CHAPTER 3

Learning and Instructional Systems Design

> *The constructivist approach to learning is widely accepted by lecturers, but not always evident in their teaching practices, including web-based instruction.*
> (Morphew, 2000, p. 1)

3.1 Introduction

An account of various learning theories that are pertinent to this study was provided in Chapter 2. Learning theories are descriptive and make general statements about how people learn. Learning theories, explicitly or implicitly play a major role in the fields of instructional design and the educational technology. Instructional design is the application of learning theories to create effective instruction. Mayes (2004) states that for good pedagogical design, there is simply no escaping the need to adopt a theory of learning. As such, learning theory informs instructional design theory, which in turn informs instructional design.

Several new developments took place in the field of instructional design as a function of our contemporary understanding on what learning is and how it occurs. Morrison, Ross and Kemp (2004) report that instructional theory (a model for helping designers understand that the desired learning occurs) has changed as a function of our contemporary understanding of learning theory (how we learn). It has also evolved to focus on student-centred learning and student learning as a contextual experience, resulting in newer constructivist and technology-supported design approaches. With all the relevant discussions in context, this study aims to design a blended learning model that can be used to guide teachers through the necessary changes they will need to make to be successful in integrating new technology into their instructional environments and bring about a shift in focus from instructivist to constructivist pedagogical approaches, when possible.

The chapter begins with an overview of instructional design, and then a conceptual representation of instructional design. It further reviews the underlying theories of instructional design, and the principles of constructivist learning models. In order to direct the study in perspective, a review of best practices in blended learning was made in order to distil good design aspects and criteria, and critical success factors for the integration of new technology.

The chapter further serves the purpose of contextualising the case in Chapter 5, and also serves the purpose of demonstrating best practices. Moreover, this chapter helps to address the latter part of the third specific objective, "*to carry out an extensive review of pertinent learning theories and the literature relating to the principles of instructional design, and constructivist learning environments*."

3.2 A Brief History of Instructional Design

The roots of instructional design can be traced back to the seminal work of Robert Gagné (1977) on the conditions of learning and early attempts to apply general systems theory and systems analysis (Banathy, 1987). The earliest philosophical orientation in instructional design, referred to as the *systems view, objectivism* or *instructivism* (Roblyer, 2003) is rooted in the assumption that using an instructional systems design model (e.g., Dick, Carey and Carey, 2005) is based on learning theories closely tied to behaviorism (e.g., Gagné, 1977; Merrill, 1983; Reigeluth and Stein, 1983), information processing, and systems thinking (e.g., Banathy, 1987; Regeluth, 1999). Information-processing theorists (Anderson, 1995; Glazer, 1990) emphasize the organization of information through phased processes. This type of instructional design is a direct expression of behaviourism and the assumption that learners respond to stimuli with a certain level of predictability (Dalgarno, 1996).

Over the past several decades, the field of instructional design (ID) has been heavily influenced by advancements in learning theories, communication theories, and computer technology. These advances are changing the discipline of ID rapidly as new understanding of how people communicate and learn, and of how technology can enhance learning and communication are emerging. As a result of all these, the field of ID has seen many models, some behaviourist, others cognitive or constructivist-based, and the field is still in a state of flux.

The 1970s saw a proliferation of instructional design theories and models all based on the core of the ADDIE model of analysis, design, development, implementation and evaluation (Gustafson and Branch, 2002). Behaviourist instructional strategies, which rely on the development of a set of instructional sequences with predetermined outcomes, have been used as a basis for subject development since then. Gagné

(1977) proposed that the information-processing model of learning could be combined with behaviourist concepts to provide a more complete view of learning tasks.

Rooted in stimulus-response learning, instructional design focused on observable behaviours. Tasks were split into subtasks; each subtask was treated as a separate learning goal. Instruction was designed to reward correct performance and to improve poor performance. Mastery was assumed to be achievable by every learner, given enough repetition and feedback. It is a linear, systematic and prescriptive approach to instructional design. These elements were essential for learning to be effective under all conditions. The tendency was to assume that there was a correct learning sequence model, and design focused around the transfer of all students to this best model (Jonassen, 1991).

There are numerous instructional design theories that prescribe specific methods of instruction and the conditions under which they can effectively be used; some of the notable ones are:

(i) Benjamin Bloom's (1956) taxonomy of learning outcomes (discussed in Section 2.7.1.2);

These taxonomies are still widely used in the design of instruction; drawing on them several instructional design theories have evolved to address a wide range of learning situations;

(ii) Psychologist Jean Piaget's (1960) study of the cognitive development of children; he identified several discrete phases they undergo as they grow: very young children are only able to process concrete, operational information; they are unable to think abstractly, reflect on the past, or project into the future. Older children develop these abilities over time;

(iii) Seymour Papert's (1970) LOGO: a simple computer-programming language that let children control the movement of a simulated turtle by giving it simple instructions such as "forward 3 units" and "turn left 90 degrees";

(iv) The "information-processing" approach to instructional design as a consequence of the influence of digital computers on learning theories in the 1960s and 1970s;

(v) The Schema theory that underscores the schematic structure of knowledge as one of the major sources of influence on prescriptive theories and principles for instruction. A significant design principle derived from this theory is related to the Asubel's (1980) advance organizer which serves as a scaffolding to activate broader and more inclusive knowledge based on the learner's existing knowledge, and to provide a cognitive structure for new meaningful learning.

A comprehensive list of most models can be found in Ryder (n.d.) where models are classified as modern prescriptive models versus postmodern phenomenological models.

Reigeluth (1995) reports that the growing influence of postmodernism in academic culture (in the 1980s and 1990s) and the advent of the information age have called for a radical change in paradigms related to the way people are educated and trained, and have began to influence instructional design with the rise of constructivist theories. As a result, the field of instructional design further evolved to consider student learning as a contextual experience, wherein socially affected learner cognition is a feature in learning; subsequently, a less objective and more subjective constructivist perception of learning has resulted in newer constructivist instructional design theory approaches in the 1990s (Jonassen, 1999, 2001; Shambaugh and Magliaro, 2001; Willis, 2000). Being a polarized position to the systems view of instructional design, it has stirred a vigorous response from advocates of more traditional models (Dick, 1996; Merrill, 1996).

Nonetheless, none of these models is adequate to meet the consequences of the paradigm shift from industrial age to information age (Bates, 2000; Reigeluth, 1999). As a result, instructional designers are faced with the challenge of forcing learning situations to fit an instructional design/development model rather than selecting an appropriate model to fit the needs of varying learning situations (Gustafson and Branch, 2002).

3.3 A Conceptual Representation of Instructional Design (ID)

Instructional Design is a construct referring to the step-by-step prescriptive procedure for creating instructional materials in a consistent and reliable fashion in order to facilitate learning most effectively. The literature is replete with a wide range of definitions and descriptions of instructional design, therefore, providing a new definition of instructional design can be challenging.

Crawford (2004) defines instructional design as “the distinct systematic process through which evolves a superior instructional product…as delineated through an instructional design model. It guides designers to work more efficiently while producing more effective and appealing instruction suitable for a wide range of learning environments. According to Gagné and Briggs (1974) instructional design augments learning by incorporating various strategies into courseware, for example structuring, ordering and sequencing content in particular ways, depending on the expected learning outcome. The medium does not dictate the design (Starr, 1997).

According to Smith and Ragan (2005), instructional design is the entire process: from the analysis of learning needs and goals, through the development of instructional materials and activities, to the evaluation of all instruction and learning activities. Spector and Muraida (1997) refer to instructional design as a structuring of the learning environment for the purpose of facilitating learning or improving learning effectiveness. Instructional design is the systematic process of translating general principles of learning and instruction into plans for instructional materials and learning (Seels and Glasgow, 1998; Morrison, Ross and Kemp, 2004). Instructional design is the application of theory to create effective instruction (Jonassen, 2001; Reigeluth, 1999). An instructional design framework focuses on the creation of a learning experience that delivers knowledge in a more effective, interactive, and engaging way, and that can be measured, managed and directed for maximum impact (Piskurich, 2000:7). Smith (2001: [online]) states that instructional design focuses on what learners are to know, the information to be provided, while the Institute of Electrical and Electronics Engineers (IEEE) (2001) emphasises that instructional design is the process by which an educator determines the best teaching methods for specific learners in a specific context, in the attempt to achieve a specific goal.

According to Reigeluth (1999), instructional design theories and theories of learning and human development are like a house and its foundation, they are closely related (p. 13). According to Seels and Glasgow (1998), instructional design is “the process of solving instructional problems by systematic analysis of the conditions for learning” (p.1) and is based on the “premise that learning should not occur in a haphazard manner, but should be developed in accordance with orderly processes and have outcomes that can be measured” (p.7).

A commonly cited definition of instructional design in the literature is given by Seels and Richie (1994). They describe instructional design as the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning. According to Berger and Kam (1996), instructional design is the systematic process of translating general principles of learning and instruction into plans for instructional materials and learning.

Broderick’s (2001) description of instructional design provides a concise and encompassing articulation of the essence and practice of instructional design:

> Instructional Design is the art and science of creating an instructional environment and materials that will bring the learner from the state of not being able to accomplish certain tasks to the state of being able to accomplish those tasks. Instructional Design is based on theoretical and practical research in the areas of cognition, educational psychology, and problem solving. (p. 1)

Based on above descriptions, it is clear that there is no universal and unambiguous definition of the concept of ID. The Researcher wants to define instructional design as a technique that prescribes appropriate instructional events in a systematic manner for specific students in a given context in an attempt to achieve desired learning outcomes.

Besides being a construct, instructional design is also a field of theory and practice within the larger field of instructional technology. Ely (1996) defines the term *instructional design* as that used by professionals who work with direct applications of technology in teaching and learning. He differentiates between the following two terms:

- *Instructional technology* - usually used specifically to "designate the process of teaching and learning through purposeful use of teaching/learning strategies and communication media" and
- *Educational technology* - used as a broader term to indicate the "use of technology in any aspect of the educational enterprise" (Ely, 1996).

3.4 Instructional Design Models (IDM)

An instructional design (ID) model provides procedural framework for the systematic production of instruction. It incorporates basic elements of the instructional design process, including analysis of the intended audience and determination of goals and objectives, and may be used in different contexts. It prescribes how combinations of instructional strategy components should be integrated to produce a course of instruction (Braxton, Bronico, and Looms, 1995). The effectiveness of a model is heavily dependant on the context in which it is applied; instructional design methods are situational and not universal. Instructional design models provide a systematic approach of implementing the instructional design process for a specific educational initiative (Morrison, Ross, and Kemp, 2004).

Instructional design theories are design-orientated (focus on the ways to attain given learning goals) rather than description orientated. Further, they are situation-specific (Morrison, Ross and Kemp, 2004, p. 4); they identify the situations for which the methods should and should not be used (Reigeluth, 1999, p. 6). These characteristics make ID theories more directly useful because it provides guidelines for the development of courses with appropriate combinations of challenge, support, direction and structure; instructional design theories provide guidelines for designing and they specify how the end product should look like.

Gustafson and Branch (2002) claim that “models help us to conceptualize representations of reality”; and that “models explain ways of doing”. According to them, ID models have at least the following four components:

(i) analysis of the setting and learner needs;

(ii) design of a set of specifications for an effective, efficient and relevant learner environment;

(iii) development of all learner and management materials; and

(iv) evaluation of the results of the development both formatively and summatively.

Seels and Glasgow (1998) listed the following four purposes of instructional design models. They:

(i) help to visualise a systematic process, which allows those involved to reach consensus on that process;

(ii) serve as a tool for managing both the process and project;

(iii) allow for testing of theories by integrating the theories in a practical model that can be implemented;

(iv) set tasks that can be used as criteria for good practice.

With the advent of microcomputers in 1980s, there have been a variety of developments and trends that have had significant impact on instructional design practices. The need to develop new models of instructional design to accommodate the capability and interactivity of computers took high priority, and wide variations have emerged in models in terms of their purposes, amount of detail provided, degree of linearity in which they are applied and quantity, quality, and relevance of the accompanying operational tools (Gustafson and Branch, 2002). This trend is still evolving.

With the above discussed processes and ideas, and the modern trends towards constructivism in mind, the Researcher considers taking a significant step beyond systems approach to instructional design contexts to designing a model from a different perspective. As the study is all about developing a (blended) learning environment, his focus is on developing a model to guide the design of a learning environment that can provide learners with the conditions that maximise their opportunity to learn. Instructional Designer’s main goal is to construct a learning environment in order to provide learners with conditions to support the desired learning process.

3.4.1 Instructional Systems Design (ISD)

The literature shows an interchangeable use of instructional design, instructional systems design (ISD), instructional development (ID), and even instructional technology (Gustafson and Branch, 2002; Reigeluth, 1983; Schrock, 1995; Seels and Richie, 1994). However, some authors[1] (e.g., Alessi and Trollip, 1991; Kemp, Morrison, and Ross, 1996; Seels and Glasgow, 1998; Smith and Ragan, 2005) see some differences between ID models and ISD (Instructional System Design) models. To them, ISD models are broader in nature. They describe ISD as a process, discipline, field of study, a science, and even a reality in the literature. As a process it is closely related to Instructional Design theories and it emphasises what process or procedure a teacher or instructional designer should use to plan and prepare more effective and appealing instruction in a consistent and reliable fashion suitable for a wide range of learning environments.

ISD models normally cover five-phases: Analysis, Design, Development, Implementation and Evaluations where as ID models normally cover only the first two phases of the ISD model - analysis and design. ISD models put instructional design theories and principles into practice by embedding them in procedural guides for instructional development. Specifically, the use of an ISD model will identify what is to be taught, determine how it will be taught, and evaluate the instruction to determine what is necessary. ID Models focus on the analysis of a skill or knowledge to be acquired and then convert the analysis into a training strategy.

I want to take a “no difference” position as it is just a matter of definition and convention. Irrespective of any difference, if at all there, this study aims to design an ISD model with the goal of constructing a (blended) learning environment. Given below is an overview of some of the important traditional ID models.

3.4.2 The universal systems model

The instructional systems design (Beck and Schornack, 2003) based on the Universal model comprises:

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[1] *Source: Instructional System Design Concept Map. (2007). Accessed 12 March 2009 http://www.nwlink.com/~Donclark/hrd/ahold/isd.htm*

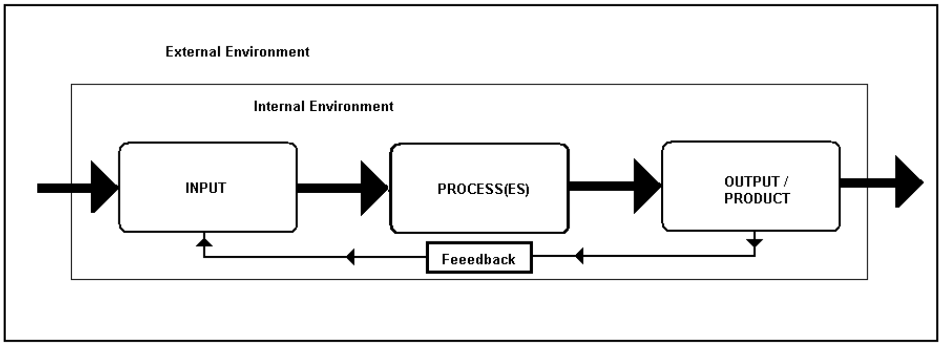
(i) Inputs,

(ii) The process(es) of transforming the inputs into outputs or product,

(iii) The outputs of the processing, and

(iv) Feedback mechanisms and the environments in which they operate.

These are represented diagrammatically as below:



Source: Beck and Schornack, 2003.

Fig: 3.1: The Universal systems model

The sources of the inputs can either be within or outside the system. The design using this model therefore analyses the sources of the inputs (people, knowledge, materials, energy, capital, finance etc), and the processes (identifying the needs, resources, delivery mechanisms, interactions, navigations, structuring etc) that produces the desired outputs (Learning materials, resources, experiences, environments etc).

3.4.3 The ADDIE Model: a generic model for ISD processes

Perhaps the most commonly used model for creating instructional materials is the ADDIE model developed by Royce in 1970 (as cited in Sommerville, 1989, p. 7). The acronym – ADDIE— stands for the five steps that represent a dynamic, flexible guideline for building effective training and performance support tools.

- *Analyze* - analyze environment, learner characteristics, tasks to be learned, etc;
- *Design* - develop learning objectives, choose an instructional approach;
- *Develop* - create instructional or training materials;
- *Implement* - deliver or distribute the instructional materials;

- *Evaluate* - make sure the materials achieved the desired goals.

These steps are based on a generic systems approach which is systematic in nature. The output of each step becomes the input for the next step. There are formative evaluations that are embedded in each of the five steps for judging the value of that process while the activities are happening; as a result, revisions are made as needed. Most of the current instructional design models are variations of the ADDIE model, although they vary in their levels of specificity and complexity (Dick, Carey, and Carey, 2005).

3.4.4 Rapid Prototyping

'Rapid prototyping' is a design approach adapted to ID field from the discipline of software engineering by Tripp and Bichelmeyer (1990, pp. 31-43). According to them, as with software engineering, rapid prototyping in ID is "the building of a model of the system to design and develop the system itself." (p. 36). It focuses on continual or formative feedback which has some relevance on Winn's (1997: 37) assertion that "the activities of the instructional designer need to take place at the time the student is working with the instructional material". He maintains that ID decisions should be made on the fly as a response to student involvement in the learning process. This design approach has sometimes been cited as a way to improve the generic ADDIE model, and is intended to create instruction for a lesson, as opposed to an entire curriculum.

It comprises a set of concurrent, overlapping four-level parallel process that will help both to speed up the process and to overcome many limitations of the traditional instructional design models. As it can be seen from Figure 3.1, rapid prototyping continues with the parallel processes of design and research, or construction and utilization.

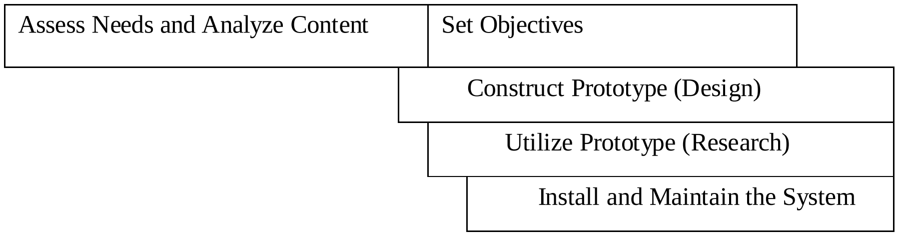


Figure 3.1: Prototyping approach to software design (by Tripp and Bichelmeyer, 1990)

At the heart of this design approach is the analysis phase followed by constructing a prototype, using the prototype to perform research, and installing the final system. Procedurally, after conducting the analysis thoroughly, research and development are conducted as parallel processes and a prototype is created based on findings, and it goes under testing out of which it may or may not evolve into a final product.

Many Instructional Designers have adopted the Rapid Prototyping approach in order to allow ongoing review, evaluation and revision in collaboration with teachers and even students. The advantages of the rapid prototyping are the utilization of the design with active participation of potential learners, which leads to *participatory* design; a design environment which makes it practical to synthesize and modify instructional artefacts quickly, which also leads to increase in creativity; an accelerated development, which built on sound footing by the earlier detection of the errors by the quick iterations (Tripp and Bichelmeyer, 1990; Wilson, Jonassen, and Cole, 1993). Another important aspect of this model is that it uses an iterative process through continual evaluation and improvement while instructional materials are being created; it saves time and money by identifying problems while they are still easy to fix, or otherwise be costly to correct.

On the contrary, the main disadvantage of rapid prototyping is its tendency to encourage informal design methods which may introduce more problems than they eliminate, such as substituting prototypes for paper analysis; committing to a premature design, if it is not remembered that a design is only a hypothesis; designs that could get out of control easily in the hands of careless and hasty designers (Tripp and Bichelmeyer, 1990).

The success of the implementation of this model depends on the expertise of the instructional designers as well as their past experience and intuition to guide the design (Piskurich, 2000). Gros, Elen, Kerres, Merrienboer, and Spector (1997, p. 49) note that designers rarely work according to theories; they merely work intuitively rather than being driven by relevant research and theory.

According to Tripp and Bichelmeyer (1990), the biggest difference between rapid prototyping and traditional instructional systems design is that although many traditional models emphasize early constraining of design decisions, rapid prototyping follows the pragmatic design principle of minimum commitment, which depends on synthesizing and limiting the design necessarily only regarding the solution of the problem at hand at that stage.

3.4.5 Gagné's nine events of instruction

Gagné's nine events of instruction should satisfy or provide the necessary conditions for learning. The events in essence become the framework for the lesson plan or steps of instruction (Corry, 1996). Though originally formulated in 1965, his nine events of instruction is a highly cited instructional model. In the actual process of using Gagné's theory, the teacher determines the objectives of the instruction. These objectives are then categorized into one of the five domains of learning outcomes listed Table 3.2. The instructor then uses the conditions of learning for the particular learning outcome to determine the conditions necessary for learning.

Table 3.1 depicts how the events can be organised and applied. The nine events are broken down into three phases: the pre-instructional phase, the instructional phase and the post-instructional phase.

Table 3.1: Gagne’s nine events and strategies to apply them

Pre-Instructional Phase	1. Gain attention (reception)	➢ Begin the lesson with a startling statement/statistic, a rhetorical question, a provocative quotation or a challenge that can motivate learners’ "need to know" and establish a common ground to address an existing deficiency, gap or problem. ➢ Use humour, vary media, and get students involved; these are elemental to effective communication.
	2. Inform learners of the objectives (expectancy)	➢ Review course objectives with students. ➢ Explain how meeting the objective is useful to the students in terms of real-world applications.
	3. Stimulate recall of prior learning (retrieval)	➢ Pre-test prior knowledge and prerequisite skills. ➢ Ask students to share their current perceptions of the topic. ➢ Create a concept map of prior knowledge. ➢ Provide students with advance organisers in order to help learners make their own bridges between concepts and learn them.
Instructional Phase	4. Present the stimulus (selective perception)	➢ Lecture in small chunks whenever possible. ➢ Use a variety of media and methods in presenting information. ➢ Show examples to clarify concepts.
	5. Provide learner guidance (semantic encoding)	➢ Highlight important ideas, concepts, or rules. ➢ Use repetition. ➢ Provide students with learning strategies such as pneumonic memory techniques.
	6. Elicit student performance (responding)	➢ Allow for several practice[2] sessions over a period of time. ➢ Provide role-play, case studies, or simulations. ➢ Provide opportunities for knowledge acquisition through collaboration, discussion and negotiation by assigning group projects where students “meet” online.
	7. Provide feedback (reinforcement)	➢ Feedback should be immediate, specific, and corrective. ➢ Allow additional practice opportunities after feedback is given.
Post-Instructional Phase	8. Assess Performance (retrieval)	➢ Provide independent activities that test student knowledge/skill acquisition.
	9. Enhance retention and transfer (generalization)	➢ Highlight connections with other subject areas. ➢ Apply learning in real-world situations by linking learning experience with personal life events of learners to make the experience more memorable to them.

