CHAPTER 2

Theoretical Framework and Literature Review

We are on the cusp of a completely "new era", and changes must be made in education to ensure that all students leave school prepared to face the challenges of a redefined world.

(Thornburg, 2000)

2.1   Introduction

Collaborative learning through structured blending of online tutorials, and lecture supplemented with Socratic dialogue, role-based group assignments and other similar activities seems to be a viable option in the context of the University of Botswana (UB). Successful blending requires an understanding of the pedagogical attributes and affordances[1] of new and emerging learning technologies, the most desirable aspects of face-to-face teaching and the ways in which these aspects can be appropriately integrated as discussed in the following sections. Therefore, this chapter discusses the scope of these technologies in Higher Education (HE) from various perspectives, its potential impact on the net generation students, its affordances in student learning and research, distinct features of elearning and blended learning, how these modes of delivery compare with traditional face-to-face approaches, and their benefits to higher education as well as the challenges they pose. This chapter also helps to gain understanding of the conditions under which the enabling potential of technology will be realised and further, establish the purpose of this study.

In order to establish the rationale of placing blended learning at the core of this study, this chapter proposes a theoretical framework that serves as the foundation for the study; it is critical to have a theoretical framework as this is a descriptive and interpretive qualitative case study; it helped the Researcher to review the underlying theories, philosophies, assumptions, and methodological techniques of the study, and to formulate the basis for developing instruments for data collection.

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[1] The organization of learning and engagement of learners through educational technologies is essential to pedagogy (Gayol and Schied, 1997).

Blended learning does not have a pedagogy of its own, but it draws its strength from the three basic theoretical perspectives on learning: *behaviourism*, *cognitivism*, and *constructivism*. Therefore, a review of all these three basic learning theories and a few other theories derived from these that have relevance to the design of student-centred blended learning environments (e.g., social constructivism, activity theory, and situated cognition) was made. Such a review of learning theories is critical to formulate a scaffold upon which this study can be grounded.

The literature review continues to Chapter 3 where a review of instructional systems design models, constructivist design principles and emerging views around learning designs will be made in order to identify appropriate learning design principles based on relevant perspectives from learning theories (which are descriptive).

Moreover, this chapter addresses the first two specific objectives and the first part of the third one listed under the research question posed in Chapter 1, Section 1.8.

2.1.1   *Societal foundation of the study*

The 21st century society makes great demands on its members because of rapidly developing and ever-changing political, cultural, social, economical and technological situations. Personal computers, cell phones, and social networks, all of which were once considered frivolous, have made such a huge impact on our culture that our daily lives will not be easy without them. Consequently, the society expects its members to keep pace with these changing situations, and adapt their skills and expertise in all aspects of life. Many societies around the world strongly believe that it is the duty of higher education institutions to provide its youths with these skills and expertise. This raises increasing societal concern for the quality of learning and teaching at higher education institutions.

As a result of such unprecedented pressure on educational institutions to keep pace with the ever-changing societal needs and expectations, the emphasis in educational approaches has shifted over time in order to reflect the transition from less formal schooling in the agrarian society to remedial repetitive learning in the industrialization age to learning with an understanding (rather than teaching) in today's knowledge society. Educational approaches have also been influenced by the recent rapid advances and proliferation of new communications technology. The kind of skills

students need to develop to be prepared for the jobs of the 21st century is different from what they needed 20 and odd years ago. Today's employers look for young people with problem-solving, interpersonal and team skills. The concept of 'lifelong learning' and its role in building a 'knowledge society' are also high on the agenda. As a result, learning design approaches, goals and processes as well as appropriate learning environments must support the development of the aforementioned skills and expertise. Thus, an urgent need to devise new ways of teaching and learning is critical if we are to prepare our students to live, work and prosper in the 21st century. As a result, different modern educational strategies such as self-directed learning, collaborative learning, experiential-based learning and active learning have emerged.

Although the new technology has significant impact on most segments of our society— work, leisure, culture and social interaction— the same degree of its uptake has not been seen in the higher education classrooms. Many educators believe that technology has the potential to solve many of the pressures associated with the societal change in attitude and delivery of education (Franklin and Peat, 2001). Considering the growing understanding of the potential of the internet and communications technology (ICT) to connect learners with learners as well as with instructors, and to provide them with interactive and engaged learning experiences, the transformation of teaching and learning in HE is inevitable. As new educational technologies become available, re-thinking conventional practices around teaching and learning is of paramount importance as resources gradually diminish and demand for access to better quality higher education dramatically increase.

Information overload is a serious concern in an information-based, technology-driven society. So much information is available in the form of facts, concepts, rules and procedures. For educators, the rapid changes in information and technology present several challenges. Information literacy skill has become one of the essential skills as the other 3R's (Reading, writing, and arithmetic) in order to judge what information is "essential" and what content information has to be included into their curriculum. All these require educators to train their students to search for, access, retrieve, interpret, synthesize, organize, and communicate information, as well as to become independent, life-long learners.

