# Chapter One

# *Introduction*

This thesis investigates the dynamics of theory and practice in instructional systems design. The study entails investigation of current learning theories, approaches to the design of instruction, and contemporary instructional philosophies and practices - with a view to synthesizing an integrated metamodel as a framework to facilitate effective learning. The framework is intended to be relevant and applicable to a variety of instructional systems - such as instructional resources and products, interactive learning environments, and open-ended learning experiences - generally termed 'learning events' in this study. The metamodel - a model of models - can be used to examine existing learning events from the viewpoint of instructional and learning theory, and is applied to three case studies. Furthermore, the study makes its own contribution 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. In short, this thesis describes the generation of a synthesis of theory and effective practice - the metamodel - and investigates the dynamics of theory and practice in instructional systems design, by using it as a tool to apply theory to practice and determining, conversely, how practice informs theory.

This study takes cognisance of the use of technology and multimedia in instructional and learning practices. The context envisaged for learning events in this study incorporates computer technology, whether used as tutor, tool, or environment. In the case studies the metamodel's framework is applied to varied learning events: a computer-based practice environment, an Internet course, and a field project using computers as tools.

This chapter sets out the real-world problem in Section 1.1 and lists the research questions in Section 1.2. It briefly addresses the value of the research (Section 1.3), before describing in detail the research goals of the study (Section 1.4) and the research methods used (Section 1.5). In Section 1.6 the limitations and delimitations of the study are given, following which Section 1.7 sets out the overall research design.

Finally, in Section 1.8 the structure of the thesis is illustrated by a diagram, and the content of each chapter is sketched as well as the interrelationships between them.

## 1.1 Real-world problem statement

Academics and practitioners are addressing the theories of learning and instruction with the aim of understanding learning. Increased understanding of learning should, in turn, enhance the design of instruction and lead to more effective instructional practice. An extensive body of literature exists on theories of learning and the design of instructional resources and learning environments. There is, therefore, a need for a compact and concise, yet not simplistic, synthesis of the current thinking in cognitive learning theory, instructional design theory, and effective practice, to facilitate the tasks of:

- Designing instructional systems and learning events/environments,
- investigating existing systems/events/environments from the viewpoint of learning theory, and
- learning more about the dynamics of theory and practice.

## 1.2 Research questions and associated subquestions

The following research questions guided the inquiry:

1. What theories and characteristics arise when current learning theory and practice are filtered through effectiveness criteria?
   (Addressed in Chapter Four)
2. What do these theories and characteristics reveal about the design and practice of effective learning?
   (Addressed in Chapter Five)
3. What, conversely, does the practice of learning and instruction reveal about these theories and characteristics?
   (Addressed in Chapter Six)

The purpose of these questions is to elicit information regarding the dynamics between various contemporary learning theories and instructional design/practice. Each of the three questions can be expanded or divided into subquestions:

### *Research Question 1*

| What theories and characteristics arise when current learning theory and practice are filtered through effectiveness criteria? |
|---|

In the context of an extensive literature survey of learning theories from the cognitive family, as well as current theories, approaches, and models for the design and practice of instruction, the following are investigated:

- What are suitable means of 'filtration' to operationalize effectiveness, so as to select the most appropriate theories and practices?
  i.e. *How can elements of a metamodel be determined?*
- Using the stated means of selection as a filter, what theoretical elements should be incorporated in a conceptual framework of learning and instructional design?
  i.e. *What are the theoretical elements of the metamodel?*
- Using the stated means of selection as a filter, what practical factors, such as characteristics and features, influence effective and affective learning within learning events - applications such as interactive learning environments, open-ended learning experiences, and instructional resources and products?
  i.e. *What are the practical elements/characteristics of the metamodel?*

### *Research Question 2*

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

Having selected theoretical and practical elements to comprise the framework of the metamodel, in what ways, and to what extent, are they found to be implemented and manifested, as diverse learning events are evaluated?
i.e. *Using the framework as a tool, what is revealed about the practice of effective learning*?
Three very different case studies were conducted:

- **FRAMES**, an interactive practice environment in Discrete Mathematics.
- **RBO880**, a masters degree course in Internet-based Learning, presented via a web-based classroom.
- **Mkambati 2000**, a collaborative fieldwork project of a postgraduate Ecotourism course.

***Research Question 3***

| What, conversely, does the practice of learning and instruction reveal about these theories and characteristics? |
|---|

Having used the framework as a tool to evaluate and examine three learning events for implementations of the theoretical elements and manifestations of the practical characteristics and features, what did the practice of learning and instruction reveal about the elements of the framework?
i.e. *How did the elements of the metamodel influence learning, and in what way should they impact upon the dynamics of instructional systems design and practice?*

## 1.3 Value of the research

The large body of literature on current learning and instructional design theories from the cognitive family can be overwhelming to designers and practitioners of instruction. The **compacted and integrated framework of instructional design and learning theory generated in this study**, and named the *Hexa-C Metamodel* (HCMm) offers utility to instructional designers and instructor-designers. As a 'metamodel', it does not propose a specific development model or design process. It is not a 'recipe' nor a 'prescription' - rather, it is a framework, suggesting an interrelated set of cognitive learning theories and instructional design approaches, **to serve as an aid** in the design, development and investigation of learning events and environments.

The integrated framework comprises six Cs - namely: cognitive learning, collaborative learning, components, constructivism, customization, and creativity - to be applied in a contextualized manner within learning events. The inherent value of the study extends beyond assessing the instructional and learning efficacy of the three case studies; it is also the intention of this research to discover amplified aspects of the six C-elements when they are applied in practice as a composite tool.