Gagné's work has contributed greatly into the field of instructional technology. His nine instructional events are commonly applied in designing web-based instruction. According to Gagne, the following steps should be clearly thought out when designing instruction:

[2] *Learners master only those activities they actually practise; this is an assumption in both constructivism and rote learning environments.*

- Identify the types of learning outcomes;
- Each outcome may have prerequisite knowledge or skills that must be identified;
- Identify the internal conditions or processes the learner must have to achieve the outcomes;
- Identify the external conditions or instruction needed to achieve the outcomes;
- Specify the learning context;
- Record the characteristics of the learners;
- Select the appropriate media for instruction;
- Put strategies in place to motive the learners;
- The instruction is tested with learners through formative evaluations;
- Summative evaluation is used to judge the effectiveness of the instruction at the end.

The nine events also offer guidelines for the appropriate selection of media (Gagné, Briggs and Wager, 1992). Table 3.2 provides guidelines for the selection of appropriate media for each learning outcome.

Table 3.2: Gagne's criteria for the selection of appropriate media

Learning Outcome	**Exclusions**	**Selections**
Intellectual Skills	Exclude media having no interactive feature.	Select media providing feedback to learner responses.
Cognitive Strategies	Exclude media having no interactive feature.	Select media providing feedback to learner responses.
Verbal Information	Exclude only real equipment or simulator with no verbal accompaniments.	Select media able to present verbal messages and elaboration.
Motor Skills	Exclude media having no provision for learner response and feedback.	Select media making possible direct practice of skill, with informative feedback.
Attitudes	Exclude only real equipment or simulator with no verbal accompaniments.	Select media able to present realistic picture of human model eg., computer simulations

Source: Adapted from Gagné, Briggs, and Wager, (1992).

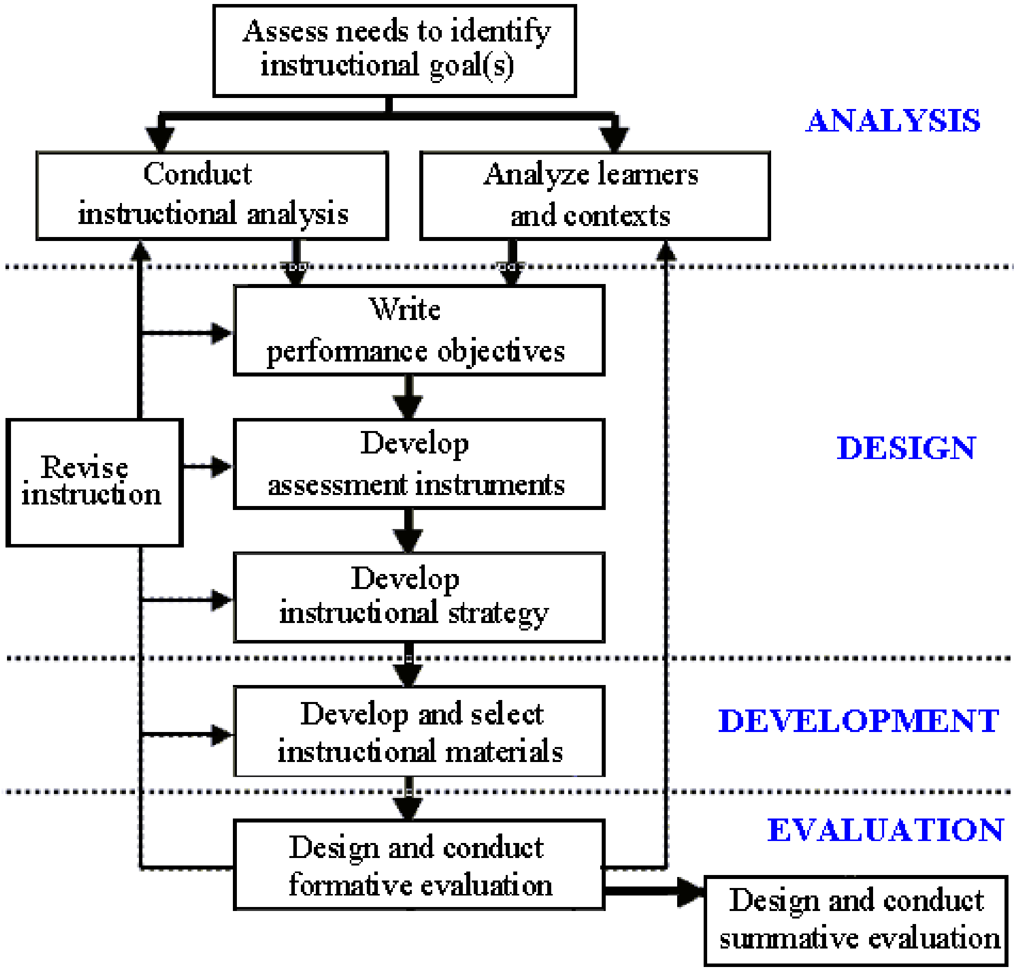
Media enhance student achievement and learning, but only if it is used appropriately (Dede, 1998; Warschauer, 1998; Young, 2002; Aycock, Garnham, and Kaleta, 2002; Yoon and Lim, 2007); it can be detrimental when it is used incorrectly, mostly in a distracting way. The key determinant of the educational value of media is how it is used in specific contexts.

3.4.6 Dick and Carey Model

The Dick and Carey (DC) model is based on a systems approach for designing instruction. One of the best known models, and perhaps, the most popular and widely used ID models in use today, is in its sixth edition (Dick, Carey, and Carey, 2005). It has been the leading behavioural instructional systems design model (Willis, 1995; Willis and Wright, 2000) since its first release to the public in 1968; later, the model was published in 1978 by Walter Dick and Lou Carey in their book entitled 'The Systematic Design of Instruction'.

Its most recent version (Dick, Carey, and Carey, 2005) describes all the phases of an iterative process that starts by identifying instructional goals and ends with summative evaluation. It consists of the following ten components that are executed iteratively and in parallel rather than linearly:

- Assess needs to identify instructional goal(s)
- Conduct instructional analysis
- Analyze learners and contexts
- Write performance objectives
- Develop assessment instruments
- Develop instructional strategies
- Develop and select instructional materials
- Design and conduct formative evaluation of instruction
- Revise instruction
- Design and conduct summative evaluation



Although all models vary in their levels of specificity and complexity, each is based on the typical processes of the major phases of instructional systems design; these are analysis, design, development, implementation and evaluation (Dick, Carey, and Carey, 2005). The DC model addresses instruction as an entire system, focusing on the interrelationship between context, content, learning and instruction. Most steps in the model are based on previous steps which makes it difficult to complete the process in a non-linear fashion.

The DC model uses Gagne's categories of learning outcomes, conditions for learning, and nine events of instruction to aid designers in establishing frameworks and making decisions on instruction (Moallem, 2001). The model explicitly adheres to the definition of instructional development by Gustafson and Branch (2002) in nine detailed stages.

The version of the DC model illustrated above incorporates some aspects of constructivist theory, and might be appealing to constructivists. A notable thing with this model is that it emphasizes an initial analysis of needs to identify goals instead of experts identifying entry behaviours and characteristics as it used to be in the early versions. According to Dick and Carey, "Components such as the instructor, learners, materials, instructional activities, delivery system, and learning and performance environments interact with each other and work together to bring about the desired student learning outcomes". In the current version, the DC model is more or less adequate in creating a rich learning environment in a practical sense and it is popularly used in many classrooms today. Further, it is also a student-centered model.

Besides identification of goals, learner- and context analysis, and setting of performance objectives occur at an early stage. Assessment instruments are set up prior to development of the instructional strategy. This ensures that the instruction is correctly focused and that objectives, instruction, and assessment are in congruence with one another. Further, each and every stage of the instruction is part of an iterative cycle of revision; both the formative and the summative evaluations are also part of a continuous feedback and modification process. Finally, summative evaluation is viewed as part of the instructional design model, and not as a separate subsequent event.

Dick and Carey made significant contribution to the instructional design field by championing a systems view of instruction as opposed to viewing instruction as a sum of isolated parts. Though originally formulated over four decades ago, even today it is a widely used model because it is based on research that has been conducted over many years and principles that have been generally accepted by those in this field; further, it is being continuously improved by its developers since its first release in order to reflect new developments in the ID field. It is all these features discussed above that fascinated the Researcher to consider it in the study.

3.4.7 Morrison, Ross and Kemp Model (MRK)

The systematic design process suggested by the Morrison, Ross and Kemp model (2004) consists of nine interrelated steps:

- identifying instructional design problems and specifying relevant goals,
- examining learner characteristics,
- identifying subject content and analyzing task components that are related to instructional goals,
- stating instructional objectives for the learners,
- sequencing content within each unit to sustain logical learning,
- designing instructional strategies for each learner to master the objectives,
- planning instructional delivery,
- developing evaluation instruments, and
- selecting resources to support learning activities.

The model is circular as opposed to the somewhat linear nature of DC model. More specifically, the nine elements listed above are interdependent. Moreover, they are not required to be considered in an orderly way to realize the instructional learning systems design. What differentiates the MRK model from most other models is that it considers instruction from the perspective of the learner, provides a good application of the systems approach where the ID process is presented as a continuous cycle, and finally, puts great emphasis on how to manage an instructional design process.

Although they portray prescriptive instructional design process, they still acknowledge the fact that the field of instructional design is evolving to consider student learning as a contextual experience which is less objective and more subjective in line with constructivist perception of learning. Accordingly, they suggest that constructivist perspective of learning is an available option to teachers and students in their most recent edition of their *Designing Effective Instruction* (4th Edition, 2004).

Literature reveals that there are many ID models such as Knirk and Gustafson Design Model, Hannafin and Peck design model, Huitt's Model, Jerrold and Kemp Design Model, Gerlach and Ely Model, Reigeluth's model, etc. In addition, there are several important theories / pedagogical models for developing instructional strategies. According to Ryder (n.d.), they are "like myths and metaphors for helping to make sense of our world". Designers rarely work according to a single theory. Depending on the situation, one model can be used for an entire course of instruction, or elements from multiple models can be combined (Braxton, Bronico and Looms, 1995) in order to create a balanced approach.

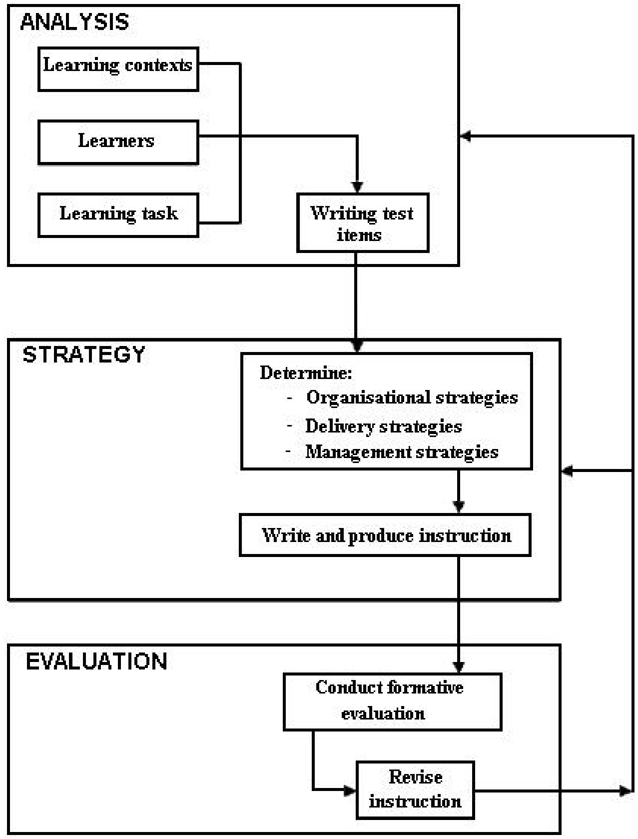
3.4.8 Smith and Ragan's Model

Like the Dick and Carey model, Smith and Ragan's (2005) model is also based on a systems approach to designing instruction. It comprises three phases as discussed below:

Stage 1: an analysis phase that is concerned with learning contexts, learners, and learning tasks (mastery of specific tasks—the nature and levels of knowledge, skills and attitudes— rather than subject knowledge; this is required for the design of instructional materials);

Stage 2: a strategy phase that involves organisational, delivery, and management strategies, and,

Stage 3: an evaluation phase that deals with formative evaluation and revision.



Source: Smith and Ragan, (2005)

Figure 3.2: Smith and Ragan's Model

Smith and Ragan's (2005) upholds the view that the traditionally conflicting objectivism and constructivist approaches are not in fact opposing paradigms, but are complementing approaches. According to them, education comprises both supplantive and generative elements. They demonstrated how Gagné's events of instruction can act as the central core for both points of departure, as Table 3.3 shows.

Table 3.3: Supplantive and generative instructional events

	Supplantive	Generative
Introduction		
1.	Compel attention to lesson	Activate attention to lesson
2.	Inform learner of instructional purpose	Establish purpose
3.	Stimulate learner's attention	Arouse interest and motivation and motivation
4.	Provide overview	Preview learning activity
Body		
5.	Stimulate recall of prior knowledge	Recall relevant prior knowledge
6.	Present information and examples	Process information and examples
7.	Compel and direct attention	Focus attention
8.	Guide or prompt use of learning strategies	Employ learning strategies
9.	Provide for and guide practice	Practice
10.	Provide feedback	Evaluate feedback
Conclusion		
11.	Provide summary and review	Summarize and review
12.	Enhance transfer	Transfer learning
13.	Provide re-motivation and closure	Re-motivate and close
Assessment		
14.	Conduct assessment	Assess learning
15.	Provide feedback and remediation	Evaluate feedback

Source: Adapted from Smith and Ragan (2005).

According to Smith (2000), "Almost every training program I design benefits from a combination of behaviourist and constructivist techniques." With learning task as procedural, a behaviourist approach will suffice. When the learning event involves abstract concepts that are difficult to proceduralise, the objectivist approach becomes unsuitable. It will then require fuzzy methods that call for the cognitivist or constructivist approach that acknowledges the need to understand concepts and relationships. A user of the model would select both generative and supplantive elements as and when they became necessary.

3.4.9 Merrill's Models of Instructional Design

This section discusses David M. Merrill's contributions towards a transition from behavioural to cognitive approaches to instructional design. Based on the first principles and systematic review of instructional design theories, models and research, Merrill (2002) proposed a set of five coherent, interrelated, comprehensive prescriptive instructional design principles from an eclectic perspective, incorporating behaviourist, cognitivist, and constructivist conceptions. His "Five Star Instruction" model is a problem-based instructional model, and it offers a comprehensive, yet simple, device for the evaluation process.

3.4.9.1 The Component display theory (CDT)

M. David Merrill's component display theory (CDT) (Merrill, 1983) is based on pre-determined objectives of instruction. It deals with the micro level of instruction, especially single ideas and methods for teaching them. It is designed to work in conjunction with Reigeluth's Elaboration Theory, which is a macro learning system.

CDT is based on a set of relationships between its two dimensions- *content* to be taught and the type of *performance* required. Performance is the manner in which the learner applies the *content*. Performance consists of a) remembering: memory and recall of content information, b) using: application, in which the student is called upon to demonstrate some practical usage for the content, and c) finding: generalize, in which the student uses the information inductively to generate a new abstraction, concept, or principle.

Merrill also specified four primary presentation forms: rules, examples, recall, and practice, and five secondary presentation forms: prerequisites, objectives, help, mnemonics, and feedback. Instruction should contain all these forms or a unique combination of these to be most effective. It allows learners to select both the instructional strategy and the content, thus making it possible to optimise the learning process. In selecting the instructional strategy, i.e. the type of performance required, learners control the kind of display, the amount of elaboration, and the number of examples and practice items. In selecting content components, they tackle the material that is most appropriate at that time. Thus CDT allows customisation or individualization by accommodating personal learning styles and needs, and metacognition by teaching self-regulation and learning strategies.

3.4.9.2 The second generation instructional design principles

Later improvements to reflect cognitive views led to the second generation instructional design (ID2) which was specifically intended to analyze, represent and guide instructional development, so as to:

- teach integrated sets of knowledge and skills;
- produce flexible prescriptions for selecting interactive instructional strategies; and
- be an open system that could incorporate new knowledge about teaching and learning and apply it in the design process.

ID_2 has a cognitive foundation, based on the belief that learning results in the organization of memory into cognitive mental models. Construction of mental models and retrieval of information are facilitated by instruction that explicitly organises and elaborates the knowledge being taught. The feature that distinguishes ID_2 from other design methodologies is *knowledge representation* according to which the knowledge base acquires and stores knowledge relating to course content and course delivery. The structures for knowledge organisation are called frames and the relationships are indicated by links called elaborations.

Using the concepts of ID_2, described in the previous section, Merrill and the ID_2 research group (1996, pp. 30-37; Merrill, 1997[online]; 1999, pp. 397-424) set out to extend them and to specify their rules so that they were sufficiently complete to drive a computer program.

3.4.9.3 Instructional Transaction Theory (ITT)

ITT is the computer implementation of conceptual ID_2. The term *instructional transaction* relates to a set of components comprising the interactions necessary for a learner to acquire a particular kind of knowledge or skill. Instructional transaction shell is a computer program that encapsulates the conditions for teaching a given type of knowledge. This approach supports the use of realistic simulations, which is an extension of his Component Display Theory. The benefit of the approach is that the same subject matter can be used with a number of different strategies based on the decisions made by learners as they interact with the computer program (Merrill and ID2 Research Group, 1996; Merrill, 1999).

3.4.9.4 Merrill's Fist Principles of Instruction

The use of problem-based learning (PBL) is well documented in the research literature. Merrill (2002) suggests that the most effective learning environments are those that are problem-based and involve the learner in four distinct phases of instruction that are necessary for instruction to be most effective. Together with the problem itself, he refers to these five phases as "first principles of instruction." Learning is facilitated when:

(i) Learners engage in solving real-life problems.

(ii) Existing knowledge is activated as a foundation for new knowledge.

(iii) New knowledge is demonstrated to the learner.

(iv) New knowledge is applied by the learner.

(v) New knowledge is integrated in the learner's world. (Merrill, 2002, pp. 44-45)

Organizing instruction around problem-solving triggers associations with previous experiences and activates existing knowledge. According to Merrill, principles of problem-based instruction seek to make the instructional context relevant, focused on meaningful skills and therefore effective for transfer-of-learning. Further, making the problem difficult makes the learning more challenging, engaging and effective. It establishes a motivational context essential for the adult learner.

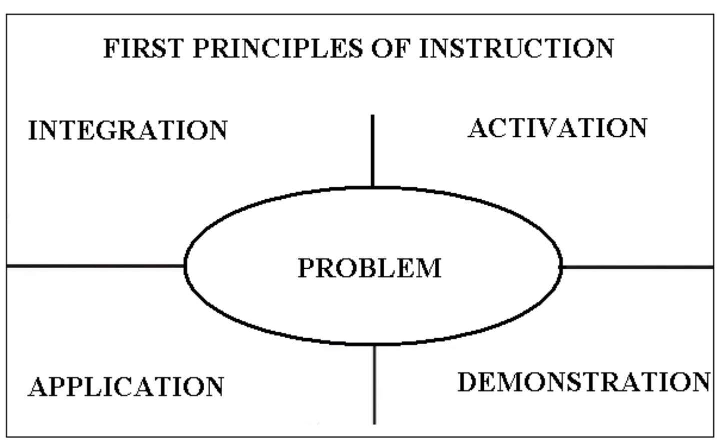


Figure 3.3: Merrill's five phases of his first principles

According to him, learning will be effective when cognitive strategies associated with each principle are implemented correctly. It is a problem-based instructional model, and offers a comprehensive, yet simple, device for the evaluation process by addressing the following questions in depth.

Given below are simplified criteria appropriate to each principle, and the broad question that could be used to evaluate whether the student has learned.

(i) The problem-centred principle

Learning is facilitated when the learner:

- engaged in solving a real-world problem.
- engaged at the problem or task level, not just the operation or action level.
- solves a progression of problems.
- is guided through an explicit comparison of problems.

Question: Is the courseware presented in the context of real world problems?

*(ii) The activation principle (*activating pre-existing knowledge or motivational structures)

Learning is facilitated when the learner is:

- directed to recall, relate, describe, or apply knowledge from relevant past experience that can be used as a foundation for the new knowledge.
- provided relevant experience that can be used as a foundation for the new knowledge.

Question: Does the courseware attempt to activate relevant prior knowledge or experience?

(iii) The demonstration principle

Learning is facilitated when the:

- learner is shown rather than told.
- demonstration is consistent with the learning goal.
- learner is shown multiple representations.
- learner is directed to explicitly compare alternative representations.
- media play a relevant instructional role.

Question: Does the courseware demonstrate or show examples of what is to be learned rather than merely tell information about what is to be learned?

(iv) The application principle

Learning is facilitated when the:

- learner is required to use his or her new knowledge to solve problems.
- problem solving activity is consistent with the learning goal.
- learner is shown how to detect and correct errors.
- learner is guided in his or her problem solving by appropriate coaching that is gradually withdrawn.

Question: Do learners have an opportunity to practice and apply their newly acquired knowledge or skill?

(v) The integration principle

Learning is facilitated when the learner can:

- demonstrate his or her new knowledge or skill;
- reflect on, discuss, and defend his or her new knowledge;
- create, invent, and explore new and personal ways to use his or her new knowledge.

His “A Pebble-in-the-Pond Model” for instructional design is a content-centred modification of more traditional ISD; it implements the first principles of instruction that have been demonstrated to make learning more effective and efficient. By developing the content first, Pebble-in-the-Pond model is a more efficient development process. This approach results in instruction that works and it is consistent with the current view of requiring authentic experience in real-world problems.

3.4.10 The Dynamic ID model

The dynamic instructional design model proposed by Lever-Duffy and McDonald, (2008) comprises the following components:

- knowing the learners;
- stating the objectives;
- establishing the learning environment;
- identifying teaching and learning strategies;
- identifying and selecting technologies; and
- performing a summative evaluation.