In order to address the needs and demands associated with a knowledge society and the wave of technological innovations, the HE system in Botswana must transform.

According to Garrison and Vaughan (2008) higher education must start delivering on its promises of providing learning experiences that engage and address the needs of society in the twenty-first century. The good news is that the government of Botswana is fully committed to the widespread adoption of ICTs in all sectors of society, including education. Subsequently, the University of Botswana has developed the required technological infrastructure including the acquisition of an LMS (Blackboard/WebCT), with a view to advancing one of its aspirations to develop a student-centred, intellectually stimulating, and technologically advanced teaching, learning, and research environment (University of Botswana, 2004). This study is around developing a model to tap the potential of new and emerging technology by blending it with the traditional face-to-face teaching and learning environment at UB.

2.2 The scope of ICT in higher education

If African countries cannot take advantage of the information revolution and surf this great wave of technological change, they may be crushed by it... Catching this wave will require visionary leadership in Africa.

…… Naidoo and Schutte (1999, p. 90)

Although modern technologies have had huge impact on most aspects of our lives, and the society in general, they did not have the same transformative effect on higher education in Botswana. In the following sections, the Researcher throws some light on why he thinks technology-supported learning environments, when developed correctly and used appropriately, can engage students in learning and can have a positive impact on student outcomes in higher education because that is the underlying driver of this study. The discussions focus on ICT's impact on higher education students' characteristics, ICT's benefits to students in their learning process and associated challenges. Further, this section addresses the research objective, "*to understand the strengths of ICT in higher education context and the rationale of using it in teaching and learning in relation to conventional face-to-face instructional approaches, and to identify the way forward to realise these strengths.*"

2.2.1   The impact of new technologies on the characteristics of higher education students

Environment seems to have an impact on a person's intellectual development. As a result, it is likely that the rapid societal and technological changes can have a huge impact on how students think and learn.

Neuroscientists are advancing their research into areas relevant to education. Dr. Gary Small, one of America's leading neuroscientists and experts on brain function and behaviour in a new book called 'iBrain: Surviving the Technological Alteration of the Modern Mind' argues that daily exposure to digital technologies such as the internet and smart phones can alter how the brain works (Small, 2008). According to him, as we continue to learn, our brains continue to develop and create new pathways and new connections which are continually shaped, reshaped and controlled by advancing societal and technological advances.

Recently, social networking applications such as blogs, wikis, and twitter have seen an unprecedented uptake by many people, especially by the youth. Growing in an interactive, socially interconnected technology environment, as compared to such passive activities as watching television or listening to a lecture can cause a huge change in the demographics, interests, needs, expectations and work habits of today's student population. When technology and its impact is ubiquitous and pervasive in all aspects of our life, our classrooms need to reflect what goes on around outside. Schools must try to bridge the gap between classrooms and real-world scenarios.

In the world of pervasive Internet, and the Web 2.0 social networking technologies[2], learners are also evolving into a new genre—the so-called "digital natives" who want to be in constant communication with their peers, expect individualized instruction and a personalized learning environment, which automatically adapt to their individual needs. In a recent study by Researchers at the University of Maryland on the impact of cell phones, social media and the Internet on American college students, 200 students were asked to give up all media for one full day (The New York Times, April 23, 2010). The study found that after 24 hours many of them showed signs of withdrawal, craving and anxiety along with an inability to function well without their

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[2] The term "Web 2.0" is commonly associated with web applications that facilitate interactive information sharing, interoperability, user-centred design and collaboration on the World Wide Web (http://en.wikipedia.org/wiki/Web_2.0).

media and social links; these, in fact, are symptoms similar to drug and alcohol addictions.

Today's technologically savvy new generation of students have often taught themselves technical skills and digital literacy; they use technologies—internet, mobile phones, instant messaging, and the like— for socialisation, entertainment, etc and do not see technology as something foreign. They consider technology to be part of their lives. It does not make sense to deprive learners of technology while they are at school; they will want and readily accept technology at school.

As a result of such significant impact of new technology tools, most of today's students enrolled into HE institutions think and process information fundamentally different from their predecessors; they may not be satisfied with the traditional transmission approach of the lecture approach and knowledge transmission; they would prefer to interact with the instructor and to be in constant communication with their peers, and learn best in highly customisable environments in which knowledge can be created and shared collaboratively. Further, they would expect technologically-literate teachers, a new form of tuition with emphasis on individualized instruction and a personalized, engaging learning environment, new models of learner support, and access to technology-supported courses. Dey, Burn, and Gerdes (2009) lament that students arrive on campuses ready to engage information in new ways, only to find faculty who are reluctant to alter their traditional and entrenched teaching approaches. It will soon be not a surprise if students question conventional practices as an effective approach to engage them in critical and creative thinking and learning. Therefore, a revolution in Botswana higher education landscape is inevitable.