This study should support designers and practitioners in the pursuit of facilitating effective learning. It should contribute to an understanding of the dynamics of learning and instructional theories; and should inform practice on their relationship to the design, development and delivery of instructional systems and learning environments. The former - the dynamics of learning/instructional theories, can be termed *internal dynamics,* i.e. interrelationships and interaction between the metamodel's elements, and the second form – the dynamic relationships between the framework and instructional design/practice, as explored in the case studies - can be viewed as *external dynamics. ('Dynamics*', in this study, should be interpreted as set out above, focusing on interaction between aspects of learning theory, and not on systems theory *per se*, which addresses dynamics within specific systems.)

## 1.4 Research goal and criteria

In this section, some of the common research goals of educational technology studies are outlined, followed by an explication of the research goal of this particular thesis. The field of the investigation is described - setting the scene for presenting the selection criteria to be used in the synthesis of an integrated framework.

### 1.4.1 Research goals within educational technology

Reeves (1995; 2000) distinguishes between research goals and research methods (Section 1.5), where research goals are described as being influenced by the researcher's training and epistemological views, as well as by dominant research paradigms. The six major types of research goals commonly pursued by educational technology researchers are (Reeves 2000):

- *Theoretical goals* - explaining phenomena through logical analysis and synthesis of theories and principles and the results of other research (e.g. empirical studies);
- *Action goals* - focused on a particular program, product or method in an applied setting, for the purpose of estimating its effectiveness and worth or improving it.
- *Empirical goals* - the dominant form of educational research - testing conclusions related to theories of teaching, learning, performance, assessment, instructional design, etc. It is usually conducted by experimental or quasi-experimental methods.
- *Interpretivist goals* - drawing on research traditions from sciences such as sociology and anthropology, the interpretivist sets out to show how education works by interpreting phenomena related to experiences of teaching, performance, etc. within certain groups of learners.
- *Postmodern goals* - focused on examining the assumptions of contemporary education to determine whether there are underlying agendas, relating, for example, to aspects of gender or culture.
- *Development goals* - aiming for the dual objectives of developing creative approaches to solving problems in the fields of human teaching, learning, and performance; while simultaneously constructing design principles to guide future development efforts.

### 1.4.2 Research goals of this thesis

The **primary** research goal of this study, namely, exploration of the field in a quest to select, integrate, and extend knowledge on learning theories and the design/development of instruction - combines the *theoretical* and *development* perspectives described above. Its **secondary** intention - evaluation of case studies - pursues an *action* goal. There is also a **tertiary** goal to obtain further knowledge about learning theories and characteristics in practice, which is a *development* goal with an *interpretivist* approach, since it examines how phenomena differ between, and interrelate within,

different kinds of learning. The composite goal, closely related to the three research questions in Section 1.2, therefore is:

> To explore the current thinking in cognitively-based learning theory, instructional design theory, and effective practice, so as to develop a compact synthesis that can be used:
> 1. As a framework or tool to assist in the development of instructional systems, learning products, environments, and events;
> 2. For evaluating existing products, environments, and events from the viewpoint of learning theory; and
> 3. For determining further information about the dynamics of theories and characteristics embodied in the framework.

A concise set of positions and stances are sought for the metamodel, which as a whole will comprise a framework of theories and characteristics that capture the essence, strengths, and complexities of learning theories and instructional practice within the cognitive family. The theories and characteristics should conform to the effectiveness criteria listed in Section 1.4.4.

## 1.4.3 Field of investigation

This literature investigated in this study primarily represents the thinking of the past 10 - 15 years, in particular, resources that have been published since the major debate on constructivism commenced in 1991. Behaviourist tendencies dominated instruction up till the influence of cognitive psychology in the 1980s, and this in turn was followed by the advent of constructivism. The realm of current thinking in cognitive-based learning theory, instructional design theory, and effective practice is a broad and inter-related field, which the researcher had to delimit, since it is impossible to cover all relevant sources. Although the explicit intention in this study is to synthesise the current thinking in learning and instructional design theories from the cognitive family, it was expedient also to overview behaviourist positions, due to their role as the platform from which cognitivism developed. Within the 'cognitive family' the researcher positions constructivism at one extreme as an experiential form of the cognitive sciences (2.4.6), and pragmatic instructionism at the other. The literature surveyed was delimited as follows - sources were studied that incorporate a selection of classic works on the various instructional paradigms and philosophies of learning overviewed, as well as publications by recognised experts in the field. The literature consulted is in the English medium and the main context is instruction and learning that uses technology. Among others, articles are drawn from the journals *Educational Technology*, *Educational Technology: Research and Development*, *Instructional Science*, and the *South African Journal of Higher Education*. The parameters of thinking in this study are also influenced by the realm of *IT Forum* (the online Instructional

Technology Forum), and reference is made to papers from its web site. Various textbooks were consulted, also edited collections of articles and refereed conference papers.

Seminal contributions that served as catalysts for this study, urging the need for a move towards consensus and more compact theory are Reigeluth's (1996a; 1996c) proposals for *new paradigms* of instructional theory and instructional systems development (ISD), i.e. changes in theory and practice. Reigeluth's proposals culminate in *Instructional-Design Theories and Models: Volume II* (Reigeluth, 1999), which contains a diverse array of theories with regard to their situations and underlying values. Duchastel's (1998) *Prolegomena to a theory of instructional design*, poses a further challenge, suggesting the need for a single, full, all-encompassing theory of instructional design. Although this dissertation does not attempt to present a theory or model of instructional design, the metamodel it proposes can be viewed as a move toward integration and a concise, though not simplistic, identification of issues to be borne in mind by instructional designers and instructor-designers.