A focus on teaching/learning strategies and instructional media need to match the learning outcomes in instruction (Rogers, 2002). For Lever-Duffy and McDonald, (2008), teaching strategies are the methods that teachers use to support students in attaining objectives and, learning strategies are the skills and activities that teachers would require students to engage in mastering the content. As Rogers (2002) noted, teaching strategies must allow learners to practise learning strategies. Different kinds of learning require different kinds of instructional strategies aimed at skills, cognitions and affects (Posner and Rudnitsky, 2001).

3.5 Pedagogical Models

The literature on Instructional Design Models identifies two types of models: *ID models* that describe development processes for designing learning experiences and *Pedagogical models* for supporting learning; however, there is some crossover between the two. All these models can be applied at several different levels, complete courses or programmes, stages, modules, individual or parts of teaching sessions. The important aspect is that they address not so much the content or context of the learning and its relation to the subject domain but how the learning is structured or organized. Some important pedagogical models are: Gagne's nine events of instruction, Keller's ARCS model, Reigeluth's Elaboration Theory, Merrill's 5 star instruction, Activity theory, Jonassen's constructivist learning environment, McAlpine's research-based model for designing learning as well as teaching that emphasises learner practice (McAlpine, 2004), ICARE[3] (Anagnostopoulo, 2002), and the 4D/IC model from van Merriënboer, Bastiens, and Hoogveld (2004).

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[3] The term ICARE is an acronym for Introduction, Connect, Apply, Reflect and Extend.

There are three types of strategies within these models/theories:

- **Organizational** strategies that deal with the way in which a lesson is arranged and sequenced.
- **Delivery** strategies deal with the way in which information is carried to the student, particularly, the selection of instructional media.
- **Management** strategies involve the decisions that help the learner interact with the activities designed for learning.

The salient features of the some most cited of these models/theories that have some bearing on this study are highlighted below. One of the most important of them is Gagne's theory and it was discussed in Section 2.7.1.1; though its emphasis is on cognitive information processing, it also has some relevance for constructivist learning environments and appropriate media selection.

3.5.1 Reigeluth's Elaboration Theory

Reigeluth's *Elaboration Theory of Instruction* (1999) is a cognitive prescriptive theory. According to it, instruction should be organized in a simple-to-complex, general-to-detailed, abstract-to-concrete manner for optimal learning. Another principle is that one should follow learning prerequisite sequence; it is applied to individual lessons within a course. For a student to develop from simple to more complex concepts, certain prerequisite knowledge and skills must first be mastered. This prerequisite sequencing provides linkages between each lesson as student spirals upwards in a course of study. As new knowledge and skills are introduced in subsequent lessons, they reinforce what is already learnt and become related to previously learned information.

A key concept of elaboration theory is that the learner needs to develop a meaningful context into which subsequent ideas and skills can be integrated. Elaboration theory proposes seven major strategy components in the design process: (1) an elaborative sequence, (2) learning prerequisite sequences, (3) summary, (4) synthesis, (5) analogies, (6) cognitive strategies, and (7) learner control.

The first component - elaborative sequence- is the most important phase in the design process. The elaborative sequence is developed through the following steps.

Step 1: Decompose the content into concepts, principles and procedures

Step 2: Sequence them according to their level of difficulty at macro level

Step 3: Sequence them according to their level of difficulty at micro level

Step 4: Provide comprehensive summaries

Step 5: Provide opportunities for students to integrate new information with their schema (i.e., use analogies, mnemonics, diagrams, or concept maps).

Step 6: Use encouragement verbs to motivate students' efforts.

Reigeluth's customised, learner-centred and social-contextual design theory has two components for facilitating human learning and development:

- *methods of instruction* which relate to the context in which learning can take place and
- *situations for learning* which effect the methods of instruction.

The model is illustrated in the following figure.

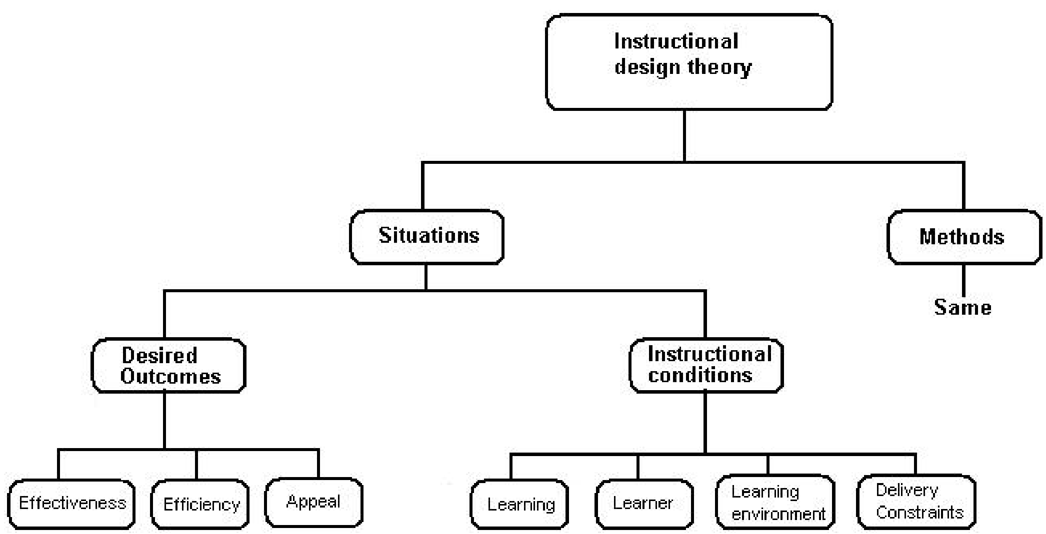


Figure 3.4: Reigeluth's elaboration theory

Reigeluth's elaboration theory is very appropriate for designing instruction, particularly for flexible learning environment. Sequencing of content is essential for effective teaching and learning. The selection of approaches and media are important and integral components of the sequencing process.

3.5.2 Keller's ARCS Model

John Keller (1983, 1987a, 1987b) developed a model called the ARCS model based on its acronym (*A*ttention, *R*elevance, *C*onfidence and *S*atisfaction) to assist educators in a systematic process for analyzing learner motivation and designing motivational tactics that are keyed to specific areas of motivational problems and integrated with teaching/learning strategies. According to him, there are four steps in the instructional design process: arousing interest (*Attention*), creating *Relevance*, developing an expectancy of success (*Confidence*), and producing *Satisfaction* through intrinsic/extrinsic rewards. Motivational intervention using the ARCS model can enable instructors to effectively and efficiently support for students' motivation. One of the main reasons students drop out of school is that they get easily bored with traditional approaches which are almost in the same way everyday.

a) Attention

Attention can be gained through *perceptual arousal* and *Inquiry arousal*. Perceptual arousal uses surprise, uncertainty or a provocative quote to gain interest. Inquiry arousal stimulates curiosity by posing challenging questions or problems to be solved. Once the interest has been aroused, it is essential to break up monotony and maintain it by varying the elements and methods of instruction (eg., lecture, video, group discussions, etc).

b) Relevance

Emphasize relevance of the new learning in learners' real life in order to increase motivation by using examples which the learners are familiar with, and to develop positive attitudes towards learning. Adults desire to be competent in matters that are valuable to them and necessary for their personal or professional growth and development.

c) *Confidence*

Ensure the learners are aware of performance requirements and evaluative criteria; it enhances their potential for success within the learning environment. Provide feedback and support for success. Learners should feel some degree of control over their learning and assessment. They should believe that their success is a direct result of the amount of effort they have put in.

d) *Satisfaction*

Satisfaction that is closely related to confidence is based upon motivation, which can be intrinsic or extrinsic. Provide opportunities to use newly acquired knowledge or skill in a real or simulated setting. Provide feedback and reinforcements that will sustain the desired behaviour. If learners feel good about learning results, they will be motivated to learn.

3.5.2.1 Elearning design implications of ARCS model

Keller's (1983) goal was to address the question of *how* to create instruction that would stimulate motivation to learn. The focus is not on how people can be motivated but on how the conditions can be created (i.e. to design elearning courses) to have people (i.e. users of elearning courses) motivate themselves. Table 3.4 presents an example of how the main constructs and sub-constructs of motivation to learn can be practically implemented for elearning design.

Table 3.4: Main constructs of Keller's model and elearning design

	Main Concepts	**Designer's question**	**Implementation of concepts**
ATTENTION	Perceptual Arousal	What design features can capture interest?	Create curiosity, wonderment by using novel approaches, injecting personal and/or emotional material
	Inquiry Arousal	How can the elearning design stimulate an attitude of inquiry?	Discussion topics, embedded questions
	Variability	How can the elearning design maintain attention?	Various content formats (multiple media, various assessments, simulations, etc.), concrete analogies, interesting examples
RELEVANCE	Goal Orientation	How can the elearning design best meet learners' need?	Examples, case studies, clear learning goals and objectives

	Motive Matching	How and when can an elearning designer provide learners with appropriate choices, responsibilities, and influences?	Make elearning design responsive to learner motives and values by providing personal achievement opportunities, collaborative-group activities, leadership responsibilities, and positive role models.
	Familiarity	How can an elearning designer tie the elearning course to the learner's experience?	Make the elearning content materials and subject matter concepts familiar by providing concrete examples and analogies related to the learner's work and responsibilities.
CONFIDENCE	Learning Requirements	How can the elearning design assist in building a positive expectation for success?	Establish trust and positive expectations by explaining the requirements for success and the evaluative criteria.
	Success Opportunities	How will the learning experience support or enhance the learners' beliefs in their competence?	Embedded self-tests, thought provoking questions, and simulations into the learning activities.
	Personal Control	How will the learners clearly know their success is based upon their efforts and abilities?	Use techniques that offer personal control (emphasis on a clear navigational strategy), and provide feedback that attributes success to personal effort.
SATISFACTION	Natural Consequence	How can the elearning design provide meaningful opportunities for learners to use their newly acquired knowledge/skill?	Provide problems and issues for further exploration, simulations, or real work examples that allow the learners to see how they can solve "real-world" problems.
	Positive Consequence	What will provide reinforcement to the learner's success?	Use positive feedback
	Equity	How can an elearning designer assist the learners in anchoring a positive feeling about their accomplishments?	Match tests and questions and other type of assessments with learning objectives

Source: Adapted from Keller, 1987a

A more thorough discussion regarding design (usability) attributes that may influence motivation to learn will follow in Section in 3.12.1.

3.5.3 The ICARE Model

ICARE is an acronym for Introduction, Connect, Apply, Reflect, and Extend. According to its main proponents (Hoffman and Ritchie, 1998), the ICARE framework is distilled from basic instructional design practice, adapting various systems or 'steps of instruction'. It is used by designers to develop effective online learning modules at a lesson level or micro level. It is partly design based and partly pedagogical. This is one of the important models that are used to sequence instructional events such as the ones advocated by Robert Gagne. Its five components are listed and explained in the following Table 3.5.

Table 3.5: Components of the ICARE Model

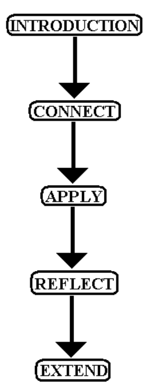
Introduction	This section introduces learners to what is to be learned in the unit. It is critical to make the introduction appealing and a memorable one. ➢ Context: ✓ A welcoming climate- add instructor's voice to enhance presence; ✓ An overview of the course- details of the material to be covered, a clear explanation about how the course materials are organized in the module, how the module fits in to the online course as a whole and an orientation of the entire course site; ✓ Use of threaded voice boards, voice-enabled email, embedded voice within course pages, as well as live group discussions and debates, which increase the interaction and learner engagement level of an online course. ➢ Goals/Objectives: Provide clear expectations: if expectations are set in advance, learners plan how to invest time and energy. According to Chickering and Gamson, "Expect more and you will get more." One way professors can communicate high expectations is by giving challenging assignments (Graham, Cagiltay, Lim, Craner, and Duffy, 2001). ➢ Prerequisites, a list of priorities, deadlines, and responsibilities ➢ Indication to the required study time ➢ List of essential reading material Clearly stated objectives are a must in this model for three reasons. First, to clarify learner expectations, second, to keep the module focused, and third, to reference later in evaluating student outcomes for the module. (Gagne's instructional events 1 and 2)

Connect/Content	Connect means presenting the subject matter of the session and it connects to the rest of the components such as reflection and application; the structure, look and feel, and content of class presentations are important. ➢ Present content on visually interesting screens/pages ➢ Information chunking (cognitive overload theory; it is difficult to listen to abstract discourse for long; simple syntax and vocabulary rather than long, subordinated sentences and technical jargon) ➢ Contextualize by relating course materials to real-world activities ➢ Elicit relevant prior knowledge ➢ Accommodate learners by presenting content in multiple formats and using varied instructional methods (eg., assignments, activities, timely feedback, use of technologies to optimize certain instructional activities, etc) to enhance visualization and comprehension. This can be further enhanced by using examples, illustrations, graphs, diagrams and visual analogies along with text in order to make unfamiliar things familiar or to paint mental pictures. All these enable listeners to retain information and grasp abstractions or highly conceptual material. ➢ Encourage active participation by students with the content and also teacher-learner as well as learner-learner interactions. (Gagne's instructional events 3, 4 and 5)
Apply	➢ Apply new knowledge and skills with practical activities. ➢ Activities may include: exercises, interactive and collaborative activities, etc. ➢ Engage students in an active learning process with real-world problem(s) relevant to the academic needs of the course. ➢ May be on- or off-line activities. (Gagne's instructional event 6)
Reflect	➢ Provides time and space for learners to reflect on their acquired knowledge and articulate their experience. ➢ Helps students to organize their thoughts about what they have just learned by providing an opportunity for them to discuss and expand on the information. This can be done in several ways. ➢ May include topics for discussion, a learning journal/log, a concept map, a self test, an end-of-unit test, etc. (Gagne's instructional events 7 and 8)
Extend	➢ Provides enrichment activities (e.g., links to web sites that the teacher thinks will be helpful) for students who have mastered the content and want to learn more on their own, and alternative resources or remediation exercises for those who have not or struggled through a topic. Further, a

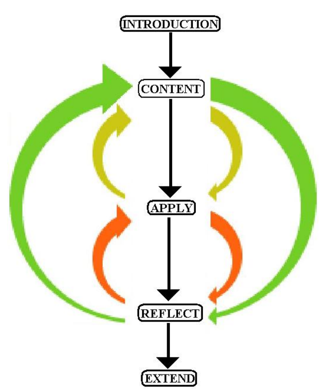
	good conclusion and glossary are part of a clear organizational structure; they should include summaries, explicit transitions to the next session/ module, repetition of key words and phrases. ➢ **Evaluates** in two ways. First, based on original objectives, what have students learned? One way to evaluate this is by giving students an online test or quiz. Second, evaluate the module itself for design, navigation, and content. Can it be made better? (Gagne's instructional event 9)

A modified version of ICARE as adapted by Middlesex University (Mojab and Huyck, 2001) illustrated in Fig 3.1 (MDX-ICARE) assumes a less linear progression through the five sections. For clarity, the "Connect" phase has been changed to "Content". This model encourages close links between the 'connect', 'apply' and 'reflect' sections making it possible for students to engage in intermittent activities and make learning an active rather than a passive process.

The adapted model as shown below gives flexibility to learners regarding the management and organization of learning and instruction; they could follow the suggested navigation path by following the links in the content or move in and out of sections depending on their needs, thus have multiple learning paths. The activities are often linked to the Apply component of the unit (see Figure 2).



ICARE original model



MDX-ICARE framework

Figure 3.5: The ICARE Model

This model affords pedagogical approaches that can provide a well-balanced rich learning experience with regard to teacher-learner and learner-learner interactions, and is beneficial in a blended learning environment. For example, if the focus on the 'connect/content' area it implies a didactic approach and if on the 'apply' and/or 'reflect' sections then it is more likely a constructivist approach whereby the instructor acts as a facilitator of learning. ICARE model provides a systematic, yet iterative approach to development of learning situations and can increase the possibility of learning taking place.

3.5.4 The ASSURE Model

The ASSURE model is a six-step instructional guide for planning and delivering technology-supported lessons with great focus on addressing learner needs. This model assumes that instruction is not delivered using lecture only. It will be especially helpful for instructors designing online courses. The model emphasizes:

- teaching students with different learning styles, and
- constructivist learning where students are required to interact with their environment and not passively receive information.

ASSURE is an acronym for the description of six classroom procedures central to the informed selection and use of educational technology. It highlights six classroom procedures: **A**nalyze learners, **S**tate objectives, **S**elect methods, media, and materials, **U**tilize media and materials, **R**equire learner participation, and **E**valuate and revise. The ASSURE model incorporates Gagne's events of instruction to ensure effective use of media in instruction.

Strategy	Description
Analyze learners	General characteristics - grade, age, ethnic group, sex, mental, emotional, physical, or social problems, socioeconomic level, and so on. Specific entry competencies - prior knowledge, skills, and attitudes. Learning styles - verbal, logical, visual, and so on.
State objectives / learning outcomes	The learning outcome may be primarily: Cognitive, Affective, and Psychomotor / Motor Skill
Select / modify instructional methods, media,	Choosing and using educational technology or media is a deliberate process, dependent for its success on having clear goals, and a rational and thoughtful method for matching characteristics with expected

and materials	outcomes. Select the: ➢ Instructional method (e.g., a lecture, group work, a field trip, etc.) that is most appropriate to meet the objectives for the particular group of students. ➢ Materials relevant to the objectives. You can create your own materials or existing materials might be adopted and used as is or they might be adapted with suitable modifications. **Media selection** ➢ Media should be selected on the basis of instructional method, objectives and student needs. ➢ Students should have easy access to the selected media. ➢ Must be appropriate for the learning objectives and teaching format. ➢ Should be consistent with the students' capabilities and learning styles. ➢ No single medium is the total solution. ➢ Tutors and students should have the skills to use it.
Utilize media and materials	In order to utilize the media and materials listed above: ➢ Always preview the materials before using them and also use the media tools in advance to be sure it works. ➢ Don't assume that technology will always work, be ready with alternative plans. ➢ Prepare the learners: Give the students an overview, explain how they can use it and how they will be evaluated during the course.
Require learner participation	➢ Use strategies to get all students actively and individually involved in the lesson. ➢ Incorporate questions and answers, self-assessments, discussions, group work, hands-on activities, and other ways of getting students actively involved in the learning process. ➢ Make sure that all students have opportunity to engage in the learning activities. ➢ Focus on student learning as opposed teaching them. ➢ Provide opportunities to manipulate the information and allow time for practice during the demonstration of the skill.
Evaluate and revise	➢ Involve evaluation student performance, media components and instructor performance. ➢ Reflect upon the stated objectives, the content, the instructional strategy, motivational strategies, the learning activities, the assessment, the time available to the students to study the content, and determine if they were effective or revise them until your students become successful learners;

3.5.5 The Mayes' Pedagogical Framework

Mayes (2002) identifies three stages of learning and represents them as a learning cycle. This framework makes it easy to map stages of learning onto categories of elearning. It addresses conceptual learning rather than skills acquisition. Each stage directs attention to an aspect of pedagogy: the analysis of what is to be learned, the tasks that will enable the intended outcomes to be achieved through feedback and reflection, and the situating of these outcomes through dialogue with tutors and peers. The emphasis is on dialogue and engagement with peers.

The three stages in the learning cycle are: Conceptualisation, Construction and Application.

Conceptualisation refers to the users' initial contact with other peoples' concepts. This involves an interaction between the learner's pre-existing framework of understanding and a new exposition.

Construction refers to the process of building and combining concepts through their use in the performance of meaningful tasks. Traditionally these have been tasks like laboratory work, writing, preparing presentations etc. The results of such a process are products like essays, notes, handouts, laboratory reports and so on.

Application refers to the testing and tuning of conceptualisations through discussion, argument and reflection used in applied contexts. In education, the goal is testing of understanding, often of abstract concepts. This stage is best characterised as *dialogue* in education. The conceptualisations are tested and further developed during conversation with both tutors and fellow learners, and in the reflection on these.

One of the strengths of the Mayes' pedagogical framework (Mayes and Fowler, 1999; Mayes, 2002) is that it focuses on the design process and the applications of technology in order to make the learner think, thus targeting the main focus of the educational process.

3.5.6 The Seven Principles for Good Practice in Online Courses

The "seven principles of good practice in undergraduate education," originally framed by Arthur Chickering and Zelda Gamson in 1986, is a concise summary of educational research findings about the kinds of teaching/learning activities most likely to improve learning outcomes. The concept of interaction is a core element of the seven principles of good practice in education. Given below are the seven self-explanatory principles.

(i) Encourages contact student-faculty contact

(ii) Develops reciprocity and cooperation among students

(iii) Encourages active learning

(iv) Gives prompt feedback

(v) Emphasizes time on task

(vi) Communicates high expectations

(vii) Respects diverse talents and ways of learning

Though these principles seem like good common sense, they rest on 50 years of research on the way teachers teach and different kinds of students learn, how students work and play with one another, and how students and instructors talk to each other.

Since the formulation of these principles, new technologies have become major resources for teaching and learning in higher education. Chickering and Ehrmann (1997) assert that, if the power of these technologies is to be fully realized, they should be employed in ways consistent with the seven principles. They provide various ideas, and cost-effective and appropriate ways on the TLT Group Website[4] on how to use technology to help improve the process and results of higher education.

Graham, Cagiltay, Lim, Craner and Duffy (2001) from Indiana University's Centre for Research on Learning and Technology (CRLT) used the seven principles as a general framework to evaluate four online courses at the Midwestern University. Their evaluation strategies focussed on analyses of the online course materials, student and instructor discussion-forum postings, and faculty interview outcomes. Subsequently, they generated a list of "lessons learned" for online instruction that correspond to the original seven principles, and they are discussed below:

Lesson derived from Principle 1: *Instructors should provide clear guidelines for interaction with students.*

[4] http://www.tltgroup.org/seven/Library_TOC.htm. Accessed 28 Feb 2009.

To avoid getting overwhelmed with email messages or discussion board postings, set clear expectations for instructors' *timelines* for responding to messages.

Lesson derived from Principle 2: *Well-designed discussion assignments facilitate meaningful cooperation among students.*

Guidelines for encouraging meaningful participation in asynchronous online discussions include the following:

- Learners should be required to participate (and their grade should depend on participation);
- Discussion groups should remain small;
- Discussions should be focused on a task;
- Tasks should always result in a product;
- Tasks should engage learners in the content;
- Learners should receive feedback on their discussions;
- Evaluation should be based on the quality of postings (and not the length or number);
- Instructors should post expectations for discussions.