By employing technologies familiar to students for designing and developing learning environments, educators can better stimulate their active involvement in experiential and authentic learning in engaging ways. Incorporating the concept of Web 2.0 into our courses, both on—campus and online—will help elicit learner participation beyond the standard textual expectations and engage them more as active learners (Kurtz and Sponder, 2010).

The classrooms have to change to reflect what goes on around outside, and to bridge the gap between classrooms and real-world conditions such as changing workplace demands. As Tapscott (2009) points out, the net generation (students born during

1977-1997) is forcing a change in the model of teaching, from a "teacher-focused approach based on instruction to a student-focused model based on collaboration."

According to Chris Dede (2005) "Rapid advances in information technology are reshaping the learning styles of many students in higher education." As a result, advances in technology create new opportunities for higher education; emerging technologies can be used to deliver instruction matched to the learning styles of the new genre of students. Therefore it is critical for Higher education to make use of modern technologies in a manner that encourages and optimizes learning.

However, engaging students in meaningful and rewarding instructional activities in technology-supported learning environments is a real challenge for both researchers and educators. It has become necessary for them to learn more about their students and to put that understanding to work in the design and implementation of their teaching and learning environments. Unfortunately, the new learner characteristics and needs are not recognised by some or most of the teachers. Gabriel (2008) notes a recurring complaint among university teachers that most of today's students come underprepared to university; the simple reason for this view is that most of today's students are not interested in sitting down in traditional classrooms to attend long lectures.

2.2.2 *New ways of learning with technology*

Major advances in the fields of cognitive psychology and neuroscience have significantly impacted the educational landscape. The convergence of these disciplines with technology is increasing at a fast pace, and it is affecting academia and their professional practice in many ways. The emergence of the Internet as a mainstream communication medium has resulted in the development of new educational opportunities, such as instruction delivered via asynchronous learning networks, synchronous online seminars, blogs, wikis, podcasts, etc. "Internet-based tools can facilitate communication, interaction, and collaborative learning in ways that were not possible before" (The Node, 2001). Paradigms such as just-in-time learning, constructivism, student-centred learning and collaborative approaches have emerged and are being supported by technological advancements such as simulations, and virtual reality. As a result, the higher education landscape is changing from the de-

emphasis on the delivery of instruction and the concurrent emphasis on the facilitation of student learning, to the use of technology to expand access and participation in education, and to the recognition of the importance of collaborative learning through communities of learners.

These developments have created both opportunities and areas of serious concerns around supporting pedagogies in the digital age. In the following sections, the Researcher discusses the benefits that students can gain from these new technologies based on the possible impact of its various attributes and how they can influence the factors that contribute towards student learning experiences. Subsequently, the Researcher discusses some of its relevant challenges as well as debates around the use of ICT in education.

2.2.3 *From the perspective of technology as a cognitive tool*

This study emphasises the notion about learning as a mindful, constructive activity involving deliberate cognitive efforts, and the application of technologies as cognitive learning tools rather than as instructional media. This represents a significant departure from traditional conceptions of technologies that were used for rote learning through activities such as mundane drill, and practice. Thus, the primary distinction between traditional learning applications of technologies and their use as cognitive tools is that traditional view assumes media as conveyors of information and learners to be passive recipients rather than active constructors of knowledge.

The literature on the use of computer as a cognitive tool has evolved in the last two decades. 'Mindtools' is another term that represent more or less the same thing as 'cognitive tools'; these two terms are used interchangeably in this study. Cognitive tools are technologies that help learners to engage in and facilitate cognitive processing leading to knowledge construction. The tool of technology is not one of a physical nature but rather a cognitive nature being used as an engager, facilitator of thinking and knowledge creation (Jonassen, Peck and Wilson, 2000). They enhance the cognitive powers of human beings during thinking, problem solving and learning (Jonassen and Reeves, 1996). According to Jonassen (2002), "the role of a mindtool is to extend the learner's cognitive functioning during the learning process, and to

engage and facilitate critical thinking and higher-order learning… Mindtools enable learners to become critical thinkers".

Cognitive tools are technologies that learners interact and think with in knowledge construction, designed to bring their expertise to the performance as part of the joint learning system (Kim and Reeves, 2007, p.224). According to Jonassen, Peck, and Wilson (2000), students do not learn directly from technology; the role of technology in instruction is to engage the learner more actively in the process of thinking and manipulating information which in turn facilitates the learning process. Thinking fosters learning.