## 1.4.4 Selection criteria

This study undertakes an extensive literature review and discussion, following which an analysis, filtration, and synthesis process is conducted to determine appropriate theories and characteristics for the integrated framework. The stances to be selected should conform to the following **effectiveness criteria**, which are substantiated in Table 1.1 in Section 1.4.5. Specifically, stances are required which:

1. *Are **consensus-builders** - methods applicable to situations that **transcend paradigms**;*
2. *Demonstrate **functionality and utility in authentic situations** of learning/training/instruction;*
3. *Are **learning-focused** for situations where the learner's role is predominant;*
4. *Comply with **pragmatic, rather than idealistic** purist, considerations;*
5. *Conform to the requirement that formal instruction incorporates some form of **external assessment/grading** of learners;*
6. *Integrate **affective and cognitive** aspects;*
7. *Incorporate means of **communicating complexity** within the learning domain;*
8. *Are **platform-independent**, in that they are not coupled to a specific, single technology for means of presenting instruction; and*
9. *Prepare learners to **apply skills in practice** and **use knowledge in real life**.*

### 1.4.5 Motivation for the selection criteria

Table 1.1 establishes the relevance of the selected effectiveness criteria, and explains` why they are used as filtering agents in the process of selecting appropriate instructional and learning theories.

**Table 1.1 Motivation for the selection criteria**

| Number | Selection criterion | Reason for criterion |
|---|---|---|
| **1** | Consensus-builder - methods and stances that can be used in situations which transcend paradigms. | Stress should be laid on the intrinsic value of a stance and its applicability in contexts independent of paradigms, rather than perpetuating the paradigm war of the early 1990s. |
| **2** | Demonstrate functionality and utility in authentic situations of training or instruction. | Behaviouristic instruction was systematic and research-validated; constructivism was initially idealistic and theoretical. Disregarding origins, theories and characteristics should be selected that result in effective learning. |
| **3** | Learning-focused for situations where the learner's role and interests are predominant. | The discipline of instructional design originated in the USA military, which was instructor-centric. Current thinking tends to the learner-centric - also more appropriate for the life-long learning undertaken by many adults. |
| **4** | Pragmatic, rather than idealistic purist, considerations. | The prime aim of a workable, usable theoretical model is a balanced approach. |
| **5** | Incorporate some form of external assessment/grading of learners. | This is a requirement of formal educational institutions, and also common in market-oriented training. |
| **6** | Integrate affective and cognitive aspects. | Emotions and attitudes should be considered, as well as physical and mental aspects. |
| **7** | Incorporate means of communicating complexity within the learning domain. | Learning processes must address the difficult parts of subject matter in order to be effective. |
| **8** | Platform-independent for means of presenting instruction | Stances that are inextricably bound to a single specific technology as means of delivery should be avoided. |
| **9** | Help learners apply skills in practice and use knowledge in the real world | Learning should be preparation for real life. |

These criteria are discussed further in Chapter Four, Section 4.3, where they are used as a filter to extract theoretical stances and practical characteristics to be considered for incorporation in the proposed metamodel. The metamodel is presented as an integrated framework to facilitate effective learning in response to the first research question of Section 1.2.

## 1.5 Research methods

In the previous section (Section 1.4), it was stated that Reeves (1995; 2000) distinguishes between research goals and research methods - the latter serving as tools in the process of achieving the former. Once the research goals and research questions of a particular study are in place, appropriate research methods can be selected to address the nature and requirements of the problem/s. There is frequently a natural relationship between a goal portrayed in Section 1.4.1 and an associated method from Section 1.5.1.

### 1.5.1 Research methods for educational technology

Research methods are tools selected once goals and tasks are clear (Reeves 2000). Reeves presents six major types of research methods used by educational technologists:

- *Quantitative* - experimental, quasi-experimental, correlational and other methods primarily involving collection and statistical analysis of quantitative data.
- *Qualitative* - observation, case studies, interviews, etc. involving the collection of qualitative data and its ethnographical analysis.
- *Critical theory* - deconstruction of texts, technologies, or systems, to reveal hidden agendas, disenfranchisement, etc.
- *Historical* - objective and accurate reconstructions of the past, frequently with the aim of substantiating a hypothesis.
- *Literature review* - various forms of research synthesis, primarily involving analysis and integration of other forms of research, for example, meta-analyses.
- *Mixed-methods* - approaches that combine a mixture of research methods - usually quantitative and qualitative - in order to triangulate findings.

### 1.5.2 Research methods used in this thesis

The research methods used in this study involve several of the above. There is a *literature review* with the goal of exploration, analysis, integration, and synthesis within the broad field of learning theories and instructional design. Then there are the case study evaluations, which combine *qualitative* and *quantitative* research, i.e. a *mixed-method* approach within an action goal. The third facet of the goal, namely, to obtain further knowledge about instruction and learning in practice, is achieved using *qualitative* and *inductive methods* (not mentioned in the list above). The comprehension design of the research is elaborated in Section 1.7.

## 1.6 Limitations and delimitations of the study

Before the development of this study, it is necessary to set out the researcher's assumptions and various limitations on the field. Four concepts are addressed, namely,

- The view in this study of *instructional systems design* and *instructional systems*,
- the domain of the study and its literature resources,
- a brief comment on research and development perspectives, and
- the view of technology.

