knowledge construction. Where an element, if appropriately used, could contribute directly towards achieving an outcome, the cell in the matrix is marked with a '**D**'. Where it can play an indirect role (e.g. peer-teaching of technological skills), it is indicated by '**I**'.

Figure 7.1 How the HCMm contributes towards the critical outcomes of OBE						
Critical outcome	**Element of the HCMm framework**					
	Collaborative learning	Cognitive learning	Components	Construc-tivism	Creativity	Customi-zation
Problem-solving skills		D	D	D	D	D
Teamship	D			D		
Self-responsibility	D	D		D		D
Research skills		D			D	
Commun-cation skills	D		D		I	
Technological and environmental literacy	I	D	D	D	D	I
Macrovision				D		

This research, therefore, has practical implications for South Africa during its period of transformation of education. At a time when participatory, experiential, and interactive learning is required, the HCMm can be used in the development of resources and learning events and in the evaluation of existing ones. Learning events and resources that implement the elements of the framework will implicitly satisfy most of the critical outcomes.

7.5   Directions for further research

This section sets out opportunities for further research, building on this study as a foundation.

1.   *Guidelines and principles for the design of instructional systems*

Application approaches, design principles, and practical guidelines should be drawn up for the development of learning events/environments/resources to facilitate effective and affective learning using the Hexa-C Metamodel. The design guidelines and principles would vary according to the application:

- Interactive learning environments;
- Web-based educational resources / online courses;
- Open-ended learning environments and constructivist learning environments;
- Direct instruction via textbooks, workbooks, lessons, and CAI tutorials,
  i.e. hard-copy printed resources, as well as computer-based products;
- Multi-media productions and videos; or
- Events and resources specifically intended to meet the seven critical outcomes (Section 7.4).

2.   *Evaluation principles for instructional systems*

The theories and guidelines can also be used to generate evaluation criteria (from the perspective of cognitive learning theory) of interactive learning products, instructional websites, learning events/environments, and general educational resources.

3.   *Further evaluation*

The learning events evaluated in Chapter Five were selected due to the researcher's close personal involvement in each, which is a requirement for action research and qualitative ethnographic analysis. It is proposed that the HCMm be used to evaluate further events:

- (i)   Learning and instructional systems/events/environments that are ineffective in supporting learning, or that give rise to problems;
- (ii)   Learning systems/products/events/environments with target group primary and secondary learners;
- (iii) Adult corporate/industrial training in the workplace, as opposed to tertiary education for formal qualifications;
- (iv)   In-depth investigation of distance-collaboration and Internet-based co-operative work, and their problems; and possibly
- (v)   Learning events of a behaviourist nature (using a modified version of the HCMm).

4. ***Diagnostic evaluation*** (extention of 3(i) preceding):

The learning events evaluated in Chapter Five were selected not due to their effectiveness or success, but due to the researcher's close involvement and direct participation in each. The case studies show that each of the three was successful in promoting learning and engaging learners. However, the HCMm also has potential to be used as a diagnostic and remedial toolset. Research is recommended in its application to systems/events that demonstrate inadequacies or that are disliked by learners, in order to show what went wrong and why.

7.6 Conclusion

This study puts forward a dynamic integration of contemporary learning theories and the practice of instructional design. The proposed framework - encompassing the theoretical concepts of *constructivism*, *cognitive learning* and *knowledge/skills components*, as well as the practical characteristics of *creativity*, *customization* and *collaborative learning* - can make a contribution to instructional practice and support effective learning, as well as contribute to the inquiry into the nature of learning and instruction.