Computers have the ability to mediate cognitive processes (Jonassen, and Reeves, 1996) by providing learners with the critical cognitive support to construct dynamic mental models which in turn, engage learners in still deeper processing and better learning. When using technology as cognitive tools in learning contexts, students and technologies can become intellectual partners in learning; in the process, it helps learners to surpass the limitations of their (commonly very limited) cognitive capabilities such as memory, thinking and problem solving capabilities, and to transfer some of the low level tasks such as calculations, storage and information retrieval to the computer. All these supports allow the learner to think more productively, and engage in important processes of articulation and reflection, which are the foundations of higher order thinking skills and knowledge construction. According to Jonassen (1994) a student who uses any cognitive tool effectively must necessarily engage (actively), think (deeply), and articulate their knowledge. With such technology affordances, students engage in knowledge construction and not in knowledge reproduction.

The 'cognitive tool' perspective holds that learning occurs only when learners actively engage themselves in complex learning environments that foster higher order thinking and problem solving skills. Activity theory (discussed in Section 2.7.4) and the socio-cultural work of Vygotsky (1978) provide a basis in this regard. According to Vygotsky, tools mediate and extend our ability to interact with each others by making it possible to externalize our thinking into forms that we can share with others and can act up on. He proposed that learning requires two mediational means— tangible tools (technical tools) and intangible tools or signs (semiotic tools). The role

that technology can play in learning is of particular importance when considering the idea of tools mediating human action.

It has to be noted that, though learners enter into intellectual partnerships with the tools, the role of technology as a cognitive tool is not meant to do the thinking for learners, but only to facilitate the thinking and learning processes. It is not that computers will directly teach content or thinking skills, but after working in partnership with computers, the student will internalise the way that computers think as a cognitive tool for their own use (Wegerif, 2007). Lajoie (1993) argue that "the appropriate role for a computer system is not that of a teacher/expert, but rather, that of a mind-extension "cognitive tool" (p. 5). Kennedy and McNaught (2001) argue, "carefully designed computer-based cognitive tools can scaffold learning by modelling complex environments or expert problem solving strategies".

Lajoie (1993, p. 261) summarizes the benefits of cognitive tools to learners as follows:

> ➢ Support cognitive processes, such as, memory organisation and metacognitive processes;
>
> ➢ Share the cognitive load by providing support for lower level cognitive skills so that resources are left over for higher order thinking skills;
>
> ➢ Allow the learners to engage in cognitive activities that would be out of their reach otherwise;
>
> ➢ Allow learners to generate and test hypotheses in the context of problem solving.

According to Jonassen and Reeves (1996, p. 693) the salient features of computer-based cognitive tools are that they:

> ➢ are simple for students to use;
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> ➢ function best in a constructivist learning environment;
>
> ➢ provide the opportunity for students to address meaningful questions in a realistic context and receive appropriate and timely feedback;
>
> ➢ encourage students to 'take on' the ownership of their own learning;

> ➢ offload basic cognitive demands while the learner focuses on higher level processes;

> ➢ facilitate the development of deeper and richer knowledge structures;

> ➢ facilitate collaborative and negotiative learning experiences that provide opportunities for students to explore, test, and validate their conceptions; and

> ➢ are unintelligent tools that facilitate a dialogue between teachers and learners and timely feedback appropriate to the task.

The perception of computers as cognitive tools has shed some new light on the long-standing argument about whether or not media influences learning. Computers as mindtools (Jonassen, Peck, and Wilson, 2000, pp.154-155) allow students to engage in a variety of critical thinking activities:

(a) to access and assess information,

(b) to compare and analyse data,

(c) to formulate and test hypotheses,

(d) to identify relationships and classify phenomena,

(e) to speculate and predict outcomes

(f) to synthesize and organize information

(g) to formulate and carry out a plan of action

(h) to make and evaluate decisions

(i) to represent and share knowledge.

The underpinning learning theory of the 'cognitive tool' perspective is constructivism, as opposed to instructivist theories underlying the traditional communications perspective. Today, constructivist approach to instruction is the most recognised and preferred method of instruction within technology-rich environments.

2.2.4   From the perspective of learning as a social activity

Learning is a social activity (Vygotsky, 1978). Social interaction plays a fundamental role in the development of cognition (Kearsley, 1994; Buchberger, 2000) that results in active learning. Human interaction is arguably the most powerful tool for learning

and skills development (Hall and LeCavalier, 2000); as a result, it enables active user participation leading to new ways of co-constructing ideas.   It is in social interaction that information can become knowledge. Social learning requires students to work in groups and it will enable them understand the way knowledge develops and changes today. Since knowledge is expanding exponentially in the information age, no one individual is an expert, rather individuals are part of a social network with others.

Lave and Wenger's (1999) model of situated learning proposed that learning involved a process of engagement in a 'community of practice'. Community of practice (CoP) is considered to be a type of learning community (Wenger, McDermott, and Snyder, 2002). Social learning theorists suggest that learning communities provide a foundation for sharing knowledge. It is believed that individuals can learn by creating and sharing information and knowledge within the learning community as well as observing and modelling other people.