### 1.6.1 View of instructional systems design and instructional systems

The title of the thesis is: *The dynamics of theory and practice in instructional systems design*. In the terminology descriptions at the commencement of the study, various views of instructional design theory and instructional design are set out. Of particular note, in this researcher's view, are the following stances (Reigeluth, 1983; 1997; 1999; the *Terminology* Section; and Section 3.2.3.2):

> Instructional-design theory is concerned with the characteristics of the instruction and its methods.
>
> Instructional designers should be versed both in descriptive learning theories and prescriptive design theories, so that theory and practice can be integrated.
>
> Instructional design is both:
> - A professional activity, whereby decisions are taken as to what methods of instruction are best for bringing about desired changes in student knowledge and skills in a specific content area,
> - A discipline concerned with producing knowledge about optimal instructional methods, strategies, and combinations of methods (i.e. whole models).
>
> According to the classic Dick and Carey systematic model for the design of instruction (1978; 1985; 1990; 1996), the design and development of instruction incorporates evaluation - both formative evaluation within the workplace and summative evaluation on the final product.

The view in this study of the design of instructional systems and learning events goes beyond defining ISD as a process-model or a set of decision-making procedures by means of which the most effective instructional strategies are developed or chosen. Using aspects of the definitions above:

**instructional systems design is defined as a broad discipline, encompassing expertise in:**

- **Learning theories;**
- **Instructional design theories and methods/strategies;**
- **The development and delivery of instructional resources / learning environments, and**
- **Evaluation of products/events in use - both formative and summative.**

With regard to **instructional systems**, any system *per se* is considered to comprise input, process, and output subsystems, linked by flow. The study, however, does not focus on the dynamics between those three subsystems and their linkages, but rather on the dynamics between theory and practice.

## 1.6.2 Domain of the study and its literature

As set out in Section 1.4.3, the study has an **international flavour.** It is not written specifically for the researcher's local territory of South Africa, although it holds relevance here.

In line with the intentions described in the introductory comments to this chapter, the literature resources consulted relate particularly to current learning theories and approaches to the design of instruction, as well as contemporary instructional practices. Consequently, particular stress is laid on sources that describe philosophies, theories, and practices **from the wider cognitive family** with a view to incorporating them in the compact metamodel. A broad and extensive body of literature was consulted in this study, as described in Section 1.4.3. Nevertheless, no literature survey can be absolutely complete, and the possibility exists that a work which some may regard as crucial, may have been missed. For example, the general field of systems theory is not addressed, because the 'dynamics' emphasis in this study is on internal and external dynamics of learning theory, and on the dynamics of theory and practice in design, development and delivery of instructional systems and learning events.

## 1.6.3 Research and development perspectives of the study

Any study has a particular perspective as a point of departure. By definition this entails that other theoretical or philosophical perspectives are excluded. As is clear from Sections 1.4.2 and 1.5.2, this study is founded on clearly-defined research goals and methods, and does not address the others mentioned in Sections 1.4.1 and 1.5.1.

The research does not culminate in a document of explicit design guidelines nor in an evaluation instrument. Moreover, the researcher recognises the unique content, context, conditions, and circumstances of differing learning events. To propose design 'recipes' would, therefore, be at odds with the open constructivist ethos of this study, which posits that constructivist theory is focused more on principles than on strategies (section 2.8). Rather, the HCMm is a multi-faceted aid to the design, development, delivery, and evaluation of instructional systems and learning events in a range of contexts/situations, based on a view of learning as an active, participative process, whereby learners construct concepts, based on using and transforming their former knowledge and expertise.

## 1.6.4 Technology in this study

Technology in this study is limited to computer technology, viewing computers in their roles as **presentation and practice tools, communication tools,** and **productivity tools**. Other technologies such as television, video, radio, satellite, and cellular/digital telephones, have been excluded.

# 1.7 Research design

## 1.7.1 Research design in this thesis

As stated in Sections 1.4.2 and 1.5.2, this study addresses its different facets in different ways, combining *theoretical* and *development* perspectives as well as pursuing an *action* goal, and using a variety of research methods. This section integrates the research goals of Section 1.4.2 and the methods of Section 1.5.2 by briefly overviewing the three aspects of the research in Table 1.2. The rest of the section elaborates on development research and action research, which play major roles in this thesis, showing how each is used in this study, and the research methods applied within them.

**Table 1.2 Research goals and methods of this thesis**

<table>
<tr><td colspan="3">Goal 1 - Exploration of learning and instructional theories, so as to generate a framework to support development of learning events</td></tr>
<tr><td rowspan="2">Goals</td><td rowspan="2">Theoretical goal<br>Development goal<br>(Development of the metamodel, not development of an instructional system)</td><td>Methods</td></tr>
<tr><td>Literature review:<br>Meta-analysis of learning theories, characteristics of instruction, and the design of instruction.</td></tr>
<tr><td colspan="2"></td><td>Analysis and integration of literature and results of other research:<br>Textual filtration and synthesis of a metamodel as a concise and creative framework to aid development of learning/teaching events and products.<br>Motivation / elaboration: First, the selection criteria for the filtration process are defined. These are compiled by the researcher, based on requirements which, according to certain experts, support effective learning. In this study they are termed effectiveness criteria (1.4.4, 1.4.5, 4.3). Second, a textual filtration process is conducted. This is a pragmatic strategy, developed by the researcher, whereby information regarding learning/instructional theories and characteristics of practice (Chapters Two & Three) is tested using the nine criteria. Theories/stances that comply are then extracted. Textual data is thus filtered through effectiveness criteria, culminating in the metamodel.</td></tr>
<tr><td colspan="3">Goal 2 - Case studies: evaluation of three learning events</td></tr>
<tr><td rowspan="2">Goal</td><td rowspan="2">Action goal:<br>(Using the metamodel as a tool to investigate effectiveness of applied learning products/events)</td><td>Methods</td></tr>
<tr><td>Quantitative methods:<br>Collection of quantitative survey data and limited statistical analysis.</td></tr>
<tr><td colspan="2"></td><td>Qualitative methods:<br>Investigation of qualitative, ethnographic, descriptive data from open-ended questionnaire surveys / observation / online observation / interviews.<br>Motivation / elaboration: As a direct participant in each case study, the researcher was able to use qualitative ethnographic methods, obtaining empirical data from natural settings, and investigating unanticipated avenues.</td></tr>
</table>