Lesson derived from Principle 3: *Students should present course projects.*
Students learn valuable skills from presenting their projects and are often motivated to perform at a higher level. They also learn a great deal from seeing and discussing their peers' work. They critique and make further comments about the project work. After all students had responded, the group leader consolidates the findings and posts his the outcome that may include new insights gained from peers. At the end of all presentations, the instructor provides an overall reaction to the cases and specifically comment about issues the class identified or failed to identify. In this way, students learn from one another as well as from the instructor.

Lesson derived from Principle 4: *Instructors need to provide two types of feedback: information feedback and acknowledgment feedback.*

Information feedback provides information or evaluation, such as an answer to a question, or an assignment grade and comments. For example, the instructor may send an email acknowledging that he or she has received a question or assignment and will respond soon. Just as the role of eye contact in face-to-face approach to indicate that the instructor has heard a student's comments, acknowledgement feedback involves purposeful effort to imply that the assignment has been received and it would be attended soon as well as the tutor's interest for each student.

Lesson derived from Principle 5: *Online courses need deadlines.*

Deadlines encourage students to spend time on tasks and help students with busy schedules to avoid procrastination. They also provide a context for regular contact with the instructor and peers.

Lesson derived from Principle 6: *Challenging tasks, sample cases, and praise for quality work communicate high expectations.*

Communicating high expectations for student performance is essential. One way for instructors to do this is to give challenging authentic assignments. Provide examples of work or interactions expected of the students. Also, publicly praising exemplary work communicates high expectations. Instructors do this by calling attention to insightful or well-presented student postings.

Lesson derived from Principle 7: *Allowing students to choose project topics incorporates diverse views into online courses.*

Students should be allowed to research their own issues of interest, and to shape their own coursework by choosing project topics according to a set of guidelines, rather than being assigned by the tutor. Instructors can provide guidelines to help students select topics relevant to the course while still allowing students to share their own perspectives.

The seven principles and the lessons learned from them formed one of the basis or a benchmark for the development of the two evaluation tools developed and used in this study.

3.5.7 Blended Learning Models

There are a number of conceptual frameworks for blended learning solutions, but they all comprise more or less the same pedagogic elements as discussed in Section 2.4.2. In his description of a blended course, Boyle (2005) advocates for a pedagogically driven model where every element of the blend is justified according to the course outcomes and needs of the learner.

Twigg (2003) examined efforts of different higher education institutions in the United States of America to redesign instruction using technology to achieve quality enhancements as well as cost savings. He examined thirty projects in multiple disciplines and identified five distinct course (re)design models based on their design, similarities and differences. These are supplemental, replacement, emporium, fully online, and buffet models. A key difference between each of these models is the nature and extent of technology integration. They can be placed on a continuum from fully face-to-face to fully online interactions with students as shown below.

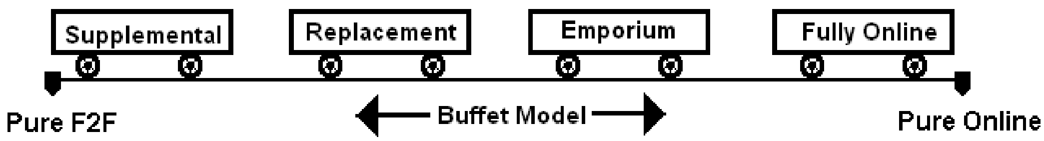


Figure 3.6: Pure F2F - elearning continuum

The Supplemental model retains the basic structure of the traditional face-to-face courses, with occasional use of some technology applications (e.g., PowerPoint presentations and flash animations) to supplement traditional approaches in order to encourage greater student engagement with course content. However, this has limited pedagogical benefits. The Replacement model advocates replacing (rather than supplementing) face-to-face lectures with online, interactive learning activities for students. This brings a reduction in class-sitting time. The argument is that certain activities, in relation to the desired learning outcomes, can be better accomplished online on an anytime, anywhere basis either individually or in small groups than in a classroom setting. The Emporium model eliminates all class meetings and replaces them with specialised learning resource centres that provide online materials and extensive on-demand personalized support. These centres have specialized spaces or rooms and equipment such as workstations for individual tutorial activities and have provision for students to avail these at their own convenient time.

The Fully Online model adopt many of the design principles used by the supplemental, replacement, and emporium models described above with a focus on improving student performance. Web-based materials are used largely as supplemental resources rather than as substitutes for direct instruction. The tutor must be responsible for all interactions, personally responding to students' every query, comment, or discussion. This means that tutors often spend more time teaching online and interacting with students than is the case in classroom teaching. Student can work at their own pace on any particular topic and can take the end-of-module quizzes as soon as they are ready. The software also provides a built-in tracking system that allows the tutor and the course assistant to know every student's status.

The Buffet model recognises each student with unique characteristics, rather than treating all students as if they were the same. It offers each individual student a customised learning environment and learning paths that suit their different learning styles, needs, preferences, abilities and tastes at each stage of the course.

Of these five models, the most commonly used one is the buffet model because it treats students as individuals rather than homogeneous groups. Individual students learn in different ways; most students need strong human interaction and there are also students who prefer to study independently without interacting with others. Therefore, the right way to design a high-quality blended learning course depends largely on the type of students involved. The buffet menu offers a range of possible pedagogical choices such as lectures, laboratories, small group sessions, multimedia tutorials, and online resources with opportunity for increased interactivity, engagement and flexibility such that students get meaningful learning experience.

As teachers' experience with new technologies continues to develop, and organizational support and access to technology continues to grow, it becomes possible to move the practice from purely face-to-face end to the other end of the continuum.

Three other important models discussed below are the Kerres and De Witt's model, Garrison and Vaughan's CoI Model, and Moshinskie's Model.

(i) Kerres and De Witt's Model

Kerres and De Witt (2003) offer a '3C-didactic model' which comprises three elements which can be delivered in different formats using appropriate media. According to them, any learning environment consists of three components:

- a *content* component that makes learning material available to learners;
- a *communication* component that offers interpersonal exchange between learners or learners and the tutor; and
- a *constructive* component that facilitates and guides individual as well as cooperative learning activities to actively operate on learning tasks (or assignments) with different degrees of complexity (from multiple-choice to projects or problem based learning).

Each of the 3 C's can lead to different levels of learning on Bloom's taxonomy as shown below.

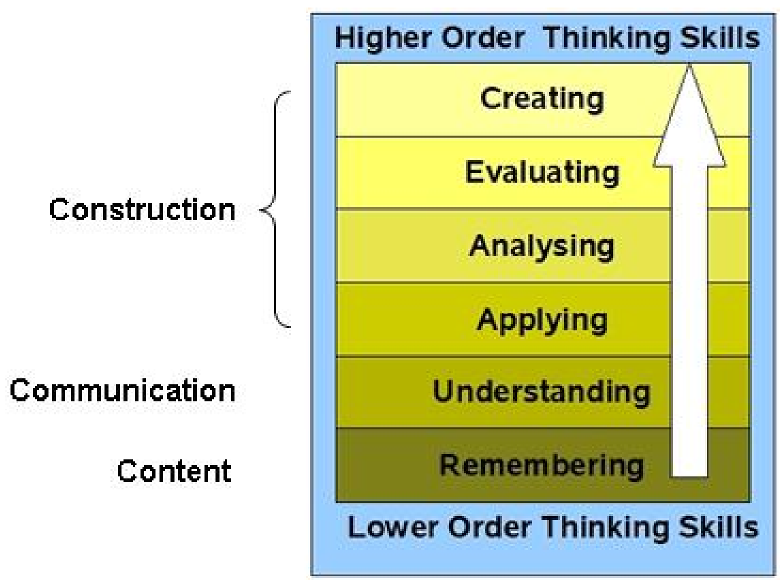


Figure 3.7: 3C- Didactic model and Bloom's taxonomy

Content would dominate if the knowledge to be learned consists of facts to be recalled, and this is around the lowest level of Bloom's taxonomy. In addition, the content component may comprise (Kerres and de Witt, 2003):

- information and knowledge that can be communicated by media; and
- a prerequisite for other learning activities.

The communication component seems necessary when:

- the knowledge reaches a certain complexity;
- a deeper understanding of a theoretical framework is required;
- the knowledge consists of different competing concepts;
- students should learn to formulate, express and discuss a personal point of view;
- students should learn to participate in discussions, to formulate and receive feedback in discursive settings.

The construction component will be included if:

- knowledge is to be applied (and not only to be recalled);
- the knowledge consists of procedures (and not only of declarative knowledge) that require practice;
- the content includes "fuzzy" knowledge.

Each of these components can be delivered using different media. The relative weight of the three components can vary depending on the nature of the problem or content. All components should be included in order to give learners rich learning experience; however, their proportion should be adjusted to help learners achieve their particular learning goals and objectives. The specification of learning objectives usually helps to define the relative weight of the three components. For example, if the learning objectives primarily consist of the acquisition of information and basic knowledge then the more emphasis is on the 'content' than on the other two components.

The initial design steps peculiar to this model are:

a) List learning objectives;
b) Classify each according to three components;
c) Determine how much of the course will be devoted to each type of component;

d) Break down your content;

e) Identify the delivery method (online versus face-to-face).

In terms of the medium of delivery, they recommend that it should match the learning task.

(ii) Garrison and Vaughan's CoI Model

Garrison and Vaughan (2008) proposed a comprehensive framework which is an application of the Community of Inquiry (CoI) concept in a blended learning setting. Their educational ideal is of an "engaged community of inquiry" (p.10) based on reflection and discourse which is created through social, cognitive and teaching presences (p.18). They have offered the following seven blended learning (re)design principles:

i) Plan to establish a climate that will encourage open communication and create trust;

ii) Plan for critical reflection, discourse, and tasks that will support systematic enquiry;

iii) Sustain community by shifting to purposeful collaborative communication;

iv) Encourage and support the progression of enquiry;

v) Manage collaborative relationships to support students in assuming increasing responsibility for their learning;

vi) Ensure that enquiry moves to resolution and that metacognitive awareness is developed;

vii) Ensure assessment is congruent with intended learning outcomes.

The Community of Inquiry (CoI) framework has become a prominent model of teaching and learning in online and blended learning environments. This framework is valuable because it is derived from a body of substantive research and has had some empirical evaluation.

(iii) Moshinskie's Model

In this motivational model presented in the white paper, *How to Keep E-Learners from E-Scaping*, in 2001, Moshinskie focussed on improving learner motivation before, during, and after online courses through the following strategies.

A summary of these techniques is provided below.

Before the Online Course	During the Course	After the Course
✓ Know the intended learner ✓ Know the work environment ✓ Match learners' values and motives ✓ Prepare the work environment ✓ Apply both push and pull strategies ✓ Include non-instructional strategies ✓ Provide a learning portal	✓ Create a conducive environment ✓ Chunk the information ✓ Build on the familiar ✓ Vary the stimulus ✓ Give legitimate feedback ✓ Provide the human touch ✓ Provide a social context ✓ Build opportunities for fun ✓ Make it timely ✓ Stimulate curiosity	✓ Celebrate successful completion of the training ✓ Provide support when the learner returns to the workplace ✓ Reinforce the learning ✓ View elearning as a process not an event ✓ Measure motivation to transfer ✓ Investigate the meta-cognitive strategies

3.5.8 Project- and Problem-based Learning

(i) Project-based learning

Project-based learning engages students' self-directed investigation of real-world cases which results in the construction of meaningful solutions and knowledge. This approach is feasible with courses with goals requiring less lecturing and more student engagement. The general model of problem-based learning (PBL) was developed in medical education in the 1950s (Savery and Duffy, 1996, pp. 135-148). Today many professional programs such as business administration, education, health science, and social work rely heavily on collaborative learning as a technique for group problem solving (Picciano, 2009).

PBL has a constructivist framework, but can also occur outside constructivist learning environments. PBL contributes to the intrinsic motivation of learners as they are engaging in real life problems that are useful and relevant to them.

In the PBL approach, students work together in small groups to solve problems; the goal is to share, challenge, and form alternative viewpoints. It engages students' interest, motivates them to learn and helps them retain the information they learn. With project-based learning, either teachers choose a real-world project, problem or a case, or encourage students to generate it and to develop strategies to solve it; in the process of finding a solution, students naturally interact or make connections to the world beyond school, in order to drive their learning needs. Other advantages are that:

(i) it makes students learn how to organise and to manage time appropriately, and how to apply previously acquired knowledge and experience to accomplish the project;

(ii) the project encourages students to work collaboratively to seek information and solutions to realistic problems;

(iii) it improves students' interpersonal, communication, and problem solving skills, and thus enhances their learning process.

Land and Greene (2000) identified metacognition, domain knowledge, and system knowledge as the critical success factors in project-based learning.

(ii) Problem-based learning

Problem-based learning (PBL) is organized around problem solving, rather than around subject matter; it is based on the complex problems encountered in the real world. Students are presented with a problem to tackle on their own, but collaboratively. It is a motivating way to learn, and is a learner-centered educational method**.** Learners are involved in working with real problems and what they have to learn in their study is seen as important and relevant to their own lives. Students are not given any particular method on how to study with a problem-solving approach. They should determine independently how to meet the learning goals and what resources to use, approaching problems from various perspectives and contexts. When they analyze problems, they can engage in concept mapping or the manipulation of ideas as a means of understanding concepts and their relationship. They may use and at the same compare different ways to solve a problem (Vanderbilt University, 2009) based on their prior knowledge; it helps them become more flexible problem solvers, and develop personal meaning and understanding more effectively. The end result may be the same for two learners but the process of internalising the knowledge will be different because of their differing backgrounds.

The teacher's role is to support students in their critical thinking skills, self-directed learning skills, and content knowledge in relation to problems. Problem-based learning encourages active construction of knowledge through personal inquiry as well as social negotiation and work with peers (Oliver, 2000, p.6).

Learners improve their problem-solving skill when they engage in real-life problems and realistic problem-solving processes. PBL challenges students to develop the ability to think critically, analyze problems, find and use appropriate learning resources. According to Merrill (2002) the most effective learning environments are those that are problem-based. Using Problem-based Learning (PBL) as an instructional methodology, Savery and Duffy (1996, pp. 135-148) derive a set of eight instructional principles (vide Section 3.9.5).

The greatest benefit of blended learning design is the increase in both interaction and meaningful problem solving. The underpinning thesis of PBL is that students learn best when deeply engaged in a topic, actively exploring and searching for new knowledge, and acquiring new skills to solve the problem at hand. Students are progressively given more and more responsibility for their own education and become increasingly independent of the teacher for their education. Problem-based learning is well articulated in the research literature of instructional models and documented (e.g., Schank, Berman, and Macpherson, 1999; Jonassen, 1999; Savery and Duffey, 1996; van Merriboer, 1997; and Merrill, 2002).

3.6 Summary of Features and Criticisms of ISD Models

The analyses of various ID models showed that even though each model had some differences, they were all basically similar in their need to provide certain components that are common to instruction. Only the components were known in different names or several steps of one model were clubbed together into one step of another; however, they were all attempting to create effective instruction.

Traditional ID community holds an objectivist world view, based on the premise that the purpose of instruction is to transfer objective information and impart knowledge. Some of these traditional models, the design process is top-down, linear, systematic, prescriptive (Braden, 1996; Wedman and Tessmer, 1993), strongly objectivist in nature (Jonassen, 1999) and cumbersome for the real-life instructional design situations as learning is not always linear.

Common to all the traditional instructional design models is the notion of a 'classroom' setting. Further, learning activities focus on the skills to be learned and are presented under the best conditions for learning; thus, educators can focus on the needs and abilities of the individual learner resulting in the development of effective learning activities. Traditional design models prescribe rigid methods regardless of the contextual differences in that it assumes each learner learns in the same way; as a result, strategies prescribed by the teacher expect every learner to learn the same thing in the same way at the same time in the decontextualized classroom environment. According to advocates of the systems approach, this approach to instructional design is effective because it forces educators to pay careful attention to what it is that is going to be learned (learning objectives) and what must already be known prior to the learning transactions (Dick et al., 2005; Smith and Ragan, 2005).

However, the majority of the traditional ID models (e.g., Dick, Carey and Carey, 2005; Morrison, Ross and Kemp, 2004) were criticised for being process-oriented rather than people-oriented, and for having a bureaucratic and linear nature within a clumsy process (Zemke and Rossett, 2002; Gordon and Zemke, 2000; You, 1994). Deubel (2003) reports that according to some critics the systems approach is too focused on specific objectives and therefore he argues that explicitly stated objectives may limit students' ability to use information in situations that are not similar to those in which initial learning occurred; further, it may not help learners develop higher level thinking .

Although it is a valuable approach particularly for teaching concepts, procedures, and basic knowledge in relatively structured knowledge domains, it is not generally flexible and adaptable in solving loosely or even ill-defined problems because much of what must be learned entails advanced knowledge in complex, ill-structured domains, where behaviour cannot be predicted, nor acceptable performance can be precisely defined.

The assumption that each learner learns in the same way, at the same rate and has similar needs is challenged by Reigeluth (1999). He argues that the traditional paradigm of training and education based on standardisation (which entails teaching a large group of learners the same content in the same amount of time) may be a model for efficiency but not effectiveness." (p. 9). He stresses the need for a shift from standardization to customization, which is an attempt to make possible a unique learning experience for each learner, rather than trying to produce a single, clearly-defined outcome for all learners.

Jonassen *et al.* (1997, p. 28) further criticise the positivist basis of ID models. This basis in positivism has led to certain fundamental assumptions by ID about learning situations.

- Learning situations are closed systems.
- Knowledge is an object which can be "put into" a learner (i.e. it is the instructor's responsibility).
- Human behaviour is predictable.
- Processes in the educational setting can be understood according to the laws of linear causality.
- Certain interventions determine certain outcomes.

The view that human behaviour is predictable is often untenable. Winn (1997) advances the following four arguments against the predictability of human behaviour:

- All individuals are different.
- Learners' metacognitive abilities mean that they can choose to use different methods of learning; this means that it is impossible to predict which method is best, and what outcomes will be achieved.
- The learning environment is very important in determining the outcome. The designer can never predict what all learning contexts will be like, and so cannot predict the learners' behaviour.
- People do not think logically. The designer cannot predict the lack of planfulness of the learner, and so cannot use a linear, predictable plan to design the learning programme.

However, with the proliferation of technology into educational environments, the concept of 'anytime, anyplace, anywhere learning' and a re-conceptualisation of the classroom are necessary. Learning environments no longer need to be a specific geographical location with student access during fixed periods on prescribed days. The emphasis is now on learning rather than on instruction and performance. Further, the traditional view of technology's role as a content delivery 'wagon' is changing to that of a cognitive tool to promote learning. All these mean that selection of strategies and even of content cannot be pre-determined by the designer or the teacher; it should evolve as learning occurs. By shifting instructional decisions to the time of delivery, the design of instruction is re-integrated with its implementation.

Traditional way of learning does not necessarily occur in authentic environments or through dialogue among the students or between students and the teacher. Knowledge and skills needed for higher order skills including analysis, evaluation, and problem solving but not explicitly related to an authentic environment remains inert and is not readily available for application or transfer to novel situations (Butterfield and Nelson, 1989). Thus, the traditional ID models are unlikely to instil in learners the type of skills required to live and prosper in today's information age and knowledge economy.

Due to the foregoing problems with traditional ID models, it is essential to have alternative models based on flexible approaches to support new possibilities for active learning because today's learners are no longer passive recipients and reproducers of information. Further, the learners should be prepared for the diverse and complex real world. As a result, ID theory needs to move in the direction of flexibility, customisation and learner-empowerment if it is to allow the field of ID to keep up with technological changes. Instructional approaches are becoming more learner-centred: "recursive and non-linear, engaging, self-directed, and meaningful from the learner's perspective" (McCombs, 2000, p. 1).

Kozma (2000) argues, 'Real world educational technology research and development demand a shift in focus from the design of instruction to the design of learning environments (p.13). The following sections examine the design possibilities beyond the traditional approaches.

3.7 Beyond Traditional ISDs

The concerns about traditional design models and the growing influence of postmodernism in academic culture prompted researchers to spend the last decade attempting to outline explicit guidelines on the design of learning environments that foster constructivist learning. By the mid-1990s, constructivism started impacting on educational practice with the emergence of constructivist design models. For example, in 1995 Prof. Jerry Willis, the Director of Center for Information Technology in Education, University of Houston, described the first version of an ID model based on constructivist learning theories and an interpretivist philosophy of science. Instructional models based on the social constructivist perspective stress the need for collaboration among learners and with practitioners in the society (Lave and Wenger, 1999; McMahon, 1997). The Researcher wants to argue that similar collaboration is critical to materialise the dream of technology-enhanced blended learning designs. However, it has to be noted that although constructivist views to student learning were initially exciting to educators, it fell short in proposing practical approaches.

3.8 Exploring the core foundations of the grounded design in the study

The overall goal of this study is to develop a blended learning environment that supports the formation of an online community to engage students in active learning. According to Hannafin, Hannafin, Hooper, Rieber, and Kini (1996), learning systems are founded on psychological, pedagogical, technological, cultural, and pragmatic considerations. For a learning system to be effective, these five foundations must be aligned so as to maximize shared functions. Learning environments are examined with respect to the five foundations of the grounded design framework as discussed in the following sections.

Practitioners of grounded design recognize the value of various approaches and perspectives, synthesizing across and recognizing distinctions between, different theoretical perspectives on learning (Hannafin et al., 1996). Grounded design can be applied to any learning theory platform as well as cross-platform, because it does not promote any single theoretical stance or practical methodology over another, but aims for alignment of the underlying principles and practice of learning with related research. In other words, these five foundations can be applied to both instructionism and constructivism.

(i) The psychological foundations

Psychological foundations reflect views about how individuals acquire, organize and deploy skills and knowledge (Land and Hannifin, 1996), or make general descriptive statements about how people think, process information, and learn new ideas and concepts. It is largely media-independent. This foundation is based on research and theory on meaningful learning. Learning theories have evolved from psychological studies and have changed in response to, and because of, advancing theories of cognitive development (Ertmer and Newby, 1993).

The psychological foundations of instructionism generally suggests and promote that knowledge in a domain starts with declarative factual knowledge (*what*), and is followed by procedural knowledge (*when* and *how*) which requires automatic operation of the existing declarative knowledge. The psychological foundations of constructivism are theories such as situated cognition and socially shared cognition. These concepts promote learning in realistic, complex contexts that use knowledge and skills in appropriate situations. As stated in the theoretical framework, this study is supported by both instructivist and constructivist epistemological assumptions.