In relation to learning and its social nature, Salomon (1993) argues that people appear *to think in conjunction* or *partnership* with others and with the help of culturally provided tools and implements. Driscoll (2000) defines learning as "a persisting change in human performance or performance potential…[which] must come about as a result of the learner's … **interaction with the world**[3]" (p.11). The concept of interaction is a core element of the seven principles of good practice in education proposed by Chickering and Gamson (1987). According to them, some of the dimensions of interaction are communication, collaboration, and active learning.

According to Moore (1990, 1996) three different types of interactions are essential for learning to occur: learner-content interactions, learner-instructor interactions, and learner-learner interactions. For learning to take place, the student must actively interact and cognitively process the content of the course, not just passively be exposed to it (Moore 1990, 1996; Berge, 1999). However, Berge (1999) departs from Moore, and combines "learner-instructor" and "learner-learner" interaction into one single category of "interpersonal interaction". According to him, for learning to occur, students must interact with each other and the instructor in order to arrive at shared meaning and to make sense of what they are learning. Interpersonal interaction provides the social context for the mutual construction of understanding and has been

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[3] *Emphasis has been added by the Researcher.*

demonstrated to play a major role in the learning process (Fulford and Zhang, 1993*).* This social context of learning is crucial for motivation, critical judgment and problem solving (Berge, 1999, p. 28).

Most people learn best when they are actively engaged in collaborative activities. Salomon and Perkins (1998) report that students' construction of knowledge is enhanced when they engage in the co-construction of knowledge with peers and with their tutors. The more opportunities they have, and the more actively engaged they are, the richer their understanding (SEDL, 1999: [online]; Wilson, 1997: [online]). Engaged learners are intrinsically motivated to perform tasks and activities. In any learning environment, truly engaged learners are behaviourally, intellectually, and emotionally in their learning tasks (Bangert-Drowns and Pyke, 2001).

Emerging social networking / Web 2.0 technology tools extend opportunities for interaction with the tutor, peers and content enabling students to work in groups beyond the classroom walls, thus facilitating and advancing the learning process. Such group-oriented efforts by students result in new learning strategies that are consistent with the concept of social learning.

2.2.5   *Affordances of technology in student learning*

For the past two decades, ICTs have transformed the ways teachers teach and students learn in different parts of the world. The role of computer in education has been largely viewed as an instructional tool and for providing a richer and more exciting learning environment (Duffy and Cunningham, 1996). Other major affordances that qualify technology as a learning tool are: *authenticity, interactivity, flexibility, and lifelong learning.* The technology-supported strategies also help to solve the problem of limited human working memory.

Machnaik (2002) argues that students learn from thinking in meaningful ways "when computers support knowledge construction, explorations, learning by doing and conversing" (p. 7). Meaningful learning will result when technologies engage learners in knowledge construction, not reproduction; conversation, not reception; articulation, not repetition; collaboration, not competition; and reflection, not prescription (Jonassen, Howland, Moore, and Marra, 2003). The related skills include skills in managing complex information, of higher order cognitive processes, and of self-

directed lifelong learning, and ability to organise, evaluate and monitor the progress of their own learning. Online learning by its very nature requires active student engagement in learning activities and a great degree of learner discipline, motivation, and control.

Different kinds of computer-related technologies are available to be incorporated in teaching and learning strategies (e.g., Bitter and Pierson, 2002; Lever-Duffy, and McDonald, 2008). Internet-based tools can facilitate communication, interaction, and collaborative learning in ways that were not possible before (The Node, 2001). Interactive features of technology help to create challenging activities that enable learners to link new information to old; acquire meaningful knowledge; and use their metacognitive abilities; hence, it is the instructional strategy, not the technology that influences the quality of learning (Bonk and Reynolds, 1997). Nowadays, the widespread acceptance and use of social software, learning is increasingly supported by interactive learning environments, semantically enhanced content and social software (e.g. Wikis, Weblogs, ePortfolios, Social Bookmarks, Social networks like YouTube, FaceBook, Flickr, and Second Life). Richardson (2008) reports: Web 2.0 can exploit the internet's educational potential for social learning and teaching, as well as informal learning, and bring in an increased emphasis on autonomy, interactivity, creativity and collaboration. Greenhow, Robelia, and Hughes (2009) argue that Web 2.0 technologies are well suited to enhancing the education research community's purpose of generating and sharing knowledge. The affordances of Web 2.0 seem to fit with modern thinking about the nature of learning for the information age and the corresponding educational practice expected by the 'digital native' students. These affordances include:

> *Offering* new opportunities for learners to take more control of their learning and access their own customised information and resources;

> *Encouraging* pupils to have a greater creative input into how they present their work;

> *Allowing* more collaborative ways of working, with community creation, dialogue and knowledge sharing;

> *Giving* pupils the opportunity to showcase their achievements to an authentic audience, often using non-traditional media such as video;

> ➢ *Accommodating* individual differences and abilities more easily than in traditional classrooms.