| **Goal 3 - Determination of further information relating theory to instruction and learning in practice** | | |
|---|---|---|
| | | **Methods** |
| **Goals** | *Development goal*<br>*Interpretivist goal*<br><br>(Further development and amplification of the metamodel, based on interpretation of phenomena from practice) | *Inductive methods and qualitative methods*:<br>Examination of the theories and characteristics being applied in practice, and induction of ways to implement them.<br>Qualitative inquiry into how the elements of the framework function in different kinds of learning.<br><br>Motivation / elaboration: The interpretive paradigm is characterized by subjectivity and the study of individual experience; it views theory as emergent from situations. This is indeed the case in this study, where the theoretical approach embodied in the metamodel is further informed by practice, tending to become a grounded theory. |

This overview of the research design is followed by brief elaborations on development research and action research and an explanation of how each (or a variant) is used in this study.

## 1.7.2 Development research

If educational technologists wish to be socially responsible, they should undertake research that pursues development goals (Reeves, 2000). Socially responsible research in education is described by Reeves (1995; 2000) as *scientific research*, in that it:

- Queries the nature of reality, using processes that are verifiable,
- adheres to scientific norms, and
- is open to peer review.

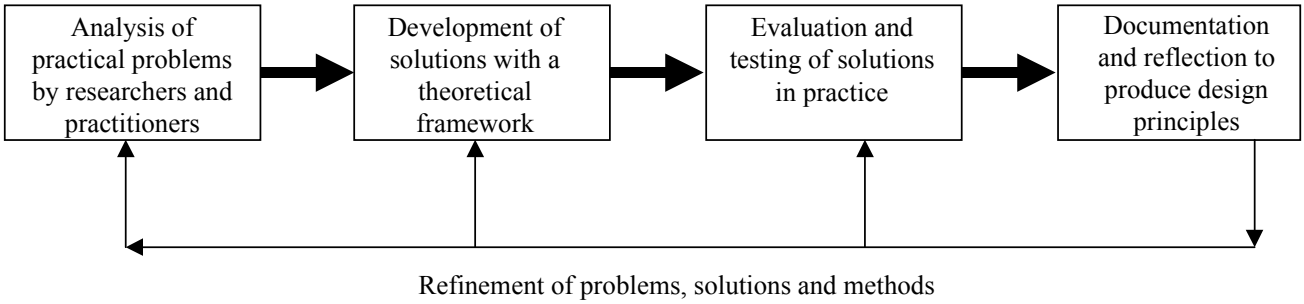
At the same time, it is a *social activity* which:

- Addresses problems that detract from quality of life for individuals and groups,
- with regard to learning and human development.

The overall purpose of development research is **to solve real problems, while simultaneously suggesting general design principles**. Development research in educational technology thus achieves its ultimate aim, if it results in the application by instructional practitioners of the proposed theoretical frameworks. Figure 1.1 sets out Reeves' (2000) cycle of phases in development research.

**Figure 1.1 The development approach to research**

(Reeves, 2000: 25)




## 1.7.3 Development research in this study

Development research, according to Reeves, requires a pragmatic epistemology that recognises the contributions of both researchers and educators (practitioners) to learning theory. This study supports that approach, in that it works from the base that instructor and designer are frequently one and the same, i.e. an instructor-designer, rather than an instructional designer. The research methods shown in the first and third parts of Table 1.2 are variants of development research. They correspond to a certain extent with the first phase portrayed in Figure 1.1, namely an *analysis of practical problems*, in that *Goal 1* addresses the instructional problems and benefits encountered under three major learning paradigms and corresponds closely to the second phase in the cycle, *development of solutions with a theoretical framework,* by its synthesis of an integrated framework termed the Hexa-C Metamodel. In respect of Reeves' third phase, *evaluation and testing of solutions in practice*, *Goal 3* in Table 2.1 aims precisely for this - using the framework to investigate existing learning events (i.e. learning events developed independently of the metamodel). The fourth phase of Figure 1.1, *documentation and reflection to produce design principles,* is partially implemented by the reflective inquiry into instruction and learning in practice (*Goal 3*), and by recommendations about ways of implementing the six Cs of the metamodel's framework in the design of instruction and learning events. Feedback from the evaluations informs further application of the metamodel; this is in line with Figure 1.1's feedback loop from the third and fourth phases back to the second.

## 1.7.4 Action research

Action research encompasses a variety of research and intervention methods, and simultaneously pursues *action outcomes* and *research outcomes* (Dick, Passfield, & Wildman, 1995). It has aspects which resemble field research, as well as aspects which function as an agent of change. In some forms *research is the main emphasis* and the action a secondary benefit. It can serve as an effective research process for investigative research and for evaluation. In action research the researcher is personally and closely involved with the participants.

***Features of action research***

According to Cohen, Manion and Morrison (2000) the focus of action research is on analysing and solving problems within their contexts. They define action research as a form of disciplined *self-reflective inquiry* in which an attempt is made to understand and reform practice, i.e. *small-scale intervention* in real-world operations. It is a move towards reflective practice that:

- Is designed to *bridge the gap* between research and practice;
- Combines *diagnosis* with reflection, focusing on practical issues; and
- Is done by practitioners on their own work.