(ii) The pedagogical foundations

Pedagogical foundations include the instructional practices that the designers use to support learning. Pedagogical foundations emphasize how information is conveyed to learners and focus on the activities, methods, and structures of the environment that are designed to facilitate learning (Land and Hannifin, 1996). The pedagogical foundation is based on research, theories of instruction, and teaching strategies.

These two foundations (the psychological and pedagogical) are highly consistent with one another. Taken together, they reflect underlying beliefs about the nature of learning, the methods and strategies employed, and the ways in which the learning environment should be organized and made available to the learner. For example 'behaviourist theories' (such as instructivism) where the focus is on stimulus-response and observable learning outcomes maps well to technologies which enable trial and error and adaptive responses – such as e-assessment tools. In contrast, a range of asynchronous and synchronous communication tools provide ample opportunities for dialogue, a key element to pedagogies based on socio-constructivist principles, where the emphasis is on co-construction of knowledge.

As discussed under the theoretical framework, this study is underpinned by approaches to teaching and learning ranging from an instructivist to a constructivist pedagogical philosophy, yet the overall instructional environment is maintained to be learner-centred which is the key tenet of constructivism. The two beliefs may be represented along a continuum as illustrated in Figure 3.8 below. The assumption made in this study is that the two beliefs can complement each other in a hybrid instructional context as it is that of UB. Thus, it is a walk between the two worlds (tradition and emergence) while making systemic changes to the teaching and learning environment. The Reseracher’s position is that learning situations and the nature of knowledge are varied, and for a holistic approach to learning, there is need to accommodate learning situations that clearly contain elements of both beliefs. Instructionism is often a more efficient means of imparting standard knowledge.

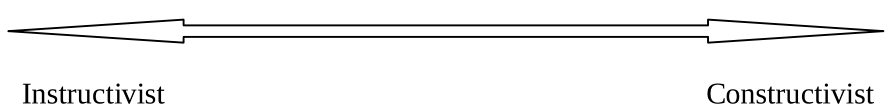


Figure 3.8: Pedagogical philosophy

In this approach to curriculum development, a variety of learning opportunities enriches the curriculum by accommodating individual learners and achieving learning outcomes through multiple perspectives. It is a way of building a curriculum that progressively shifts from transmissive or instruction-based pedagogy to the transactive and transformational learning that characterizes the active learning pedagogy of the learner-centred paradigm. For example, pre-determined, constrained, sequential, criterion-referenced instructional design is most suitable for introductory learning while constructivist approaches are more appropriate for advanced knowledge acquisition (Mergel, 1998). Methods consistent with constructivist foundations and assumptions typically emphasize teacher-student or student-student interactions and social discourse to support student-centred, collaborative, reflective and resource-based learning of progressively complex concepts. Pedagogical approach consistent with constructivism are anchored instruction, which embeds learning in a holistic and realistic context that supports ill-structured problems, and an apprenticeship model that provides scaffolding and coaching in knowledge, heuristics, and techniques in the context of authentic tasks.

(iii) The technological foundations

The technological foundation addresses the potential of technology to transform teaching and learning, the capabilities of specific technology tools, and the limitations of interactive multimedia technology. Land and Hannafin (2000) contend, "… technology can control the pacing and chunking of information where cognitive load limitations are assumed…" The presentation of content in well structured multimedia format enables to reduce the cognitive load and enhance the cognitive processing. In constructivist practice, learners assume a high degree of control over their learning process. In this context, learners use technology as a tool to explore and manipulate resources, and to integrate knowledge in the process of problem solving or meeting personal learning goals. As advances in technology offer new opportunities for learning, it is important to use a range of theoretical perspectives to optimize use of new technologies in teaching and learning (Wild and Quinn, 1998).

In this study, WebCT provides the technology platform; its synchronous and asynchronous communication tools with their interactive and collaborative features. WebCT has provision for self assessments which help students to monitor their own progress through the course. Most of these technology foundations are addressed under psychological and pedagogical foundations as technological foundations link both these foundations.

(iv) The Cultural Foundations

The major tenets of technology-enhanced learning are collaboration, and sharing through community building. Cultural foundations reflect the prevailing values of a community and its culture. Cultural considerations play a role when academic communities tackle far reaching issues - establishing standards and setting priorities - and in so doing, are influenced by their beliefs about learning, technology, or pedagogy.

Students in a technologically enhanced learning environment form a cultural community as they interact in synchronous and asynchronous forums. They share meanings that they make of the learning material, common interests, ideas, and feelings; these social exchange processes help build a sense of trust and respect among community members (Lally and Barrett, 1999). This can help students develop a need for working collaboratively, a sense to support fellow beings in their needs, and thus, prepare themselves for life, work and citizenship, and further, develop certain foundation skills that are not found in curriculum.

The above discussion is based on the view that instructional technology is culturally neutral when it comes to the design of instruction. However, since knowledge then is socially mediated and all socialization is grounded in culture, recent research shows that culture has an enormous impact on how knowledge is conveyed, received and attained (Thomas, Mitchell and Joseph, 2002). According to these researchers, this view calls for a move in the instructional design approach from a *systematic to systemic* methodology whereby in a systemic system, practitioners would use a more integrated, holistic, multi-directional approach to instructional design in order to deliver more culturally sensitive programmes to an increasing global audience.

(v) The pragmatic foundations

Whereas technological foundations indicate what is possible technologically, pragmatic foundations dictate the extent to which various alternatives can be implemented in order to address the needs of learners in a given learning system. The evaluation instrument has items that attempts to examine how both the blending approach is effective and how learning environment has effectively addressed the research question and the complementing aspect of the two generally opposing pedagogical philosophies. The use of instructivist and constructivist approaches in a single study like this one is a pragmatic approach for a holistic approach to learning, and to create a realistic teaching and learning environment.

3.9 Constructivist views and principles of designing learning experiences

Although there are diverse views on what the term ‘constructivism’ means, they tend to share the following beliefs:

(i) Learning is an active process of constructing rather than acquiring knowledge, and

(ii) Instruction is a process of supporting that construction rather than communicating knowledge (Duffy and Cunningham, 1996, p 171).

Constructivism is geared towards the use of learning (through various methods and frameworks) rather than instruction. Even there is a distinction between instructional and learning materials. Not all learning materials are instructional materials. Thus, it has now progressed from a philosophy to an instructional approach to learning design. Since constructivist interventions do not qualify as instruction (Reeves and Reeves, 1997), the term *learning design* (instead of the traditional instructional design) is more appropriate where the emphasis is mostly on constructivism. However, this study will make use of both terms interchangeably as this study embraces both philosophical approaches in a complementary fashion.

From a variety of types of constructivism, the specific constructivist variant relevant in this study is the sociocultural approach which emphasises learning from experience and discourse in authentic learning environments. Students learn by immersing themselves in authentic problems and collaborating with others; learning takes place through a continual process of constructing, interpreting, and modifying their representations of reality based on experience and negotiation of meaning with others. Knowledge is individually constructed and socially co-constructed by learners based on their interpretations of experiences in the world (Jonassen, 1999, p. 217).

Social constructivists argue that, as no two individuals have exactly the same social experiences, each individual is responsible for his/her knowledge construction. If we accept the assumptions that there are multiple dimensions of what the truth must be and learning is based on prior knowledge, we cannot assume that all our learners will understand new information in the same way (as traditional ID models assume). Thus, the structured process offered by the systems view is problematic in an increasingly complex real world.

Constructivists believe that learning outcomes are not always predictable, and that ‘instruction’ should foster, not control, the processing of the learner. They question the applicability of traditional ID models to the learning of complex higher order thinking skills because their basic approach focuses on controlling the learner and environment, which often leads to inert knowledge. They have been most critical of the systems view for offering a quick and easy to fix complex problems in education. According to radical social constructivists, there is nothing systematic about how we learn or construct knowledge (Kanuka and Anderson, 1999). No meaningful construction is possible if all the relevant information is pre-specified (Bednar, Cunningham, Duffy, and Perry, 1995).

Constructivist pedagogical theories do not subscribe to the view of knowledge transmission through the practice of teaching. As a result, an interest in “Learning Design” (LD) as a focus of research began gaining momentum. The emphasis of LD is on what learners are doing, how to support their activities, and how to support their individual needs and personalise their learning experience; all these are well supported by constructivism. This dependence on the context in which learning takes place required an approach based on design principles rather than pre-defined instructional sequences or the delivery of pre-selected ‘facts’.

In a constructivist leaning environment, the tasks are to be designed in complex rather than clearly defined tasks and subtasks, neatly broken up into lessons and modules. These tasks are placed within a full and authentic context rather than fragmented tasks and predetermined structured instructional sequences. The deliberately introduced complexity will require more reflective thought than traditional step-by-step lessons.

It has to be noted that a sociocultural approach does not eliminate the need for other types of learning strategies including mnemonics for memorization, practice for rules, or outlining for organization. This is because memorised facts are not simply information to be remembered in isolation, but knowledge to be applied in real life contexts. However, the learner chooses which strategies are suitable according to their needs, strengths, weaknesses, and aspirations.

There is no explicit design model for constructivist learning because knowledge construction processes are context-specific (Jonassen, 1994, pp. 35-36). This does not mean that there is no design process for constructivist learning, but its design and development are more complex than designing objectivist instruction as it is discussed in the following sections.

3.9.1 The Concept of Constructivist Learning Environment

Constructivist theories and Activity theory view knowledge and meaning as contextualized - emphasizing interpretation, multiple perspectives, and social construction of meaning. Activity theory postulates that learning and activity are interrelated; conscious learning emerges from activity. The implication for designing instruction is that the context of learning and performance is vital, since activity cannot be understood outside its context. As knowledge construction is context-specific (Jonassen, 1994, p. 37), a rich learning environment is seen as a major goal in constructivism where “prime emphasis is placed on the unique interests, styles, motivations and capabilities of individual learners so that learning environments can be tailored to them” (Reeves, 1992). Barr and Tagg (1995) wrote that the new educational paradigm “creates environments...that bring students to discover and construct knowledge for themselves” (p. 15).

Wilson (1996) defines a constructivist learning environment as “a place where learners may work together and support each other as they use a variety of tools and information resources in their guided pursuit of learning goals and problem-solving activities”. Lebow (1993) investigated the implications of constructivist philosophy for instructional design. According to him the context should incorporate learner collaboration and support self-regulation through the promotion of skills and attitudes that enable learners to take increasing responsibility for their own developmental restructuring process. Cognitive strategies should promote learner engagement and responsibility for learning. Constructivist design permits instructional designers to design learning environments in which students can integrate and maximize authentic learning experiences and activities (Tam, 2000; Willis, 2000). According to Perkins (1991), tasks are managed by both learners and the teacher in a rich learning environment. He stressed that students have more control in this environment and the teacher takes on the role of ‘coach and facilitator’ (Wilson, 1996, p.6/7), who may in many situations be better described as ‘co-learner’ (Harper and Hedberg, 1997).

Whilst both objectivism and constructivism focus on the experience of the real world, the difference is that rather than designing instructional sequences, the emphasis of constructivism is on the design of a learning environment (Jonassen, 1994, p.35). Constructivists advocate ill-structured problem-solving tasks that are relevant to the learners and that include some of the complex attributes of real-world problems, so that some of its aspects would still emerge and be defined by the learners. The learning environment needs to provide non-linear as well as ill-defined/structured activities which have real-world relevance, and which present a single complex task to be completed over a sustained period of time, rather than a series of shorter disconnected examples (Brown, Collins, and Duguid, 1989; Reeves and Reeves, 1997; Lebow and Wager, 1994). Characteristics of ill-structured problems (Jonassen, 1999) are:

- unstated goals and constraints;
- multiple solution paths or no solutions;
- multiple criteria for evaluating solutions;
- uncertainty regarding which concepts, rules, and principles to use, or even no general rules and principles for predicting the outcome; and
- learners are required to make and defend judgments.

Learners improve their problem-solving skills when they are engaged in real-world problems and realistic problem-solving processes. Problem-based learning encourages active construction of knowledge through personal inquiry as well as social negotiation and work with peers (Oliver, 2000:6). Thus, students tend to own the problem and the ownership engenders the motivation to solve it. Some perspectives related to constructivist learning environment are: situated cognition, anchored instruction, and cognitive apprenticeship. Further, constructivism espouses problem-based learning.

3.9.1.1 Open Learning Environments (OLEs)

Open learning environments (OLE), also called Open-ended learning environments (OELEs), are closely related to CLEs. According to Piaget (Inhelder and Piaget, 1958), learning is a personal endeavour; individuals play a role in uniquely defining meaning. Learners should take control, making decisions in line with their needs and cognitive states. Open environments are learner-centred environments that support learners contextual learning as learners manipulate and interpret processes associated with relevant problems and content domains. An OELE incorporates a variety of approaches, resources, and tools that facilitate cognitively complex tasks that demand critical thinking, self-direction, problem solving, and integration of knowledge (Hannafin, Land and Oliver, 1999). Although, it empowers the learner, OELEs are not designed to teach particular content, to particular levels, for particular purposes, but to support learners' efforts to generate their own learning sequences. They are intended for situations where divergent thinking and multiple perspectives are preferable to single solutions, for example, the solving of ill-structured problems (Hannafin, Land, and Oliver, 1999) and cases that require exploration, manipulation and discovery, and personal interpretation. OELEs support different learning paradigms and psychological theories such as constructivism and situated cognition.

3.9.1.2 Situated cognition, anchored instruction, and cognitive apprenticeship

Situated cognition was discussed in Section 2.7.5. The implications for design of instruction is that learning should occur within authentic tasks and activities situated in real-world settings. Where a context is not situated in the real world, it can be simulated or made authentic by using attributes of technology and activities developed there upon. Decontextualized learning can produce knowledge that is inert, and has no value in the long run.

Cognitive apprenticeship assists learners by embedding the learning in a functional context where support and assistance are available for them to explore ideas and concepts, and practise skills. Situational learning introduces learners to varied contexts, thus improving transfer of skills to diverse settings. Scaffolding is provided to extend the development of learners within their own zones of proximal development. Learners become engaged when they use knowledge directly in problem-solving processes, but should be coached by the educator in various cognitive strategies such as self-questioning and metacognition.

The ideas of situated learning, anchored instruction and cognitive apprenticeship provide significant pointers for creating flexible online learning environments, particularly with the use of online discussion forums and chat offering new opportunities to optimise interaction and contact between lecturers and students, as well as between students in technology-supported virtual learning environments. New technology allows instructors to set up complex, ill-defined and authentic real-life tasks, and assign roles for students to take in the solution of these problems. The instructor might require students to work individually or in groups. Thus, learners will compare and contrast their views on specific problems, select the best one based on the group discussions or further refine their views. It also allows for peer assessment.

3.9.2 Jonassen's principles of constructivist design

Jonassen (1991) identified "constructivist criteria" for the conception of evaluation methodology which he had drawn from cognitive psychology (p. 11). From this he proposed his first set of strategies towards identifying design goals in constructivist learning environments as follows:

- the negotiation, rather than imposition, of goals and objectives;
- task analysis consideration be given to appropriate interpretations and provision of the intellectual tools that are necessary when learners are constructing knowledge;
- the promotion of multiple perspectives of reality through these tools and within the environment;
- the provision of generative, mental construction 'tool kits' embedded in relevant learning environments that facilitate knowledge construction by learners; and
- a goal-free evaluation for self-analysis (Jonassen, 1991, p.12) .

From these goals, Jonassen (1994, p. 35) later formulated the following guidelines that may be useful in facilitating constructivist learning environments.

- Provide multiple representations of reality;
- Avoid oversimplification of instruction by representing the natural complexity of the real world;
- Focus on knowledge construction;
- Present authentic tasks by use of contextualised rather than abstract instruction;

- Provide real-world case-based learning environments, rather than predetermined instructional sequences;
- Enable context- and content-dependent knowledge construction; and
- Support collaborative construction of knowledge through social negotiation, but not through competition between learners.

Jonassen and Duffy in 1994 proposed a design model by taking three common elements, context, collaboration, and construction, as being fundamental to the environment, which are key processes rather than products (cited in Lefoe, 1998). From these processes they proposed a set of heuristics for a design process, which indicate that such an environment should support:

i) Knowledge construction which is:

- founded on internal negotiation of meaning;
- established as a social negotiation of reality;
- assisted by exploring real world environments and the creation of new environments; and
- developed into mental models.

ii) A context for learning which is meaningful and authentic and makes use of knowledge constructed, which should:

- be supported by such things as case based scenarios which are situated in the real world and based on authentic tasks;
- require an understanding of both problem solving methods and thinking processes in that specific context; and
- be modeled by a performer who is skilled though not necessarily expert.

iii) Collaboration, both student/student and student/teacher, where the teacher becomes a coach or mentor rather than the custodian of knowledge who:

- employs and encourages social negotiation; and
- supports an intellectual toolkit to encourage mental modeling through internal negotiation (Jonassen, 1994, p.37).

In 1995 Jonassen added “conversation” to the common elements. According to them, learning environments that implement these principles and guidelines promote meaningful learning. All the above characteristics are well-encapsulated in Jonassen, Peck, and Wilson’s (1999, p. 8) constellation of attributes of meaningful learning as shown in Figure 3.9.

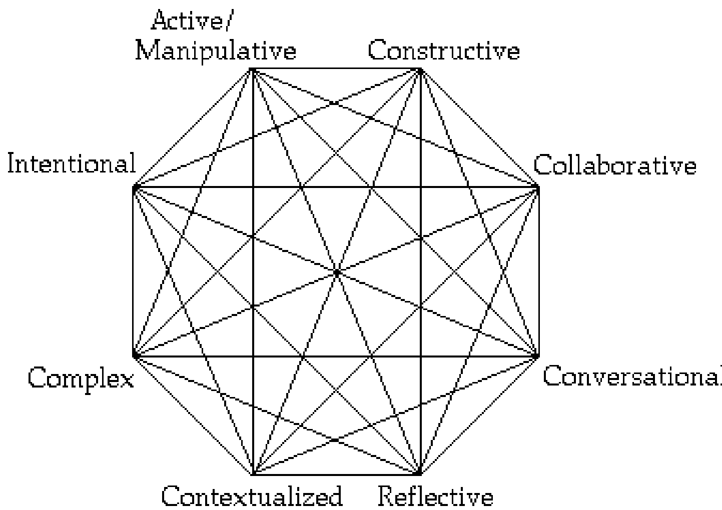


Figure 3.9: Attributes of meaningful constructivist learning

According to them, these constructivist design principles, implemented within the framework of the values and procedure outlined above can lead to a variety of learning environments, such as cognition in real-world context, cognitive flexible learning or collaborative learning.

3.9.2.1 Jonassen et al’s new principles of scientific models

Based on the division between instructional design and learning sciences (LS) as a result of a objectivist-constructivist debate in the United States, Spector (2004) argues , “… LS is primarily focussed on learners and basic questions about learning, while ID is primarily focussed on learning and the basic questions about instructions” (p. 48). Jonassen *et al.* (1997, p. 29-33) suggest adapting new sciences and developing scientific models such as Hermeneutics, Fuzzy Logic and Chaos Theory as a basis for ID.

a) Hermeneutics emphasises the importance of socio-historical context in mediating the meanings of individuals creating and decoding texts. This has the following implications:

- ID must strive to introduce gaps of understanding which allow the learner to create his/her own meanings.
- Learners need to become aware of their own and others' biases. Exercises must problematise the world of ideas and values, rather than simplifying and codifying it. As Jonassen et al. (1997) express it, "Good learners are naturally sceptical learners" (p. 30).
- Other factors outside of the immediate learning situation play a role in the learner's creation of meaning. Designers need to work in a manner that allows the flexibility and openness that will enable these "external" factors a place in the instruction.
- The learning programme should facilitate understanding of different time periods, and other cultures, so that learners' understanding is not mediated only by their own unconscious biases.

b) Fuzzy Logic is based on the idea that reality can rarely be represented accurately in a bivalent manner. Rather, it is multivalent, having many varieties and shades which do not have to belong to mutually exclusive sets. It implies non-linear, dynamic IDDM phases, which has “fuzzy” rather than strict boundaries. In terms of needs assessment and design, the implication of this is that behaviour can only be understood probabilistically, using continua rather than binary measures. Also, it means that problem areas, such as student perceptions of the efficacy of the educational programme, can be incorporated into the design.

c) Chaos Theory

Chaos theory (Jonassen, 1990) postulates that all systems, even simple deterministic ones, are subject to unexpected fluctuations and give rise to complex, unaccountable behaviour. Small changes to even predictive systems are subject to enormous random consequences or fluctuations; new patterns of subsystems may emerge and may gave synergistic impact on the whole system. According to Jonassen et al. (1997), “We can never be certain of what will happen when we intervene in any process. Reality is contingent - it can only be described probabilistically.” Strategies that work well under certain conditions may not be effective under others. This has serious implications for instructional design. Student learning is a complex process and is influenced by numerous variables that include learners' emotions, attitudes, values and goals, and learning environments. All these can have unpredictable impact on the learner.

The significance of Chaos theory is that even in the midst to unpredicatability and chaos, there are useful structures of order. Probably, that is why students do learn, often in spite of our most systematic interventions although Jonassen, Campbell and Davidson (1994:35) called it the irony of Chaos theory.

Chaos theory is useful for non-linear, dynamic situations where input and output are not in direct proportion. Educational systems appear quite chaotic and Chaos theory can offer ID the following useful directions.

- Designers need to include metacognitive skills in their designs, to enable learners to deal with the complexity flexibly, rather than hushing it up through simplification, and thereby crippling the learner who will all too soon be faced by aspects of reality that do not fit the simplified scheme.
- Designers need to take account of learners' emotions, and promote self-awareness on this level, not just the cognitive.

Based on Chaos Theory, Yeongmahn You (1994) identifies four weaknesses of traditional ID models. He proposes practices that we should move away from as well as appropriate alternatives we should move towards:

- nonlinear design, and away from linear design;
- “indeterministic unpredictability”, and away from determinism and expected predicatability; Jonassen et al. (1997) state that the more one moves away from deterministic approaches to thinking and designing toward more probabilistic ways of thinking, the more useful it becomes in providing methods for assessing in “real-life” issues, where things are not black-and-white, but rather any number of different shades of colour across the spectrum.
- open systems, and away from closed systems;

- positive feedback and away from negative feedback.