Interactivity through the use of communication tools, especially the asynchronous type such as electronic mail, and online discussion makes it possible for learners to interact with peers and tutors, to provide responses of higher quality during interaction to share useful resources, and to provide for collaborative problem solving without space and time constraints. The asynchronous communication forum such as the discussion board lends more structure to discussion and engages reflective thinking (Jonassen, 2000). The asynchronicity offers students a considerable advantage to think, process information, reflect, construct meaning at one's own pace, and respond when they wish as a written message in a clear and concise manner. Further, an asynchronous text-based online environment reduces students' cognitive load and the need to rely on memory to process large amount of facts and ideas. The synchronous tools such as Chat and Videoconferencing do not have all these luxuries, yet if properly used they can replicate the face-to-face classroom, support real-time personalized learning in technology-supported, learner-centred environments and help in community building.

There exists a range of technology tools to introduce the possibility for socialization through the use of synchronous as well as asynchronous interactions. Appropriate technologies might include learning management systems (LMS), social networking, webconferencing, mobile devices, virtual environments such as SecondLife, and/or Web 2.0 applications.

Modern computer-mediated communication technologies have evolved to the extent that they can be effectively utilised in this re-engineering process because they have the potential to support interactive pedagogies. A shift is now possible from static content (e.g., text, illustrations, graphs, charts, photos, or maps) towards supporting knowledge production through interactive learning environments (e.g., with animation, video, or interactive illustrations) and thus, facilitating flexible and distributed engaged learning that provide wider educational opportunities. For discussing content, online discussion forums and web conferencing have worked well. Blogs and wikis are excellent tools for reflection and sharing.

Technologies in general become the information source, offer many ways to enrich the learning experience, motivate learners and meet the diversity in their backgrounds, and allow teachers to facilitate and monitor collaborative learning activities, to keep records, to track student progress as well as to provide timely feedback to the students. Thus teachers can utilise the potential of technology as a scaffolding instructional tool. Chen and Bradshaw (2007) also support the view that both supportive and reflective scaffolding promote students to transfer the application of abstract principles to real-world problems. Scaffolding helps to reduce the complexity of tasks and focus learners' attention.

The potential of the internet and new communications technology in connecting learners and in advancing interactive and engaged learning is well documented in the literature. Parker, Bianchi, and Cheah (2008) report:

> "There is a strong case in the literature for increased student engagement and satisfaction in technology-enhanced contexts …. Technology, when reflexively applied, may enhance pedagogy, and affect learning outcomes." (p. 276)

Regarding the role and impact of technology, Chen, Ruberg, and Martin (2008), based on the analysis of their data from a three-year national professional development project involving 149 schools in the US, report:

> "Technology holds great potential for students to develop deeper knowledge and execute reflective thoughts by the specific tasks that they otherwise will not have access to. Technology also provides capabilities to complement students' learning styles and multiple intelligences.… The advancement of technology creates new opportunities for learning, teaching and assessment" (p. 202-204).

In an empirical study by Reed, Ayersman, and Kraus (1997), it was found that learners with different learning styles performed the same in a hypertext learning environment, which could indicate that hypermedia learning environments accommodate all learning styles and the diversity of learners (pp. 285-304). Tileston (2000) argues:

> "Technology is a tool that can help teachers embody best practices to create an enriched and collaborative learning environment, meet a variety of learning style needs, support learning transfer, assist with the attainment of long term memory and deep understanding, address high-

level thinking, make education equitable, and incorporate real world problems and authentic assessments.… Technology possesses unique capabilities for delivering instruction and designing intellectually stimulating real-world assessments."

Dr Liam Boyle (2008) asserts that technology can be used to support the following approaches and all learners can benefit from these:

(i)   Active Learning: learn by doing

(ii) Group Learning: discussion, collaboration

(iii) Metacognition: self-learning and reflection on learning

Similar views were outlined by Norton and Gonzales (1998: 29) asserted that:

Technology is a powerful tool to support inquiry-based learning- learning that is constructivist, values conceptual understanding over procedural efficiency, responsive to student's prior knowledge and experience, builds connections to the outside world, and supports development of higher order thinking skills, prepares learners for lifelong learning, and promotes educational equity.