The methodology of action research differs from conventional experimental research. It has developed a different set of principles and also has some characteristic differences from other qualitative methods (Dick, Passfield, & Wildman, 1995; Willis, 2000). It tends to be:

- *Cyclic*, as similar steps may recur;
- *Participative*, with clients, informants, and researcher being involved as partners, or at least as participants/team members, in the research process;
- *Qualitative,* dealing more with verbal aspects than with numbers;
- *Reflective*, since critical reflection upon the process and outcomes is a vital part of each cycle;
- A *responsive* approach, in that it responds in a flexible manner to the emerging needs of the situation. Each of the first four features above contributes to responsiveness:
  - The *cyclic* nature aids responsiveness and rigour, as early cycles contribute to the way the later cycles are conducted, which in turn challenge the interpretations of the earlier cycles.
  - The use of *qualitative* information increases responsiveness. The predominant use of natural language rather than Likert-scale ratings makes it easier for the *participating* informants to serve as co-researchers.
  - Critical *reflection* is a crucial step, as the researcher and others critique occurrences, then use this reflection in designing subsequent steps and events.

Hodgkinson (1998) - synthesizing the work of Bell (1987, cited in Hodgkinson, 1998), Wiersma (1991, cited in Hodgkinson, 1998), Zuber-Skerrit (1992), and Cohen & Manion (1994) - states that action research is:

- *Situational* - diagnosing and solving a problem within same context;
- *Collaborative* - involving practitioners and researchers as teams;
- *Participatory* - with team members themselves taking part in implementing research;
- *Emancipatory* - involving all participants as equals;
- *Self-evaluative* – modifying and evaluating on an ongoing basis to improve practice;
- *Practical* - aiming to produce improvements;
- *Interpretative* - incorporating social enquiry based on the views and interpretations of the participants;
- *Critical* - with participants acting as self-critical change agents;
- *Continuous* - as participants continue to literature, evaluate and improve practice; and
- Possibly *less rigorous in terms of design and methodology* than other educational research.

Zuber-Skerrit (1992) describes four processes undertaken repetetively by the action researcher in *a spiral of cycles*, namely: *plan, act, observe,* and *reflect.* This approach views action research as an ongoing process, rather than as an event.

### 1.7.5 Action research in this study

The research undertaken in this study is not action research in the cyclic form described by Zuber-Skerrit (1992), in which a practitioner-researcher undertakes an educational intervention that evolves over a period of time. Zuber-Skerrit's cyclic processes - plan, act, observe, reflect - are not holistically adhered to, since the courses investigated in Case Studies 2 and 3 were not specifically generated for this research. However, their observation and evaluation were intrinsically part of the study, and *reflection* upon them by their course leaders will be a direct result. The software analysed in Case Study 1 was developed, implemented, and revised by the researcher.

This research comprises two major processes, the second of which can be considered a *variant of action research.*

First, there is the derivation of a selected set of characteristics in order to concisely capture the current learning and instructional design theories which comply with the nine criteria in Section 1.4.4. The field is investigated by undertaking an extensive and intensive interpretive literature survey. The results of this survey are filtered through the criteria of 1.4.4 in order to extract

appropriate theories, practices and characteristics. The resulting set of theories, practices and characteristics are, in turn, used to generate criteria which can be used in developing or evaluating learning environments.

Second, this set of characteristics is applied as a framework in three case studies to evaluate learning events to investigate whether and how they implemented the elements of the metamodel. The informants - course leaders and learners alike - contributed as participants. The processes are *participative*, *qualitative*, *reflective, collaborative*, *practical*, *interpretative* and *critical* - several of the features of action research listed in Section 1.7.4. Although limited quantitative investigations were undertaken, the data is primarily qualitative, since the small populations permitted rich open-ended investigation. The studies are characterized by intense *researcher-involvement*, which Willis (2000) views as a key feature of the current generation of action research. In each of the three case studies, the researcher had an involvement far closer than that of an external researcher, as is clear from the brief introductions to the case studies in Section 1.8.3.

If course leaders use the findings of the evaluations to refine their approaches to and delivery of their learning events, then the case study evaluations can be viewed as a *responsive form of action research*. Further responsive action would occur if course designers take cognisance of the selected theories and characteristics, and use them as recommended features when developing new course material and learning events/environments.