3.9.3 Driscoll's constructivist conditions for learning

Driscoll summarizes with appropriate references the necessary constructivist conditions for learning (in Driscoll, 2000, p. 382-383) as follows and they can be used for designing learning:

a) Embedded learning in complex, realistic and relevant environments (Duffy, and Jonassen 1991; Cunningham, 1991; Honebein 1996);

b) Provide for social negotiation (cooperative and socio-moral atmosphere) as an integral part of learning (Piaget, 1973; Vygotsky, 1978; and Bruner, 1966; De Vries, 2002);

c) Support multiple perspectives and the use of multiple modes of representation (Duffy and Cunningham, 1996; Honebein 1996);

d) Encourage ownership in learning. (Duffy and Cunningham, 1996; Honebein 1996);

e) Provide adequate time for learners' investigation and in-depth engagement (De Vries, 2002);

f) Nurture self awareness of the knowledge construction process (Jonassen 2003, Duffy and Cunningham 1996).

Based on the views of Jonassen (1992) and Driscoll (2000), constructivism has the following impacts on instructional design:

(i) Instructional goals and objectives would be negotiated not imposed;

(ii) Task analysis would concentrate more on considering appropriate interpretations and providing the intellectual tools that are necessary for helping learners to construct knowledge;

(iii) Designers would provide generative, mental construction tool kits embedded in relevant learning environments that facilitate knowledge construction by learners;

(iv) About evaluation:

(a) Since constructivism does not hold that the function of instruction is to transmit knowledge that mirrors the reality and its structures to the learner's mind, criterion-referenced evaluation which is based on predetermined objective standards, is not an appropriate evaluation tool to constructivist environments (Jonassen, 1992). The focus of evaluation should be placed on the process of knowledge construction rather than the end products of learning. And even if the end results are evaluated, it should emphasize the higher order thinking of human being.

(b) The evaluation of learning focus on the higher order thinking, the knowledge construction process, and the building of the awareness of such process;

(c) The context of evaluation should be embedded in authentic tasks and meaningful real-world context;

(d) The criteria of evaluation should represent multiple perspectives in learning environment. From the perspective of socio-cultural constructivist, since "no objective reality is uniformly interpretable by all learners, then assessing the acquisition of such reality is not possible" (Jonassen, 1992). Thus, the evaluation should focus on the learning process rather than the product;

(e) Portfolio evaluation: different student interpretation at different stages in their learning process. Learning is multifaceted and multi-perspectival, so as the results of learning;

(f) The function of evaluation is not in the reinforcement or behaviour control tool but more of “a self-analysis and metacognitive tool".

3.9.4 Brooks and Brooks: Practical Constructivist Strategies

The fact that constructivism is not a prescriptive teaching theory, but a philosophy relating to knowledge and learning, poses a challenge to educators as to how to become constructivist educators (Brooks and Brooks, 1999, 2001). They recommend practical strategies for constructivist educators:

- Encourage and accept learner autonomy and initiative;
- Use raw data and primary sources, along with manipulative, interactive, and physical material;
- Use cognitive terminology such as ‘classify’, ‘analyse’, ‘predict’ and ‘create’, when framing tasks for learners;
- Allow the learners’ responses to drive lessons, shift instruction strategies and adapt the content;
- Inquire about learners’ understanding of concepts before sharing their own;
- Encourage learners to engage in dialogue with both the educator and other learners;
- Encourage learners’ inquiries by asking thoughtful, open-ended questions;
- Encourage learners to question one another;
- Seek elaboration of learners’ initial responses;
- Engage learners in experiences that might generate contradictions to their initial conception, and lead to subsequent discussion;
- Allow waiting time after posing questions;
- Provide time for learners to construct relationships and create metaphors; and
- Nurture learners’ natural curiosity through frequent use of the learning cycle model.

3.9.5 Savery and Duffy’s Constructivist/PBL-based Design Principles

Savery and Duffy (1996) provide a framework for designing web-based constructivist learning environments with attention focused on the concept of problem-based learning (PBL) and the role of the learner in this style of learning. PBL approach is learner-centric and is highly effective in motivating learners.

The first phase involves the generation of a problem. The problem must be based on the primary concepts that students must learn. Furthermore, the problems must be real; for example, in medical education this requires real patients, and at other levels, the problem must be generated with the content and principles relevant to the course. Further, Savery and Duffy illustrate how these constructivist instructional principles can be applied to a PBL environment.

(i) Give the learner ownership of the process used to develop the solution i.e. ownership of the problem-solving process, as well as of the problem. The educator should not dictate the process to be used for addressing that problem. Pre-specification of activities will hinder critical thinking and problem solving in that domain.

(ii) Encourage testing ideas against alternative views and alternate contexts. Knowledge is socially negotiated, and its quality can be determined only in a social environment or collaborative environment where learners discuss their various perspectives, issues and ideas to enrich personal understanding.

(iii) Anchor all learning activities to a larger task or problem- learners must clearly perceive and accept the relevance of all specific activities in the context of their real world.

(iv) Design an authentic task- the cognitive demands of the task must be consistent with the cognitive demands of the environment for which the learner is being prepared. For this, the task or problem should be developed through discussion and negotiation with the learner.

(v) Design the task and the learning environment to reflect the complexity of the environment that they should be able to function in at the end of learning rather than simplifying the environment, educators should seek to support learners in situations of complexity which is consistent with both cognitive apprenticeship and cognitive flexibility theories.

(vi) Support the learner in developing ownership for the overall problem or task - learners' goals must be consistent with the instructional goals.

(vii) Design the learning environment to support and challenge the learner’s thinking - learners should become effective and critical thinkers. Resources and materials should be used as sources of information - not to teach, but to support inquiry as well as challenge the learner's thinking.

(viii) Provide opportunity for and support reflection on both the content learnt and the learning process- learners should be engaged in reflective thinking on the strategies for learning to develop the skills of self-regulation to become independent.

Instructors incorporate inductive as well as deductive problem solving into the classroom. The design features include learning goals, problem generation, problem presentation, and the role of the facilitator. From the principles and PBL's critical design features they found that PBL actively engages learners in authentic tasks, activities, and environments. The facilitator guides and encourages them to test their hypotheses and findings against the other learners.Assessment includes peer-evaluation and self-evaluation, and there may or may not be tests.

3.9.6 Laurillard's Conversational Framework

Diana Laurillard (1993) emphasises learning as an iterative process, involving discursive, adaptive, interactive, and reflexive qualities, the main focus being on teacher-student relationship since "academic knowledge consists in descriptions of the world, and therefore comes to be known through a discursive interaction between teacher and student" (p. 89). She applied the underlying ideas of dialogue as proposed by educators and psychologists (e.g., Pask, 1976, pp. 12-25; Ramsden, 1992) to teaching and learning. Further, as advocated by Jonassen (1994) and Moore (1990, 1996), she stresses the need for deep interaction and collaboration among learners instead of competition. According to her, technology can drive the Conversational Framework and put it into action.

Laurillard’s approach is constructivist; however, it places more emphasis on the *interaction* between teacher and individual student, and stresses the need for meaningful intrinsic feedback to be a central feature of elearning. Based on interaction and feedback, students can reflect on interaction to modify their ideas and understanding. Therefore, adequate dialogue using appropriate instructional techniques or technologies is the key to her 12 conversational framework guidelines as shown in Figure 3.10 below. It comprises three cycles in which a student has the opportunity to communicate with the teacher.

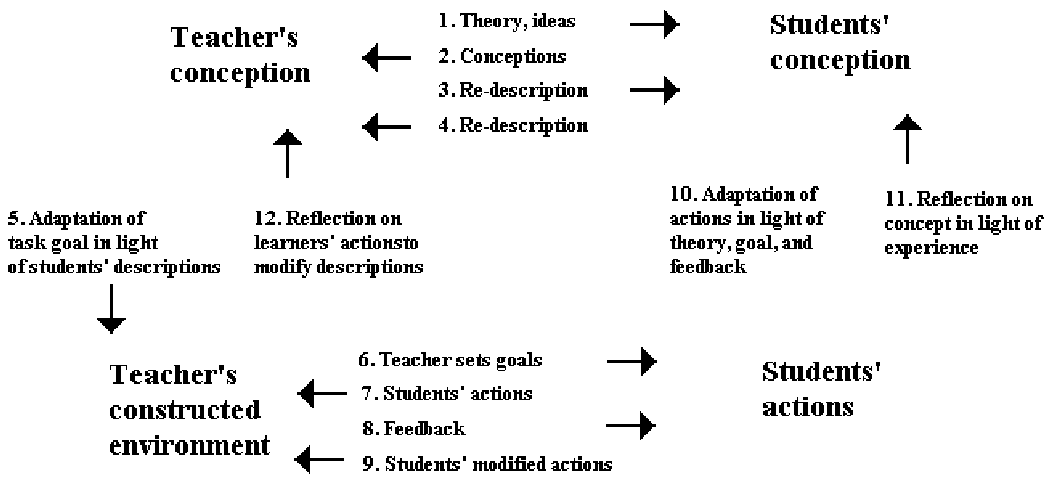


Figure 3.10: Laurillard's conversational framework

The teacher has the opportunity to evaluate students' understanding at an early stage and correct misconceptions, if there are any. Using conversation as the basis for teaching, the learning relationship becomes more transparent and open to both student and teacher. An important aspect emerging from the conversational framework is the iterative dialogue nature of the model that offers learners to engage with the topic several times; this means that a student will have the opportunity to improve on the same task.

However, Goodyear (2002) has expressed a challenge on how to provide with adequate level of individual dialogue in a situation where there are too few tutors and too many learners. This Researcher believes that with fast advances in technology this concern should not have much weight.

3.9.7 Cennamo et al's conditions for constructivist learning environments

In the process of designing materials for constructivist learning, Cennamo, Abell, and Chung (1996) propose a general approach for the design of products consistent with constructivist ideas. This is based on Driscoll's (2000) conditions to apply to the actual design of constructivist materials.

(i) Embrace the complexity of the design process.

(ii) Provide for social negotiations as an integral part of designing the materials.

(iii) Examine the information that is relevant to the design of the instruction on multiple occasions and from multiple perspectives.

(iv) Nurture reflexivity in the design process.

(v) Emphasize client-centred design.

Clients must be actively involved in determining their needs and how best they can be satisfied. They must also be involved at each stage of the process, and be able to refine their requirements as the project evolves.

3.9.8 Salmon's e-tivities approach

Salmon (2002) argues that the characteristics of elearning are online interaction and participation, and introduces the term "E-tivities", which refers to educational online activities, as a new term in online learning. He then proposes a five-stage framework for designing and implementing e-tivities efficiently based on interaction among online learners and participants to motivate and engage; it helps one not only to plan but also to run his/her own e-tivity model to share, elaborate and exchange ideas.

Salmon's model describes the stages to progress towards successful online learning. It also guides on how to motivate online participants, to build learning through online tasks, and to pace learners through stages of skills development.

Stage 1 - *Access and Motivation* - It involves essential prerequisite for students to access and participate in online learning. It is natural for a new online learner to experience difficulties in logging on. The tutor has to play a role for ensuring access and establishing an appealing social climate with welcoming and encouraging words. The essential element is motivation to get online participants through the early stages. Learners at this stage require an introduction to using the online learning environment.

Stage 2 – Socialization – It involves individuals establishing their online identities, and knowing others. The tutor must connect all the learners and create a conducive environment that would inspire learners to share and exchange their thoughts and collaborate with each other in a non-threatening atmosphere. Learners communicate with each other to get familiar with each other.

Stage 3 - Information Exchange – Learners in this stage interact with the course content, tutor and peers at their own pace. They exchange information and start to consider and support diverse view points of their peers.

Stage 4 - Knowledge Construction - Individual learners take control of their own knowledge construction by engaging in E-tivities such as online discussions and collaborative activities. At this stage, tutors have important roles to build and maintain online groups, and active collaboration among group members.

Stage 5 – Development – Online learners in this stage must become critical and self-reflective as well as responsible for their own learning to be able to build on the ideas acquired through the e-tivities and apply them to their individual contexts.

This model provides a framework for good practice in engaging learners in online discussion. One drawback of this model is that it is theoretical and is prescriptive in nature, but it implies a commitment to constructivist tasks and the greatest possibility for dialogue. Lisewski and Joyce (2003) argue that in practice there is a need for flexibility not provided by this model. The application of this model to blended learning is limited as the face-to-face aspect is not incorporated in this framework.

3.9.9 Willis's Constructivist design principles

Willis (2000) explains that knowledge is dependent on context and "trying to follow detailed specific rules of design is discouraged because each context is unique" (p. 9). According to him, the following three guiding design principles may be used to develop constructivist learning environments: (i) *recursive, nonlinear design* (ii) *reflective design*; and (iii) *participatory design*.

(a) Recursive, non-linear design:

The idea of recursion is to address the same issues such as learner analysis and instructional objectives iteratively throughout the design and development process, and at many levels. Recursion suggests that design is not linear, but is recursive and iterative like a spiral. The design procedures can be carried out in any meaningful sequence; it means that there is nothing as a pre-requisite to any task; any task can be addressed at any time. Designers do not necessarily focus on the *define* component first. Discussion of problems and solutions occur in any order. Some issues, problems or a need for change will emerge in the context of use and will then be addressed. This is one of the more controversial aspects of the alternative ID models, where instructional design is a step-by-step, orderly, sequential, logical, linear process (Banathy, 1996; Gordon and Zemke, 2000).

(b) Reflective design:

Thinking reflectively leads to reformulation of the problem as well as the strategies used to solve it, and is critical under constructivist learning. The concept of reflectiveness originates from Schön's (1987) reflective approach to professional practice. According to him, the reflective practitioner is both a participant in the process and a critic who observes and analyses.

(c) Participatory design: This refers to the vital need of the end user –the student— also to be involved in the design and development process. It is critical to take the students' perspectives into account when the curriculum is designed for them. Through such participation, students become more motivated and skilled to carry out collaborative tasks developing new competencies (e.g., communication and interpersonal skills).

Willis was one of the first to lay out in some detail an approach to creating instructional material based on Constructivist theory. He used the above discussed three flexible guidelines, and formulated the *the Recursive, Reflective Design and Development (R2D2) Model* which is discussed in Section 3.10.1.

3.10 Constructivist Design Models

Though constructivism was held in high esteem in the early 1990s as the best approach in addressing most of the educational problems, there was a lack of practical constructivist models per se that could be utilised to implement constructivist strategies. However, some notable general constructivist guidelines for design were Jonassen's principles of constructivist design (1991), Jonassen and Duffy's (1994) heuristics for designing general constructivist environments (Duffy and Jonassen, 1991a; Jonassen, 1994), Savery and Duffy's (1996, pp. 135-148) Constructivist Design Principles, Driscoll's (1995, 2000) constructivist conditions for learning, Kozma's (2000) proposed cultural changes to educational technology research and development, Willis' (2000) design principles and Brooks and Brooks' (2001) Practical Constructivist Strategies. Most of these were discussed in the previous section, and they serve as a background for designing framework for constructivist learning.

Some constructivist models started appearing from the mid-1990s, for example, Willis' (1995) R2D2 model, the Jonassen and Rohrer-Murphy Framework (1999), and Willis and Wright's (2000) Constructivist-interpretivist design model, and Hannafin, and Land (1997) model. The first three models are discussed below.

3.10.1 Recursive, Reflective Design and Development (R2D2) Model

Willis' (1995, 1998, 2000) constructivist model, named *Recursive, Reflective Design and Development* (R2D2) model, was one of the first to lay out in some detail an approach to creating instructional material based on Constructivist theory.

3.10.1.1 The main focus areas of R2D2 Model

Will's three guiding principles discussed above in section 3.9.9 revolve around three focal points—definition, design/development, and dissemination. The focal points are, in essence, a convenient way of organizing our thoughts about the work" (Willis and Wright, 2000, p. 5).

The R2D2 model assumes that most problems in the real world are ill-structured and cannot be addressed with pre-planned designs, strategies or solutions. Constructivist principles (Willis, 1998) comprise more of a framework and guidelines for thinking about teaching and learning than a set of prescriptive principles.

(i) Definition focus

It involves analysing in an ongoing manner the variables such as the learner, overall learning goal(s), type of problems required to address the needs of the learner, strategies required to involve learners in the design process and the type of tutor support required to promote student learning within authentic tasks. This is adapted from the traditional ID approaches.

Designer's first task is to build a team to support, and facilitate participatory design, or user-centred design, whereby the intended end-users play an active role in designing the course. The team should comprise teachers, learners, graphic designers, multimedia developers, etc. Within the team, decision is made on the overall learning goal(s), type of problems required to address the needs of the learner, strategies required to involve learners in the design process and the type of support required to promote student learning within authentic tasks. Unlike in the traditional ID models, there are no pre-defined specific objectives; in the constructivist approach they evolve naturally from the participatory design in which learners and facilitators discuss the specific tasks to tackle.

(ii) Design and development focus

The R2D2 combines the two traditionally distinct processes—*Design and development*— into one focus area while in traditional ID models, design is completed before development. The two phases are carried out in a participatory interactive development environment. Selection of tools, media and format, and evaluation strategies are also done in this phase. Choice of tools during the design requires a balance between utility, flexibility, and accessibility. By running segments of the program with learners, problems can be identified early enough; in this recursive manner, immediate refinement and revision to see the effects of change can be easily done. Formative evaluation and pilot-tryouts are thus integral parts of design and development phase. Student assessment and evaluation in tryouts of the materials are more qualitative (e.g., interviews-in-context, observations, portfolios, etc.) than traditional quantitative (based on objective tests).

(iii) Dissemination focus

This refers to the method of adoption of the model in different contexts. Constructivist models do not promote the use of customised materials but provide indications on how to adopt them innovatively and creatively in different contexts, in different ways, with a particular group of students because there cannot be a general design method applicable across different settings. In the traditional ID models, the last phase comprises summative evaluation, final packaging, diffusion, and adoption. Summative evaluation is uncalled for here in constructivist models as objectives are not pre-defined. Constructivist models advocate personal goal-setting by learners and diverse learning activities that may vary from learner to learner; therefore, objective tests are not suitable for evaluating the success of instruction, since different students learn different things in different ways.

Will's views were later revised by Willis and Wright (2000) and came up with a model called the Constructivist-Interpretivist design model; it is an interpretivist implementation of Willis' constructivist design principles. Its characteristics are discussed below in Section 3.10.1.2.

3.10.1.2 Characteristics of Constructivist-interpretivist design model

i) The ID process is recursive or iterative, non-linear, and sometimes chaotic

Willis (1995) suggested that the design process in constructivist models is recursive, non-linear and sometimes chaotic. This was already discussed under Section 3.9.9 (a).

ii) Planning is organic, developmental, reflective, and collaborative

A collaborative team approach to design is advocated, and it is accomplished by creating a participatory team; learners, teachers, and designers participate as active contributors in a fluid process of design and development; the designer becomes a facilitator of the design process and shares decision-making and exploration of issues with other members of the design team. No vision or strategic planning is formulated in the beginning, except a vague plan which will become clearer or emerge over the process of development. According to Willis, a constructivist might actually involve students in the design process and co-author material with students and teachers.

iii) Objectives emerge from design and development work

No specific objectives are defined in the beginning; objectives emerge and gradually become clearer during the process of collaborative development process.

iv) General ID experts don't exist

Most Instructional Designers are ID specialists and do not necessarily have content expertise which is esssential to design and develop instruction, especially content-based learning activities, in any discipline.

v) Meaningful and engaging contexts for learning

Instruction emphasizes learning in meaningful and engaging contexts rather than that of transmission of de-contextualised, inert knowledge as it happens in conventional direct-instruction approaches.

vi) Formative evaluation is critical

In constructivist environment, the learning is student directed, and the learning outcomes will vary widely from student to student. Consequently, it is critical that assessment should reflect these differences. Therefore, documenting the learning process as it occurs, and how it progresses is critical. The resulting personal understanding of the learner is then most effectively assessed through formative evaluation (Willis, 1995). Formative evaluations are more important than summative evaluation because they are the ones that provide feedback towards improving the product.

vii) Subjective data may be the most valuable

In constructivism, learning is achieved through the internalization of knowledge, which is not easily measured or quantified through the use of traditional assessment tools. Several types of alternative assessments, including authentic assessment, portfolios, etc should be used. There are also qualitative approaches, such as interviews, observations, user logs, focus groups, expert critiques, and student feedback.

3.10.2 The Jonassen and Rohrer-Murphy Framework

Jonassen and Rohrer-Murphy's (1999, pp. 70-77) framework describes how the concepts and components of activity theory may be used as a framework for describing the components and their interrelationships in constructivist learning environments (CLEs). Further, they identify six steps for using activity theory to design a CLE. The steps are:

(i) Clarify purpose of activity system; *(it guides the developer in examining the learner's goals to determine the purpose of the activity that the CLE is to support.)*

(ii) Analyze the activity system; *(each component of the activity system is examined.)*

(iii) Analyze the activity structure; *(it leads to the decomposition of the learner's activities into actions and operations.)*

(iv) Analyze tools and mediators; *(it involves elicitation of the tools and other mediatory means that have been and could be used in the CLE.)*

(v) Analyzing the context; *(it analyses the context, the community, rules, and division of labour present in the activity.)*

(vi) Analyze activity system dynamics; *(the interaction and rules for the relationships that exist within and between the components of the activity system.)*

The framework provides a large set of questions to be answered that cover diverse combinations of Activity theory principles and components in CLEs that should consist of several interdependent components: a problem-project space, related cases, information resources, cognitive tools, conversation and collaboration tools (Jonassen, 1999; Jonassen and Rohrer-Murphy, 1999).

(i) Problem-Project Space captures the activity system that is embedded in a CLE. It presents learners with an interesting, relevant, authentic, engaging, and ill-structured problem to solve or a project to carry out. The problem-project space in CLEs consists of three integrated and highly interrelated components: the problem context, the problem presentation or simulation, and the problem manipulation space. The problem context describes all important details of the context in which the problem will be solved: the rules, community, and division of labour components of the activity system. Further, it helps to define the problem. The problem presentation simulates the problem in the context in which it is normally and naturally found. Problem manipulation space in whereby learners have the opportunity to act on the problem and to see the results of their efforts in order to make it more meaningful and thus, take ownership of the problem.

(ii) Related cases enable learners to examine prior experiences and relate them to the current problem. It supports learning by scaffolding memory and by representing complexity through the use of multiple perspectives to the problems under study.

(iii) Information Resources – online resources accessible via hyperlinks in order to provide learners with sufficient information about the subject that support problem resolution.

(iv) Cognitive tools - In addition to the tools of the domain, CLEs may incorporate cognitive tools as scaffolding to help learners acquire the skills to perform those tasks.

(v) Conversation and collaborative tools - CLEs use various computer-mediated tools to support collaboration and to facilitate dialogue and knowledge building among the community of learners. Information is shared, and learners collaboratively construct knowledge.