Several educators (e.g., Stamatis, Kefalas, and Kargidis, 1999; Nunes and Fowell, 1996a) have discussed various benefits of online learning, and are summarised below:

➢ Electronic distribution of materials;

➢ Flexibility for students

➢ Teaching in a variety of ways to support different learning styles

➢ Accommodation of different ability levels;

➢ Meaningful communication between students and teachers, and between students resulting in effective collaboration and cooperation

➢ Greater access to information

➢ Greater flexibility in maintaining and updating course materials

The study conducted over a 10-year period by Sandholtz etal. (1997) on the Apple Classrooms of Tomorrow (ACOT) shows that technology when used as an integrated tool with the curriculum has the potential to change education in a beneficial way. ACOT's research has demonstrated that the introduction of technology to classrooms

can significantly increase the potential for learning especially when it is used to support collaboration, information access, and the expression and representation of students' thoughts and ideas. In ACOT classrooms, technology is viewed as a tool for learning and a medium for thinking, collaborating, and communicating. A major observation made over this period of ACOT's research was a positive impact on the lower achieving students; ICT use helped them learn and practise a variety of skills, and energised their affective attributes such as attitude to learning, self esteem and motivation levels.

The capability of flexibility and fluidity of online learning encourages learners to pace their own learning processes and to pave a way in knowledge construction which best suits them (based on individual learning styles and preferences), defying the "one size fits all" approach inherent in traditional education. The learners can decide for themselves when, where, and how to work with their material. The introduction of Internet-based learning has helped overcome the time and distance limitations associated with learning in a traditional environment (Burgess, 2004). Campuses have responded by offering administrative material via cell phone, packaging and distributing course content via PDAs, and offering various content through new Podcasting technologies (Crofts, Dilley, Fox, Retsema, and Williams, 2005). A recent study on the use of podcasts conducted at the State University of New York Fredonia to compare the performance of students who attended a traditional classroom lecture and those who viewed it from iTunes University indicated that students who listened to a lecture via iTunes outperformed those who attended in it person. The ability to pause and rewind podcast lectures gave the upper hand to college students who viewed it from iTunes University. The simple logic behind this out performance is that these students could learn from the podcast lectures at their own pace.

Ring and Mathieux (2002) suggest that online learning should have high authenticity (i.e., students should learn in the context of the workplace), high interactivity, and high collaboration. Computer technology has the potential to develop authentic problems and environments which represent the same type of cognitive challenges as those in the real world through the use of simulations. Learners tend to actively engage in challenging problems which are personally relevant or interesting to them. In the context of online learning, it is important to note that researchers agree that computers, and specifically Web-based learning environments, can provide

alternatives to real-life settings (Collins, 1999:68; Jonassen, 2002: [online]). With technology as a cognitive partner, students learn in project or problem-based, multidisciplinary, authentic learning environments where they have opportunities for collaboration while working on real-life tasks (Hancock and Betts, 2002; Jacobsen, 2001; Johnston and Cooley, 2001; NCREL, 1995).

Online learning is apt for self-regulated learning which is a self-initiated action for the development of new competencies throughout life. This is a major dimension of lifelong learning. The literature indicates that ICT can facilitate active learning, provide meaningful experiences and promote lifelong learning (Damoense, 2003; Grabe and Grabe, 2004).

For many students, online communication with tutors seems more convenient than the more intimidating demands of face-to-face communication; this is particularly true with shy students who are reluctant to ask questions directly. Students who usually remain quiet in class become active in online discussion and collaboration. Some students often feel more comfortable to discuss personal concerns in writing than orally. With these communication tools, all these can be easily accomplished by off-campus students and adult learners who normally come to class and leave soon afterward to go to work or to attend family responsibilities.

A major concern was technology's inability to provide the 'human touch' that is considered central to the facilitation of higher order thinking skills. This scenario, however, is changing a lot through the use of new advances in computer mediated communication technologies such as video conferencing, Web 2.0 technologies, etc. The incorporation of Web 2.0 technologies into educational settings is also changing the way we think about teaching and learning by enabling students to access courses and materials anytime, anyplace. For example, Webware suites, such as Google.docs and even virtual worlds, like *Second Life*, can be used to support collaborative learning both in and out of the classroom.

Besides, it must be noted that the Web and the Internet in general are likely to change significantly in the coming years. Increasing bandwidth and processing power will make activities such as video conferencing and real time visual manipulation of data across large distances a reality. This will undoubtedly impact greatly on online educational practice.

However, Researchers (e.g., Dede, 1998, 2005; Saunders and Klemmings, 2003; Olson and Wisher, 2002) have cautioned against anyone thinking that technology always brings in learning or teaching, when in fact, the effects are determined more by the way technology is used and the context in which the use occurs. Poole (2009) asserts, "technology is just a tool, and it can only really enable students to do better if they utilize it properly. … They still need to put the work in". ICTs have only a positive effect on learning, when used in an 'appropriate way and in the right circumstances' (Saunders and Klemmings, 2003: 75). Therefore, it is critical to know what is appropriate and what is not. The current underlying assumptions in the literature of 'meaningful' or 'appropriate' are based on the concepts of learner-centredness, Vygotsky's and Jonassen's social constructivism, Wenger's Community of Practice (CoP) and the importance of collaboration, self-directed learning and a focus on Knowles' adult learning principles (Kent, 2003; Carr, Brown, Cox, Czerniewicz, Deacon, and Morrison, 2005). Pedagogical techniques such as reflective teaching practice, collaborative learning, self pacing, and intensive writing may work better in online learning environments (Picciano, 2006).