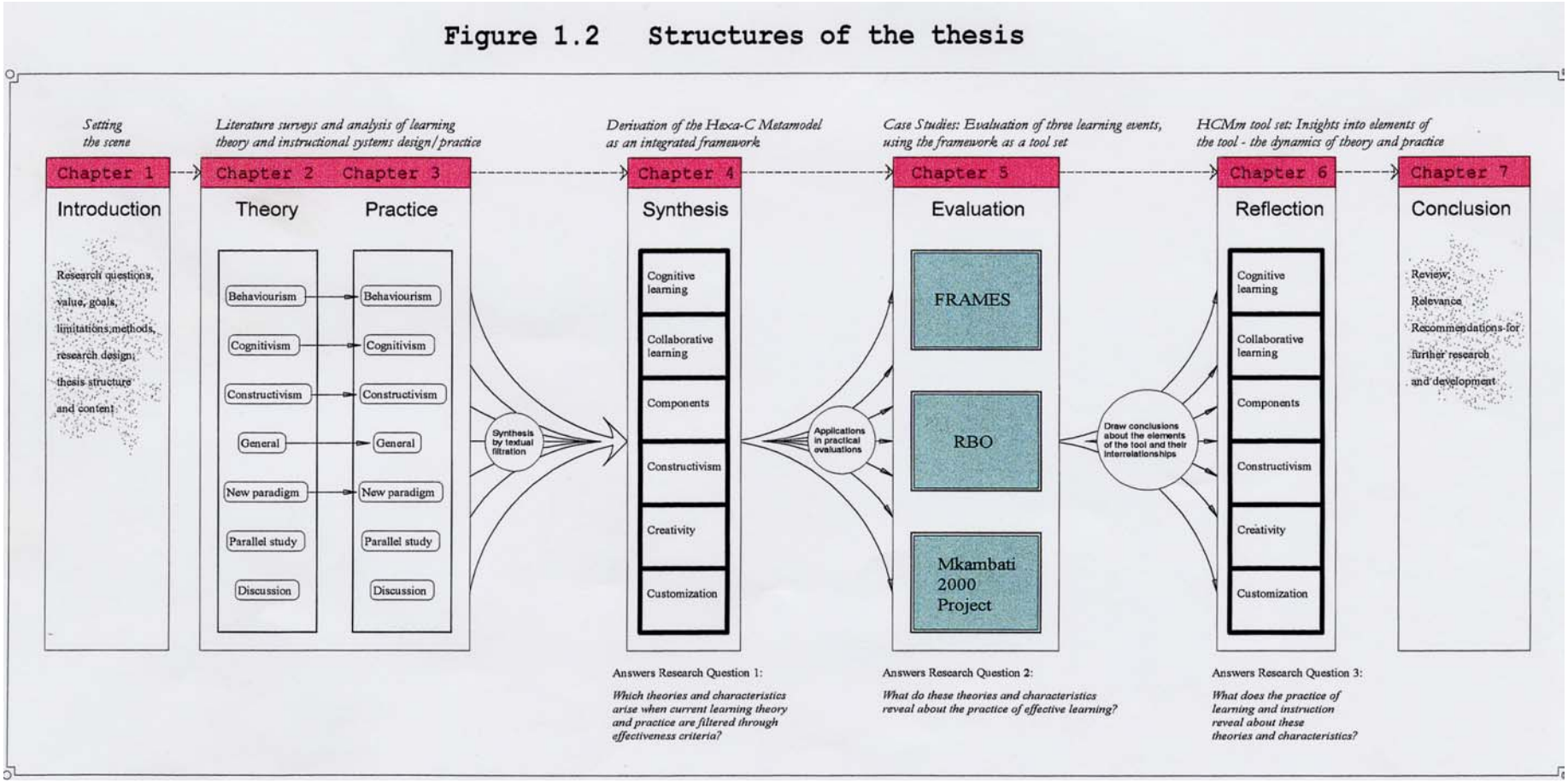
## 1.8 Structure and chapters of this thesis

Figure 1.2 in Section 1.8.1 sets out the structure of the dissertation and shows the inter-chapter relationships, while Figure 1.3 in Section 1.8.2 also portrays the content of the chapters, but as a linked diagram to show the development of the reasoning. Finally, Section 1.8.3 summarizes the material in each chapter.

### 1.8.1 Structure and interrelationships

The pull-out, Figure 1.2, shows the structure of the thesis and relationships between the chapters.