3.10.3 Design of Constructivist Assessments

Assessment is the single most important factor in any educational experience because it informs both teaching and learning. Its nature, type and quality influence the approach students take to learning. It is critical in any design approach to provide valid criteria for evaluation of the learning. Constructivist approach takes assessment as an integral part of a student's learning, not merely a means for certifying performance as it is done in traditional assessment strategies where the goal is to measure what students have *learned* in a course. This has little value if our goal is to improve their future performance.

At the core, constructivists hold that each individual's understanding comes through interactions with the environment and their construction of real world contexts. Therefore, for assessment to be valid, it should be embedded in the context of learning, rather than be based on testing in a decontextualised academic setting. It requires the assessment to be seamlessly integrated with the activity, and to provide appropriate criteria for scoring varied products (e.g., Reeves and Okey, 1996; Duchastel, 1997; Bain, 2003). Just as learning is an ongoing process, assessment can be an ongoing process of documenting that learning. The best way to achieve this is to observe them engaged in learning during class discussions, group work, active learning exercises, online chat or discussion forums. The resulting personal understanding of the learner is then most effectively assessed through formative evaluation (Willis, 1995) using criterion-referenced[5] tests. These methods can include documenting the learning process as it is occurring, using environments that have the potential to record and archive student notes, allow for grading online asynchronous discourse, or encourage concept building and scaffolding.

Another type of assessment that is desirable in elearning is the *peer review* whereby students are involved to review and assess each other's work. However, peer review will be successful only in a socially sound community, thus the need for an inviting social climate cannot be overemphasised. The practice of peer review is a valuable approach as it gives opportunity to students in decision making about the assessment process and how to make judgements on their own and each other's learning. As this practice is not supported in the traditional approach, its strategies must me made clear to the students. This is a useful skill in lifelong learning situations.

The use of electronic portfolios (ePortfolio) in higher education institutions is becoming an increasingly popular way of storing and sharing information as part of their institutional quality and improvement agendas (Bowie, Joughin, Taylor, Young, and Zimitat, 2002). This is partly because ePortfolios provide "tangible evidence" to accrediting agencies of student achievement (Cohn and Hibbitts, 2004: 7). According to them, the process of constructing an ePortfolio inspires student engagement in reflective thinking.

ePortfolios can include artefacts of examples that demonstrate something about themselves as learners for future use; for example, while applying for a job, the potential employer would see particular work as pertinent to the student's ability to do the job. Assessors can get insights into both how students learn and the products of their learning. It serves not only to fulfill their certification requirement, but also for self understanding as well as for demonstrating to others what they know and can do.

ePortfolios, in fact, offer the distinct advantage of being both a learning tool and an assessment medium. As students select, present, and represent their learning, they reflect on what the portfolio artifacts reveal about their learning. By this, assessment becomes part of the learning process. With the use of portfolios, assessment becomes part of the learning process.

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[5] *Criterion referencing is designed to assess changes in assessment performance as a result of learning that has been undertaken, while Norm referencing attempts to assess characteristics of individuals relative to other individuals, or against general norms.*

An online assessment system, which incorporates multimedia and is capable of offering simulations for the assessment of laboratory skills or field work, is outlined by Mackenzie (1999). Many of the questions in this system are, according to Bull and Mckenna (2004), thought capable of testing higher learning levels, such as application, analysis and synthesis.

As discussed in 2.7.3.2, several other strategies also may be used, for example: dialogue with learners and other teachers, projects, journals, individual and group tasks that involve collaborative learning and social negotiation, discussion assessments, self-evaluation and peer-assessment, and even scores in standardized tests.

3.10.4 Criticisms of Constructivist design approaches

Although highly scaffolded constructivist learning methods like problem-based learning and inquiry learning are effective, and is perceived to be the ideal model to guide the design of computer-based learning environments, in certain instances, and for certain content, constructivism often falls short.

Numerous criticisms have been levelled at constructivist epistemology. The most common one is that it either explicitly advocates *relativism,* whereby there exists no absolute truth and any truth is as good as other because it takes the concept of truth to be a socially constructed one. Also, the validity and generality of the knowledge constructed outside the given social group come into question. Although this knowledge may be socially negotiated, its collective scope and depth is limited to, and often has little value beyond, the group (Scardamalia and Bereiter, 1999, pp.274-289).

Another criticism is that constructivism focuses on the individual interpretation of a perceived external reality, and the results of individual interpretation will be personal to each individual and may largely be inconsistent. Constructivist strategies are often not efficient, resulting in "a trial-and-error approach to the performance in the real world" (Merrill, 1997). Several educators (e.g., Mayer, 2004; Kirschner, Sweller, and Clark, 2006) have also questioned the effectiveness of this approach toward instructional design, especially as it applies to the development of instruction for novices. Kirschner, Sweller, and Clark (2006) argue that "learning by doing" is useful for more knowledgeable learners, they assert that this constructivist teaching technique is not useful for novices. Several researchers (e.g., Moreno and Mayer, 1999, pp. 358–368; Mousavi, Low, and Sweller, 1995, pp. 319–334) do not support the idea of allowing novices to interact with ill-structured learning environments that requires the learner to discover problem solutions. Constructivism advocates deep individual inquiry that often exerts high cognitive demands that many students are not capable of achieving at their present stage of development and becomes an issue when students are required to construct a unique set of knowledge asynchronously from the rest of the class (Brooks and Brooks, 1999). Sweller and Jonassen support problem-solving scenarios for more advanced learners (Jonassen, 1997, pp. 65-94; Kalyuga, Ayres, Chandler, and Sweller, 2003, pp. 23–31). With more advanced learners, particularly at higher levels of learning, more learner-empowering strategies that can help customize learning environments with the use of technologies is possible, whereby learners are able to construct their own personal learning environments (PLEs). Such PLEs can typically consist of distributed web-applications and services that support system- spanning collaborative and individual learning activities in formal as well as informal settings. The implication is that constructivist approaches are not suitable with all learners, content and contexts. Terhart (2003) contends that, although successful in teaching in some educational areas, constructivism does not present a new didactic paradigm different from traditional educational theories (pp. 25-44).

From practical considerations, implementation of constructivist approach due to lack of teachers' expertise and experience, and students' interest or patience to fruitfully continue such time-taking constructivist investigations are major concerns among educators. Further, constructivist teaching approaches, including one-to-one or small group classroom interaction, are not always easily practical in large classes.

Considering these criticisms, and certain benefits of instructivist approaches in teaching facts and structured knowledge, the Researcher argues that constructivism is not powerful enough to cause the doom of other traditional approaches.

3.11 In Pursuit of an Alternative ID Approach for today's HE Students: Recommendations for Practice

Achieving the typical learning goals required for one to be successful in the 21st century requires models that focus on how to acquire, evaluate and synthesize information in collaboration with others in broad social contexts, not as a solitary endeavour. These changes in learning needs have major implications for the design of learning environments.

One of the major findings from the literature review is that a single theoretical approach is unlikely to achieve the broad range of educational outcomes envisaged in HE context which is expected to equip all students with all the knowledge and skills required for the 21st century. They are all useful in supporting students to gain different types and levels of knowledge and skills in specific learning contexts such as for different curricula, different subject matters, different units, and individuals with different learning abilities. For example, Behaviorist strategies can be used to teach facts (*knowing the what)* and structured knowledge; cognitive strategies can be used to teach processes, principles and problem-solving tactics (*knowing the how)*; and constructivist strategies can be used by students to learn through solving ill-defined problems, active engagement and reflection-in-action. Studies indicate that the materials and the activities based on both instructivist and constructivist philosophies were found to be beneficial for learning by students (Delialioglu and Yildirim, 2007, pp. 133-146). When they were used appropriately depending on the particular need in a given learning scenario, they complement each other to make the learning environment more effective and efficient.

Even Jonassen (1994, pp. 35-7) a constructivist guru, states that Constructivism is not the panacea for all of the instructional problems in education and training, no more than other theories and technologies are. He further suggests that constructivist design should not replace objectivist design; according to him, designers should be able to select, use and adapt attributes from the various different approaches, in order to address the needs of the curriculum. He asserts that, although we have seen a shift from a behaviourist to constructivist view of the design for computer-based learning environments, behaviourist strategies still provide the foundation and framework for many low-order online learning tasks including basic concept, skills and information acquisition.

I support Atkins' (1993) view- "designers are adopting a mixed approach to design because it offers complete flexibility". The flexibility allows instructors to choose appropriate strategies for different curricula, different subject matters, different topics, students at different levels, and instructors at different experience levels. The problem is in selecting the most appropriate one to apply in a particular real setting, or constructing one's own learning design model.

Under these circumstances, the Researcher wants to argue that Instructional designers in collaboration with the teacher should design for the real situation based on appropriate principles rather than design for an ideal situation because no two situations can exactly be the same with regard to learner needs, preferences and their learning styles, and access to appropriate technologies. This does not mean that one should not use available models by modifying them to suit the real situation. In the context of rapidly advancing technology and the lack of theoretical perspectives to optimize its use in teaching and learning, learning designers have to utilise their intuition and creativity in the development and implementation of online and blended learning environments through integrating relevant aspects of each of the contrasting approaches.

To summarise, both constructivist and objectivist pedagogies as a single paradigm framed the learning activities of the blended learning model developed in this study. Effective course design requires strategies drawn form both approaches to support learning, engaging, collaborative activities, supportive online learning community, and good assessment strategies.

3.12 Blended Learning Design: Literature Review

Since online learning is a new domain and is not underpinned by any theory of its own as discussed above, it requires new standards and good planning based on practice, existing theories and pedagogical affordances of technology. The adaptation and extension of existing frameworks to suit a given context is normal and quite characteristic of an emergent field such as blended learning. Two important conceptual frameworks for blended learning identified in the literature are Kerres and

De Witt's (2003) 3C-didactic model, and Garrison and Vaughan's (2008) CoI model as discussed in Section 3.5.7. However, these models as they are do not provide effective strategies appropriate to the learning and teaching culture of UB. However, they provide strong foundational support for new thinking about a model the Researcher is planning to develop.

Based on the framework for technology-supported blended learning (Section 2.5) and findings from the literature (e.g., Jonassen et al., 1995; Pierson, 2001; Yu, 2002; Kerres and De Witt, 2003; Tung, 2003; Garrison and Vaughan, 2008), the design of the blended learning can be modelled along the following six broad 'dimensions': context, content, pedagogy, technology, support and evaluation. The term *Context* is a very broad usage; it is a critical foundation for technology adoption in a HE landscape where teachers come from very traditional face-to-face teaching environment. It can further be divided into several specific critical factors such as attitude of teachers towards technology adoption, their confidence and expertise levels, the leadership and the availability of appropriate technology infrastructure. All these can affect the quality of technology adoption in a traditional HE situation.

The term *Content* refers to the subject matter that will be derived from the curriculum with focus of different type of learning outcomes. This means that the model should be able to work for different subjects, such as Science, Statistics, Business studies, etc. and should ensure that the content is appealing to make learning compelling, engaging and relevant to the learners' needs. This requires the content to be updated regularly for currency and relevancy.

The term *pedagogy* refers to the instructional strategies that are used when implementing the model. It has bearing on the structure, organization, management, and teaching strategies for how particular subject matter is taught. The main purpose of ICT in a blended learning environment is to facilitate pedagogical approaches through interaction with the teacher, collaboration among learners, learner-centredness, community of learners and virtual learning environments (VLE) that extend beyond the fixed teaching schedules.

The *technology* includes hardware, communication devices and the LMS needed to develop and run an elearning environment. It is technology that makes the interaction and collaboration aspects of online learning possible. Lack of appropriate, adequate, reliable technology to both students and teachers is a barrier to technology adoption in teaching. This means that technology should be recognised as an important aspect of an elearning / blended learning provision for making learning possibilities *accessible* to all learners.

The fifth dimension—*support*—includes student support, technical support and management support. Availability of reliable and adequate technology infrastructure, and consistent, reliable technical support to all lecturers and students to enable them have easy access to digital resources from anywhere, on-campus as well as off-campus are factors that lead to active participation by learners in the learning process. Support also includes staff professional development[6]. These by and large depend on several factors that include teachers' content, pedagogical, and technological knowledge as well as skills. Therefore, professional development is a critical factor to bring about change in practice.

No matter how good a model is, without appropriate continuous evaluation at each phase of its development and implementation, its success can be doubtful. On-going user feedback is critical for updating the instructional resources and for reducing barriers to technology integration. While the course is in progress, the respective phases can be submitted to repeated quality controls (*formative evaluation*).

It is a common practice to check the course after its first implementation for effectiveness and quality (*summative evaluation*). Later, these checks should be repeated at regular intervals (*confirmative evaluation)* to be able to react to changing situations. A common problem with evaluation is the fact that most evaluation processes in an elearning model focus only on easy-to-collect quantitative data. However, this study focuses on qualitative enquiry of learner satisfaction and the usability of the elearning environment.

The six broad dimensions discussed in this section form foundation for the design of the LAPTEL model in this study; thus, the section partially addresses the sixth specific objective: *To formulate a conceptual framework for a web-based blended*[7]

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[6] The appropriate use of ICT is very critical for the successful delivery of the course. Teachers should have the relevant technological knowledge and skills on how technologies can be used to support student learning.

[7] *Throughout this work, the terms 'hybrid course' and 'blended learning' refer to instruction that occurs both in the classroom and online, and where the online component becomes a natural extension of traditional classroom learning. Throughout the current study, these two terms are used interchangeably. The online component is provided through WebCT (Version 8.0) that utilises email, chat, and discussion forum as communication tools.*

learning model, and further to design and develop the Model. Further discussions are available in Sections 5.8, 5.8.1, and 5.8.2.

3.12.1 Blended Learning: Development of Design Criteria

This section attempts to identify effective design criteria or elements for designing and developing online blended learning environments. These elements should be in place to deliver instruction, facilitate interactions, catch and sustain students' interest, motivation, and satisfaction, and thus all in all, enhance the quality of learning. These elements also help users to develop an appropriate evaluation tool for the model. According to Keith (2003) effective design criteria can help users to evaluate and improve the quality and development of the web environment.

The instructional design literature showed that various instructional features and support elements according to the course objectives and learners' needs should be available irrespective of the mode of delivery. As stated by Chellman and Duchastel (2000) the design of online / blended learning environments should consider 'the full spectrum of design, including both content and technology elements'. Content elements refer to the basic instructional elements (e.g., objectives, content modules, instructional activities, and assessment) that set the pedagogic plan for a given module. Technology elements refer to the pedagogical affordances of technology (e.g., interaction and course management strategies). Weston and Barker (2001) suggest that online modules comprise carefully designed and multiple forms of media such as hypertext, links, graphics, animation, real-time audio and video and other hypermedia objects (such as Java applets and Macromedia Flash presentations) to improve presentation and involve students in active learning activities. According to Macdonald and Twining (2002), this mix of media should be adjusted appropriately to encourage students towards practising, discussion, and articulating, thus 'optimising the opportunities for self-directed learning and metacognitive learning'.

Similar views were also reflected in Oliver's (1999) proposal of three basic elements for the design of online learning environments based on constructivist perspectives; these three elements are: course content (in a variety of formats), learning activities (with room for reflective learning) and learner support (e.g., to guide learners through rich just-in-time feedback and to monitor their progress). The mostly used elements of the blend by more than 85% of the participants in a survey conducted by the elearning guild in 2003 include (in order of relevance):

- classroom instruction
- interactive web-based training
- email based communication
- self-paced content
- threaded discussion
- collaboration software
- virtual classroom
- print-based workbooks
- online testing

Tung (2003) and Yu (2002) report that course content, student participation, student interaction and technical support influence web-learning outcomes. Simpson (2000) states that the Internet could enhance student support in two ways: 'supplying information of various kinds; and offering interactive and diagnostic programmes' using email, synchronous and asynchronous conferences and information resources. These tools are helpful to facilitate student-tutor and peer interaction, encourage co-operative learning, enable the online tutor to observe and assess students' contributions and scaffold their thinking (Angeli, Valanides, and Bonk, 2003).

Hsu, Yeh, and Yen (2009) formulated a four-dimensional design criteria that include instructional strategy, teaching material, learning tool, and learning interface. Keith (2003) suggests that online learning resources could be reusable, accessible, durable, interoperable, adaptable, and affordable.

Hall, Watkins, and Eller (2003) developed a framework for web-based learning design, which consists of seven basic components: directionality, usability, consistency, interactivity, multi-modality, adaptability, and accountability.

Directionality is the first and the most important step in the design and development process in this model. It comprises the processes of carefully and thoughtfully analyzing the audience (the learners), of defining the usage context, and defining the learning goals. It helps to set the overriding pedagogical plan for a given module, and serves as a guide for all further design, and development (of learning environment, content, activities, and assessment).

The five components— *usability*, *consistency*, *interactivity*, *multi-modality*, and *adaptability* – may be broadly categorised as 'learner-interface design criteria', and is further discussed in the next section (3.12.2).

The last item the *Accountability* is the evaluation component which should in turn impact design modification via feedback. It is a basic part of an instructional design process, and is both formative and summative. It helps the designer to determine how effective a given web-based learning environment is, and to improve the design during its implementation as well as for its future use.

WebCT Corporation provides the following instructional design tips for developing an engaging and instructionally sound course using the WebCT LMS:

- Focus on organization of online materials;
- Provide transition between learning components;
- Encourage opportunities for knowledge acquisition;
- Encourage student participation;
- Provide ample opportunities for feedback;
- Provide methods for assessment;
- Follow proven instructional design techniques.

Based on the twelve socio-cognitive and technological determinants developed by Scardamalia (2002), the following guidelines may be used as a framework for the design of computer-based environments that emulate constructivism.

(a) Create environments that include social negotiation and cognitive responsibility;

(b) Provide authentic experiences and contexts;

(c) Allow for the development of pervasive knowledge.

Based on the above review, the features and elements for the design of this study may be categorised into the following six main components.

i) Hall et al.'s (2003) directionality which refers to analysis of the learners, defining the usage context, and defining the learning goals;

ii) A tutorial component that will comprise various instructional tasks (e.g., online modules, learning activities, collaborative instructional tasks and assessments);

iii) A course management component (e.g., schedule of activities such as assessments, grade release, etc);

iv) An interaction component (e.g., email, discussion boards, chat rooms, self-tests);

v) A support component (e.g., just-in-time feedback, chasing student progress, individualised additional resources, student tracking, diagnosis of student problems and selective individualised support to students) components that work together to enhance students' engagement in the learning activities and their performance; and

vi) Assessment and evaluation.

3.12.2 Learner-interface design considerations

Learner-interface is the fourth type of essential interaction in distance education by Moore (1992) and Hillman, Willis, and Gunawardena, (1994). It occurs between the learner and the technology, and it plays a crucial role in learning using digital technology. According to Cloete and Schremmer (2000) an elearning environment that displays efficiency, simplicity, and quality will attract most students and will be more likely to survive the competition. Interface design corresponds to the role of *gaining attention* in Gagné's events of instruction. Hillman, Willis, and Gunawardena (1994) argued that, in a Web-based course, the learner-interface interaction can have a tremendous bearing on students' learning of the content. A rich interface may encourage deeper immersion with course content than the traditional course format.

An interface to instruction is more than just a link between the learner and the learning materials; if it is intuitive enough it will be a key enabler in online learning because it can invoke and sustain learner's *interest*, *curiosity*, and *engagement* with activities, and can impact the quality of learner interactions with content, peers and the tutor. Engagement is a central concept for elearning course design which lacks face-to-face contact and visual cues. Quinn (1997) asserts that interfaces in instructional multimedia are (to be) designed to promote engagement.

Vilamil-Casanova and Molina (1996) provide eight useful tips for interface design.

(i) Keep cognitive load low;

(ii) Avoid dividing attention;

(iii) Use media to direct attention;

(iv) Keep important information visible;

(v) Encourage rehearsal;

(vi) Use concrete words and multiple media;

(vii) Design effective exercises;

(viii) Create realistic simulations.

The literature (e.g; Harwood and Miller, 2001; Vilamil-Casanova and Molina, 1996; Clark and Mayer, 2003) and review of learning theories in Chapter 2 (e.g., Cognitive load theory – Section 2.7.9; Cognitive Theory of Multimedia Learning – Section 2.7.10 ; Cognitive flexibility theory- Section 2.7.11) throw light on several factors that should be considered for effective interface design. Some of these are: accessibility, flexibility, ease of use, simplicity, user control, visual design, usability, consistency, interactivity, multi-modality, and adaptability. Several of these are interdependent ; each of these may be associated with other design issues or factors; for example, visual design is associated with readability, scannability, and the right choice, combination and contrast of text, graphics, animations, colour, icons and display density; readability and scannability are closely related to the design and organization of the content. These design factors are guiding principles for creating a web-based learning environment that is easy to navigate, does not cause the learner "lost in hyperspace" (Burbules and Callister, 1996), downloads quickly, includes only the most fundamental information, user-friendly, keeps the learner engaged and interested, and provides the learner a rich and meaningful learning experience.

Based on these design factors, some very useful basic principles for designing good learner interface are:

- Keep important information short (preferably bulleted), and easily accessible—easily scannable and readable with sufficient "white space" around clusters of text so that learners will not feel overwhelmed by the screen content; the background colour, font specs (size, italics, bold, colour[8], etc), and the number of lines of information on the screen should be related to readability than aesthetics. Stemler's (1997) suggestion is to align text left, and mix upper and lower case letters for faster reading.
- Use appropriate strategies to minimise unnecessary cognitive load (Sweller, 1999) on the learner and to optimize the use of their working memory; See Mayer's (2001) seven design principles in Section 2.7.10. For example, include both words and graphics close to each other in a complementary manner to explain concepts than solely in words; present content in multiple formats to facilitate maximum sensations.
- Use realistic simulations and graphics to direct attention; Adding interesting, but unnecessary, material can interfere with learning; Nielsen (2000) (cited in Hall, Watkins, Davis, Belarbi, and Chandrashekhara, 2001) advocates that web design should not include graphics and sounds unless they are absolutely essential.
- Dynamic simulations in combination with audio can be particularly effective for increasing student learning, so long as the audio is directly related to the information to be learned (Moreno and Mayer, 2000, pp. 117–125).
- Avoid dividing attention; presenting words as both text and simultaneous audio narration (simultaneous seeing and hearing the same message) can interfere with learning.
- Present words as audio narration rather than onscreen text for better possibility for student learning.
- Focus on enabling student learning rather than on aesthetic design.

All the above elements are critical in enhancing and sustaining learner motivation as suggested in Keller's ARCS model (Section 3.5.2).