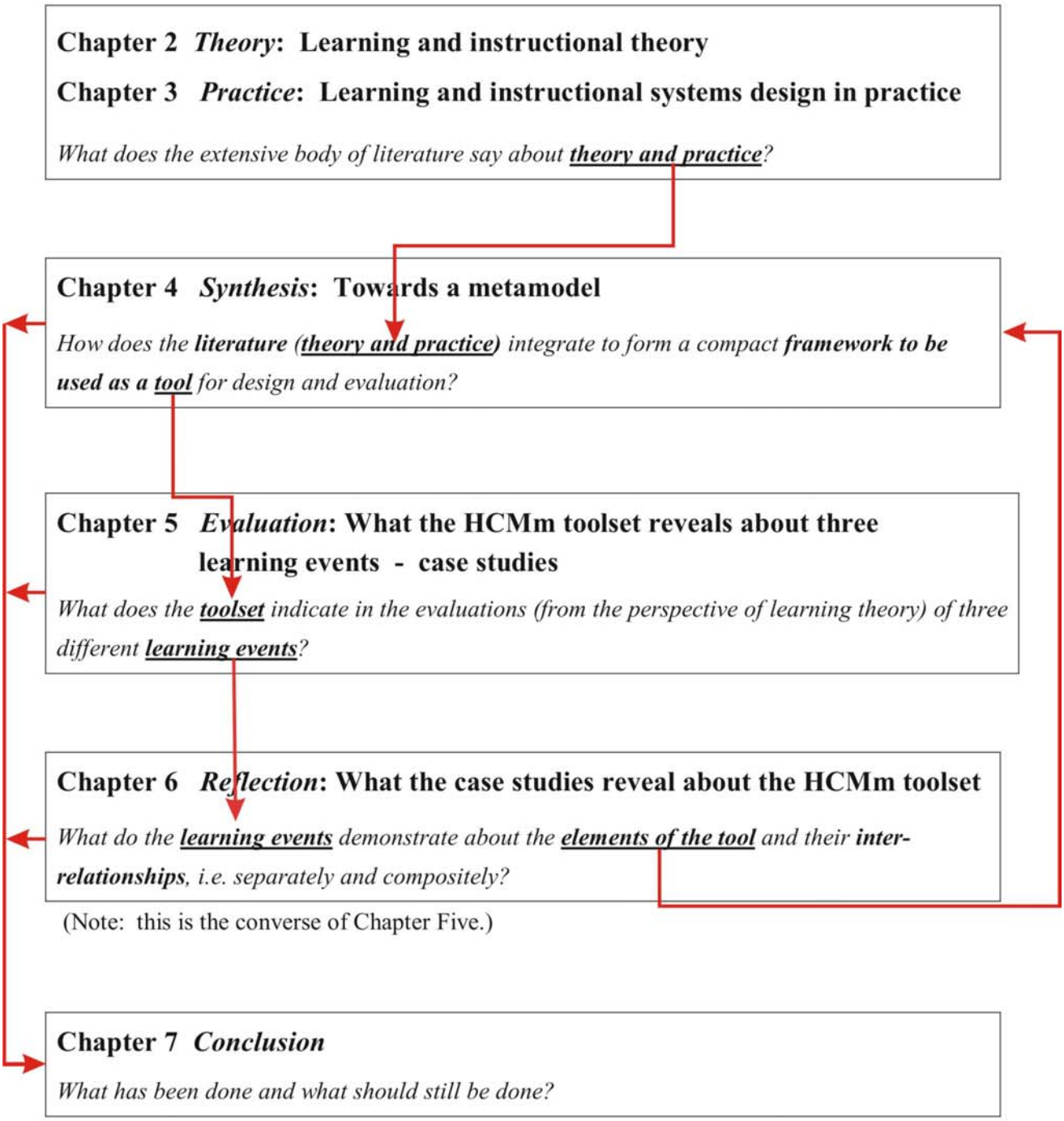
## Figure 1.2 Structures of the thesis



### 1.8.2 Development of the reasoning

Figure 1.3 depicts the headers and content of Chapters Two to Seven in the form of linked activities, portraying the chain of reasoning.

**Figure 1.3 Chain of reasoning**



## 1.8.3 Content of the chapters

### *Chapter One: Introduction*

Chapter One introduces the study - its research questions, value, and delimitations; its research goals, methods, and overall research design. It culminates in a chapter overview, tracing how the researcher investigates various theories and practices of instruction and learning (from the cognitive family), with the aim of developing and applying a compact framework to facilitate the design of instruction for effective learning.

### *Chapters Two and Three: Extensive literature surveys*

In Chapter Two the researcher takes an extensive overview of *theory* - studying philosophies and paradigms of learning and instruction - describing and discussing three current approaches, their evolution and interrelationships. Chapter Three covers the same ground as Chapter Two, but from an implementation perspective - overviewing *theory-into-practice*, i.e. practical applications of the paradigms, instructional design models, and practices within learning environments.

The literature sources surveyed incorporate a selection of classic works on the various instructional paradigms and learning practices overviewed, as well as publications by recognised experts in the field. As was stated in Section 1.4.3, some primary sources are the journals *Educational Technology, Educational Technology: Research and Development*, *Instructional Science*, and the *South African Journal of Higher Education*, as well as the web site of *IT Forum* (the online Instructional Technology Forum). Various textbooks, edited collections of articles, and refereed conference papers were also consulted.

### *Chapter Four: In which the metamodel is generated*

Chapter Four sets out to answer the first research question posed in Chapter One by determining what theories and characteristics arise when contemporary learning theory, instructional design theory, and characteristics of effective practice are filtered through effectiveness criteria. The aim of the chapter is to develop a compact integrated synthesis of the current thinking. It does so by applying the selection criteria introduced in Section 1.4.4 to the theoretical and practical concepts of Chapters Two and Three, using the criteria as a filter to extract appropriate theories, stances and characteristics. The resulting framework, named the Hexa-C Metamodel, can be used as a design aid in the development of learning products and environments and is also valuable as a tool for evaluating such from the viewpoint of learning theory. The Hexa-C Metamodel is also compared and contrasted with Reigeluth's *New paradigm of instructional systems design* and the challenge of Duchastel's *Prolegomena to a theory of instructional design*, both mentioned in Section 1.4.3.

### *Chapter Five: Case Studies - a major chapter comprising three evaluationss*

Three very different learning events are investigated - using the framework of the Hexa-C Metamodel as an evaluation tool - in order to address the second research question by determining what the selected theories and characteristics reveal about the practice of effective learning. The three learning events were chosen as case studies due to the researcher's close in-depth involvement in each.

1. ***Section 5A: Case Study One - the 1997/1998 evaluations of FRAMES***
   FRAMES is an interactive practice environment developed to help students in a complex section of COS101-S, a module in discrete mathematics for first-level computer science students at the University of South Africa. The researcher was the module lecturer (instructor), as well as the designer of FRAMES. A sample of 18 of the approximately 600 students annually (distance-learners) were surveyed in the evaluation.
2. Section *5B:* ***Case Study Two - the 1999 and 2000 presentations of RBO880***
   RBO880 is an online course for masters-level education students at the University of Pretoria, and is presented via a web-based classroom. The course presenter, who was also its designer, gave full support and co-operation in the process and the researcher participated as a student in the year 2000. The evaluation target comprised the 22 students of the 1999 and 2000 RBO880 presentations.
3. *Section* ***5C: Case Study Three - Mkambati 2000***
   The postgraduate course in Ecotourism at the University of Pretoria, incorporates fieldwork and a practical project as a major component. The researcher participated and assisted during the week-long field trip at the remote Mkambati Nature Reserve. Here too, the course lecturer was supportive of the research and keen to use its results for future refinements. The evaluation target consisted of the 12 students who participated in 'Mkambati 2000'.

### *Chapter Six: Which reflects on elements of the metamodel*

As already stated, Chapter Five used the metamodel as an investigative toolset for three evaluations. In response to the third research question, Chapter Six conversely uses the evaluations to elicit further information about the metamodel and its six elements, suggesting what the practice of learning and instruction reveals about the theories and characteristics embodied in the framework. The in-depth analysis resulted in extensive tabulations of information revealed about the elements of the framework - amplifying them, and indicating their dynamics and ways in which they can be implemented, as well as relationships between them.

### *Chapter Seven: Conclusion*

This chapter briefly reviews what has been achieved, and suggests further research and development following on the findings of this study.