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[8] *Not everyone can see all colours you use in course materials. Materials can be evaluated for accessibility at www.webxact.watchfire.com/*

3.12.3 Course organisation for blended learning

Course organisation is important especially in an online environment for the following reasons:

- It is a way of managing the course so that it becomes easier to teach/develop and to interact with;
- It makes it easier to monitor the coverage of the course in terms of depth and breadth within the scope of the course;
- It makes the course content more functional and easier to navigate through for the online learner (Graham et al., 2001);
- Careful and thoughtful course organisation allows learners to navigate easily and figure out without any difficulty where they are in the course and where they have to go next; it gives them a sense of greater control over the learning environment and the content.

Course organisation is done at macro as well as micro levels. Organisation at macro level refers to dividing the course into manageable sections and sub-sections, and deciding how these will connect to each other. It is characterised by large units of instruction (Modules) and each of these units being broken down into several individual lessons/sessions (Smith and Ragan, 2005). Micro level organisation refers to analysing the content of each session to determine the necessary supporting content, activities and sequences of the instructional events.

Course organisation involves instructional analysis that helps to determine, among other things, what needs to be taught, how much of it is to be taught and over what duration it should be taught. Once what needs to be taught has been decided, it is important to organise its content into sections and determine what will connect to what and in what way. This would lead to content units or chunks that support learning and even facilitate content reuse in other contexts and courses. Web courses may be organised as using a linear path, open paths or a modular structure (Graham et al., 2000).

Linear approach: This approach follows a fixed path and is intended to achieve focussed and specific objectives. It is more suited to directed rather than autonomous learning. Web courses which are organised this way can be constraining because of their prescriptive nature.

Open free path approach: This approach is flexible and offers many entry points and approaches to the course material courses. Courses that follow this structure have no clear route prescribed but allow learners to entirely follow their preferred paths of learning and take responsibility for their own choices. It is therefore most suitable for experienced and autonomous learners and for courses that do not require structure like creative writing and fine arts. Its major disadvantage is that without proper guidance it may disorient and discourage learners.

Modular approach: The modular approach falls somewhere in between the two approaches above. It has the advantage of offering the choice lacking in linear paths but adding the stability which is usually deficient in open structures. In this approach there is a choice of materials which can stand alone to choose from (modules) and within these modules you go through individual sections in a more linear way. A diagrammatic representation of modules and sections is given below.

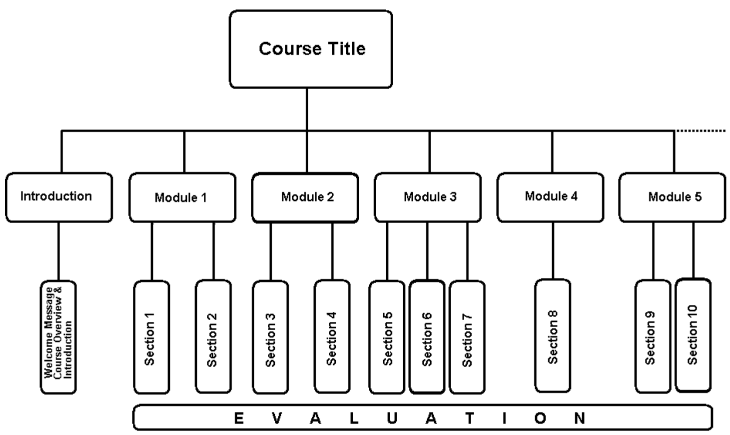

Figure 3.11: Modular organisation of a course

This approach probably has the widest application in web-based courses as it caters for different learning styles. Modularity is one of the key features of elearning models, according to Harwood and Miller (2001). Modularity makes it easily possible to divide each elearning environment into separate modules that can operate essentially independently, but when used in conjunction with other modules constitute the complete elearning environment.

The LAPTEL model was developed through the design and integration of all the above discussed content as well as technology-based components and consider. The overall blended approach was facilitated in face-to-face as well as online modes in such a way they complement and reinforce each other as discussed in Section 5.8.4.

3.12.4 Interactivity and feedback design

According to Hirumi (2002, pp. 19–27), in effective design for elearning, the key is the successful integration of all factors that influence interaction. Interactivity is the most powerful feature of the Web to date, and as such it deserves special attention when designing online instruction (Weston, Gandell, McAlpine, and Finkelstein, 1999, pp. 35-44). Students must use relevant technology affordances to interact with the content, the instructor, and the other students as discussed in Section 2.8.1.

Wagner (1997) outlined twelve specific instructional outcomes achievable through interaction:

a) Interaction to enhance elaboration and retention;
b) Interaction to support learner control/self regulation;
c) Interaction to increase motivation;
d) Interaction for negotiation of understanding;
e) Interaction for team building;
f) Interaction for discovery;
g) Interaction for exploration;
h) Interaction for clarification of understanding;
i) Interaction for closure;
j) Interaction to increase participation;
k) Interaction to develop communication;
l) Interaction to receive feedback (pp. 22-25).

Rich feedback is a vital part of the learning process during which misconceptions are corrected. The educational value of an elearning program is directly linked to the style and quality of feedback to the users. Meaningful feedback improves performance (Driscoll, 2002). Studies have shown that immediate feedback leads to significant reductions in time taken by students to achieve a desired level of performance (Anderson, Conrad, and Corbett, 1989). Learners should also receive regular as well as timely feedback on the progress they are making. Feedback from peers is also as important as instructor/tutor feedback (Johnson and Aragon, 2002).

Three types of diagnostic feedbacks are critical at this stage:

i) *Individual feedback*: The teacher checks students' queries, submitted assignments, or the correctness of the solution to problems and responds individually, usually by email, the efforts of students, thus motivating the student to solve further tasks. In an online environment the learner-tutor feedback process in a positive, encouraging and non-critical manner promotes personalised learning.

ii) *Group feedback*: The teacher can sum up submissions of all students who work on similar problems, and respond to them jointly. Here, it is important that all students find some references to their work in the teacher's summary. The appropriate tool for this can be discussion forum or group email.

iii) Feedback by students: This gives students the chance to peer review and practise collaborative assessments; they review other students' work as it will be done by the teacher. On a small scale, two partners can send each other feedback on their work. Another possibility for students is to post their answers in the discussion forum and the other students give feedback. This type of feedback and assessment helps students to reduce dependence on teachers as the only source of judgement about the quality of their learning; this can also help take some of the workload off the teachers.

In any new project, feedback from students is critical; it helps in updating learning materials and instructional strategies for subsequent presentations. A well-designed programme should provide appropriate semantic feedback that confirms the intention, feedback at appropriate points, and appropriate status indicators to show the users the progress with a lengthy operation (Greer, 2002:[online]).

3.12.5 Design of Instructional Assessment

According to Chickering and Gamson (1987), "knowing what you know and don't know focuses learning." so giving frequent assessment and feedback on performance is crucial. Provide self-assessment activities also such that students can have deep insight into their understanding of the topic and gauge their progress.

Projects, tests, assignments, and portfolios are among the major methods used for assessing student learning and are increasingly being done electronically. The portfolio is evolving into an electronic multimedia presentation of images, video, and audio that goes far beyond paper files.

Weekly class discussions that take place on discussion boards or blogs provide the instructor with an electronic record that can be reviewed over and over again to examine how students have participated and progressed over time. They are also most helpful to instructors in assessing their own teaching and in reviewing what worked and what did not work in a class.

Teachers should mark student assignments by providing them with comments on why they are strong or weak. Also students should be given sample answers and rubrics in order to make the expectations clear and the marking transparent.

Information from the final test/assessment can also be used to determine what areas of the course have to be revised. This is done by looking at the questions that were often missed by students to answer satisfactorily. It might also indicate that the test items were inappropriate, in which case they will need to be improved. Thus the course can also be revised based on the findings from the final assessment.

Though online instruction continues to thrive, there is major concern when it comes to developing effective forms of online assessment. The most important points to be taken care of are:

- ➢ Learning standards are to be defined at course introduction level;
- ➢ Alignment of assessment with course activities and learning outcomes;
- ➢ Ensure that instructions are very clear; avoid ambiguous wording for instructions and messages;
- ➢ Provide assignments and assessments that:
    - ✓ encourage students to think critically, not just to use rote memorization;
    - ✓ promote positive learning experiences;

- ✓ measure student progress towards stated learning objectives;
- ✓ consider both content and the skills used in the process of learning;
- ✓ provide opportunities for students to apply concepts and skills they have learned;
- ✓ that test on both lower order as well as higher order skills;
- ✓ are seamlessly integrated with the learning activities, and can be built up into Electronic portfolios (ePortfolios) that is becoming a popular and powerful way to document, demonstrate, and reflect upon what students know and can do.

- ➢ Progressive online learner assessment: select appropriate assessment strategies that include:
  - ✓ team/group assessments for collaboration and cooperation;
  - ✓ individual assessments;
  - ✓ discussion assessments;
  - ✓ chat assessments.

All the design criteria / elements discussed above were integrated into the six stages of the LAPTEL Model. A checklist was developed with indicators based on these design criteria and presented in Section 5.8.3 to evaluate the model.

3.13 The Role of Instructional Designers

This section reviews the role of the Instructional Designer (IDr) based on the forgoing discussions around instructional / learning design approaches from different perspectives. Since the traditional ISD holds an objectivist world view, and epistemologically conflicts with the constructivist view that requires learners to construct their own relevant and conceptually functional representations of the external world, the constructivist view calls upon instructional designers to make a radical shift in their thinking and to develop rich learning environments that help to translate the philosophy of constructivism into actual practice (Tam, 2000).

For a shift in world view, the goal of instructional designers becomes the creation of rich learning environments or “designing for learning” that aid the individual in making sense of the environment as it is encountered. Therefore, instructional designers must now support tutors by providing explicit guidelines on the design of environments that foster individual knowledge construction.

Within institutions of higher education, IDr takes the role of a ‘midwife’ who is trained to assist teachers in the design of instructional strategies in their instructional design, development and delivery. Cennamo and Kalk (2005) state that the job of an IDr is to work with subject matter experts to translate “their needs and desires into the design specifications that will yield a successful product”. They have a great amount of control over what type of experience a learner might have. The key is to provide learners with a wealth of learning materials and techniques for investigating them in different sequences of their own choice and under a high degree of learner control. To design effective learning materials and environments, the IDr requires not only an understanding of how people learn but also should have the expertise and experience to design, implement and assess educational activities that meet the needs of all students. Some of the key tasks, the IDr will engage in are:

- ✓ Needs/learner assessment
- ✓ Task analysis
- ✓ Media selection
- ✓ Formative evaluation (including pilot testing)

A seminal research conducted by Donald (2002) aimed to reach a deeper understanding of the thinking approaches taken in different disciplines and applying these approaches to students’ intellectual development, reveals that there are significant differences in thinking, validation processes and learning activities between disciplines. This implies that the design and development of effective classroom experiences requires deep understanding of the content and culture within each discipline. Therefore, it is a requisite, –when instructional designers are pedagogical experts but not content experts and the teachers are content experts but not pedagogical experts— that there exists close working relationship and cooperation between the IDr and the teacher; they should collaboratively conceive, define and design relevant teaching and learning activities that will provide high quality learning experience to the learners.

Bates (2005) argued that instructional designers are pivotal to the growth and success of elearning offerings in higher education. According to him, most academics will need to consult with instructional designers to ensure that the technologies they choose and use will teach the concepts effectively and meet their students' needs. Instructional designers have an important role in technology integration into the design process, and to provide consulting to teaching faculty in the curriculum development for elearning activities. The role of instructional designers in developing engaging and instructionally sound online courses is vital for developing innovative learning environments and may be summarised as below:

- Encourage a collaborative project management / team approach with teachers and students;
- Provide guidance and suggestions about the content, activities, strategy and structure of the web-based course;
- Provide clear explanations describing what each file contains and how the file fits in with the overall goals of the lesson;
- Focus on organization of online materials;
- Provide transition between learning components as well as between online and face-to-face;
- Design, develop and demonstrate a prototype;
- Participate in evaluating the prototype;
- Design and develop the course;
- Encourage student engagement, and foster knowledge acquisition through collaboration, discussion and negotiation by assigning group projects where students "meet" online.
- Provide ample opportunities for feedback;
- Provide methods for assessment;
- Follow proven instructional design techniques;
- Ensure that agreed deadlines are met;
- Follow quality assurance guidelines;
- Participate in the quality assurance team;

- Carry out ongoing formative evaluation;
- Implement changes based on evaluation;
- Liaise with systems experts with respect to student registration, and uploading course to LMS;
- Organise and present student orientation sessions;
- Upload student survey and download results;
- Report problems to project managers.

Thus, in addition to being a designer, they also have to be in the roles of an Editor/Reviewer/Tester, a surrogate student and a Project Manager. The use of project management in the design and development of flexible learning environments is further discussed in Section 4.11. The next section reviews the critical success factors for the integration of technology and emphasise the role of leadership of an organisation as a driver in technology adoption.

3.14 Critical success factors for the integration of new technology

Although the integration of new technology in higher education is exciting and beguiling, it cannot be successfully accomplished by only employing technological solutions according to existing educational practices. Elearning environments are complex systems and incorporate a variety of organisational, administrative, instructional and technological components (Psaromiligkos and Retalis, 2002). To succeed in implementing elearning, Jochems, van Merrienboer, and Koper (2004) suggest that pedagogical, technological and organisational aspects have to be taken into account.

It is evident from the literature that, though it is not everything, technology has a critical role in the successful implementation of web-based blended learning; its availability in terms of quantity and quality, and reliability cannot be overemphasised for everyone to have equitable access to the online course; students should be able to access the course anytime anywhere for them to actively participate, to take advantage of the flexibility of online learning, and thus, to own it. For this reason, access is considered a pre-requisite element of the LAPTEL model as discussed in Section 5.8.1.

Institutions intending to offer courses online can face many challenges because transformative technology is *disruptive*[9] and it calls for a radical change in teaching, learning and organisational culture. Existing research on faculty adoption of teaching technologies shows a range of responses that spans stubborn resistance to eager early adoption (Dey, Burn, and Gerdes, 2009).

Three significant success factors, which require special attention to minimise the possible barriers and for successful technological transformation in UB, have been identified in a study by Uys (2003) conducted at UB. These factors focus on the need:

(i) for clear vision for technology transformation, committed leadership, and dedicated change agents;

(ii) for appreciation of the systemic nature of the infusion[10] of instructional technologies;

(iii) to address the complex nature of the infusion of instructional technologies.

In fact this is not all; there are factors such as the need for the professional development of instructors in order to equip them to embrace the new pedagogical approach, continuing support to instructors, institutional strategies / policies, student support, monitoring, evaluation and quality assurance, and engagement in research into learning technologies and their application in learning and teaching. Expertise in the use of appropriate technology is a core capability for driving technology adoption in education and training. More issues peculiar to an organisation may be identified in a SWOT analysis. Though these are critical, they fall outside the domain of this study.

Matters arising from the two factors (ii) and (iii) above in the context of this study have already been discussed and relevant literature also has been reviewed in Chapter 2. All elements of the first factor may be tied to the leadership role and it is discussed in the following section.

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[9] *Indicative of the changes that elearning brings to "traditional" learning and teaching contexts and the possible difficulties that the organisation will face while trying to implement change.*

[10] To me he meant *technology integration* by the term *infusion* because that is what UB is driving.

3.14.1 Leadership Roles for Organisational Change

This section examines the role of leadership in driving and managing the change associated with technology innovation and in providing a healthy implementation climate[11] in terms of relevant institutional vision for transformation, policies, and support such as appropriate infrastructure and resources. No innovation can be successful without good support from the management and its leadership. Bates (2000) suggests that "perhaps the biggest challenge (in distance education) is the lack of vision and the failure to use technology strategically" (p. 7). Sound leadership and change management skills are key to implementing the use of new educational technologies to support elearning programs and foster transformation (LaBonte, 2008; Garrison and Cleveland-Innes, 2005; Byrom and Bingham, 2001) and to manage sustainable change in support of the ever-evolving paradigm shift in higher education (Tesone, Fischler, and Giannoni, 2002).

To effect the technology transformation, leaders themselves should have a clear understanding of the transformative potential of elearning and be equipped to lead the adoption and effective use of new technology across the organisation; they should also be aware of the associated change processes, the strategies to successfully implement initiatives and sustain them, and the different stages of infrastructure development. Creating proper awareness of any new innovation across the academia also falls under the role of leadership. It is the first stage in the ADKAR[12] model of change management, and is critical in developing a strong desire among its prospective adopters to change. Sometimes, innovations or a change takes longer to get wide-spread acceptance just because of poor understanding[13] of the underlying concepts by or poor foresight of its leaders.

Tertiary institutions have strong entrenched cultures that may resist change (Rantz, 2002). Faculty members have various reasons to maintain the status quo, often using academic freedom as an excuse. As their professional progression such as promotion and contract renewal are largely based on research and publication, some of them do not feel the need to spend time in new, unfamiliar instructional strategies that are not

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[11] *Implementation climate is defined as 'targeted employees' shared summary perceptions of the extent to which their use of a specific innovation is rewarded, supported, and expected within an organization" (Klein and Sorra, 1996, p. 1060).*

[12] The term *ADKAR is an acronym for Awareness, Desire, Knowledge, Ability and Reinforcement.*

[13] Two such interesting examples for leaders' short-sightedness from the past are statements such as: "I think there is a world market for may be five computers" (Thomas Watson, Chairman of IBM, 1943) and "640 kilobyte should be enough memory for anybody" (Bill Gates, 1981).

potentially rewarding. As a result, transition from traditional delivery methods to technology adoption is inevitably a difficult process and it requires strong and supportive leadership to support instructors through the change process by providing strong, positive climate for implementation, addressing their concerns and thus playing a major role towards organization's receptivity towards change. Common concerns of academics include: lack of reward structure, lack of expertise in the use of technology, and intellectual property issues. Leaders must be overtly supportive by articulating a vision statement, and being 'visible' in the forefront; only then they can influence, inspire and enthuse their subordinates, and gain their commitment. Leadership "influences … the way instructors organise and conduct their instruction" (Mulford, Silins and Leithwood, 2004, p. 9).

Leadership is generally defined as the ability to influence and persuade others to agree on purpose (Sergiovanni, 2007). While early definitions of leadership focussed mostly on leader's charisma and relationships within a community, more recent models focus on leadership as the ability of the leader to cope with complex change (Fullan, 2003) and the capacity to mobilise others and work with them to translate vision into reality. As a result, the position of institutional leader is typically one of the most challenging roles in tertiary education.

Uys (2000) in his LASO model for Technological Transformation in Tertiary Education highlights the crucial role of leadership, without which technology adoption in conventional tertiary education will be slow and cumbersome. Highlighting the importance of leadership in the technological change process, Bates (2000) argues, "...the widespread use of new technologies in an organization does constitute a major cultural change. Furthermore, for such change to be successful, leadership of the highest quality is required" (p. 42). Several models for integrating instructional technology into HE emphasise the role of administrative leadership; for example, the RIPPLES (**R**esources, **I**nfrastructure, **P**eople, **P**olicies, **L**earning, **E**valuation, and **S**upport**)** model (Surry, Ensminger, and Haab, 2005) advocates the role of leadership in providing appropriate institutional *policies* and *support*.

However, it is becoming increasingly evident that most of the traditional leaders in HEIs do not have adequate management and leadership competencies to respond to needs of technology driven changes in the modern society, to drive institution wide technology transformation, and to manage effectively and efficiently the changes associated with it. This has serious implications for leadership development. As a result, there is an emerging concept called “digital leadership” that is crucial for shaping digital innovations in today’s rapidly advancing digital environments.

Two approaches that may be considered to strengthen the digital leadership in educational contexts are *transformative* and *distributed* leadership concepts. *Transformational leadership* (Leithwood and Riel, 2003; Leithwood and Jantzi, 2005) advocates collaborative leadership by bringing together leaders from different levels of the institution; the thesis is that no one leader can facilitate transformational change in implementing elearning programs. Transformational leadership invokes change that comprises changing pedagogy and how learning is organised; for this to be successful, collaboration has to be extended to all stakeholders that include leaders, instructors, students, and the community at large. Distributed leadership approach is a *systemic* perspective and is essentially about sharing leadership across an organisation; the action and influence of people at all levels is recognised as integral to the overall adoption of new innovations. According to Arrowsmith (2006) distributed leadership has the potential to transform schools, raising achievement and inspiring more effective practice from staff. Both approaches promote team approach as espoused by Hall and Hord (2001), and are critical to overcome resistance and barriers to innovation. Uys (2000) also emphasises the need for integrated top-down and bottom-up, and inside-out initiatives for successful technology adoption.

Given the forgoing discussions, and further elaborations in Sections 5.8.1.1 and 7.5.1 the study takes digital leadership based on both transformative and distributed strategies as a major requirement for technology integration in higher education settings and is considered as a key component of the blended learning model developed in this study. Thus, this section addressed the fourth research objective: *To examine the role of the leadership in managing the change associated with technology innovation and in providing appropriate infrastructure and support.*

3.15 Summary

All discussions in this chapter were aimed at laying the foundation for a new blended learning model that teachers could use to guide them through the necessary changes they will need to make to be successful in integrating new technology into their instructional strategies. The chapter in its early part provided an overview of instructional design and discussed the traditionally dominant instructional design models. In general, instructional design is concerned with improving learning by translating general principles of learning and instruction into plans for instructional materials and learning activities, regardless of whether the delivery method is via online instruction, face-to-face classroom settings or a hybrid mode. The discussion further included the trends towards constructivist design approaches as well as the strategies and environments to support blended learning such as specification of learning needs, materials, activities and delivery methods and needs.

A literature review of blended learning design approaches and learner-interface design considerations have been carried out in order distil design criteria for designing the model in this study. A review of the critical success factors for technology integration revealed that the institutional leadership has a major role in facilitating the change process that comes with technology adoption. The changing role of the instructional designer in the context of technology integration was discussed as it was critical to provide teachers a user-friendly and non-threatening environment for technology adoption.

Further, this chapter addressed the latter part of the third specific objective: *To carry out an extensive review of pertinent learning theories and literature relating to the principles of instructional design and constructivist learning design that will lead to the design of blended learning environments*, and the fourth research objective: *To examine the role of the leadership in managing the change associated with technology innovation and in providing appropriate infrastructure and support.*

The next chapter reviews the theoretical and philosophical assumptions underlying the research methodology. Further, it attempts to orientate the reader to the research methodologies, strategies and design used in the study, including procedures, participants, instruments, resources and timeline; it describes the data collection and analysis methods, while explaining the process of its implementation.