To summarise, new technology can help to activate prior knowledge, support various learning styles, and facilitate engaged learning through learner-centred opportunities whereby learners actively involve in the learning process (through increased learner-learner, learner-teacher and learner-content interactivity), increase student motivation, and implement good assessment strategies. Besides, it helps to develop a wide range of skills necessary to live and prosper in the information age that is driven by knowledge-based economy.

2.2.6   *From the perspective of technology as an input device for content in multiple formats*

Considerable research suggests that students' understanding can be enhanced by visuals (Mayer and Gallini, 1990; Tversky, 1995) and with rich multimedia and Web 2.0 technologies (Kurtz and Sponder, 2010; Moore and Kearsley, 2005). Based on results derived from experiments carried out in laboratory settings, Dr. Richard Mayer (2001), a professor of psychology at the University of California at Santa Barbara who formulated a *Cognitive Theory of Multimedia Learning* proves that there are great benefits to using multimedia tools in the classroom. He further emphasises that

integrating content in multiple media can activate multiple senses (visual, auditory, and text-based communication - pictures, sound and words) of the learners and provide them an engaging learning environment. His reasoning is that multimedia, if appropriately[4] used, can accommodate multisensory input devices- visual, auditory, and text-based communication (pictures, sound and words); according to him even for kinesthetic or tactical learners (learners prefer hands-on learning such as making models, doing lab work, and role playing), teaching and learning can be customized. Multimedia applications tend to generate more frequent teacher-student interactions, and student-student interactions as well more student involvement in e-Learning activities (Kurtz and Sponder, 2010).

Arnold et al. (1991) (cited in National Cancer Institute, USA), state that adult learners retain:

  20% of what they hear;

  30% of what they see;

  50% of what they see and hear;

  70% of what they see, hear and say;

  90% of what they see, hear, say and do;

Although these percentage figures are debatable, the difference in the figures implies that the more senses are activated, the better for people to retain information. Multimedia allows for seeing, hearing and doing, and is a lot more beneficial than simply listening a lecture.

The need for restructuring content in multiple formats is also a significant aspect of cognitive flexibility theory (Vide Section 2.7.10) for effective and efficient learning. Cognitive flexibility is the ability to restructure knowledge in multiple ways depending on the changing situational demands.

To summarise, practices and anecdotal evidences indicate that modern multimedia technologies can present information in a more compelling multiple formats than the traditional standalone 'dry' print-based and teacher-centred formats. This is one of the reasons for the drive towards technology adoption even in the absence of any empirical evidence for its positive impact on education.

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[4] If not appropriately used, the results can be negative.

2.2.7 Technology as a catalyst for the long-awaited educational transformation in higher education

The proliferation of communication technologies over the past two decade, offering new modes for learning and communication, has posed a great challenge to the continued dominance[5] of traditional didactic pedagogy (with lecture as the main instructional strategy) in higher education domain because of its limited scope in today's information age with too much information which changes too fast for the traditional forms of knowledge or expertise to be valid. The process of learning is considered more important than its product. Knowledge has a half-life which gets shorter all the time. As a result, the pedagogy should focus on collaboration, interactivity, information literacy and authenticity in student learning activities for which instruction has to be more learner-centred, non-linear, and self-directed.

Emphasis has shifted from course completion to competence. Employees today need to possess relevant skills set to solve problems that are not previously encountered and provide perspectives that would put their organisations ahead of competitions against an ever-changing global scene (adapted from Reigeluth, 1999). This requirement is also a pointer to the need for workers to adopt life-long learning attitudes. Today employers require high quality graduates who possess the knowledge and skills to succeed in the workplace and who have the ability to manage their career development through lifelong learning. The editorial section of the "eSchool News" Online Journal (2009) lists the generally accepted essential skills for the 21st century as:

    (a)   Problem-solving and critical thinking;

    (b)   Collaboration across networks and leading by influence;

    (c)   Agility and adaptability;

    (d)   Initiative and entrepreneurship;

    (e)   Effective written and oral communication;

    (f)   Accessing and analyzing information; and

    (g)   Curiosity and imagination.

It is becoming clear to many, including students, that traditional methods are unable to address the need for higher-order learning experiences and outcomes demanded of

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[5] *Because their educational practice may retain deep roots in other theories that are the result of their own learning experiences.*

a changing knowledge- and communication-based society. Students favour flexible and distributed learning that is delivered and supported through means which do not require them to attend particular classes or events at specific times or locations. These issues represent a serious challenge for instructors and designers in meeting these expectations.

In order to accommodate these changing views, there is a critical need for a paradigm shift from that passive teacher-centred approach (transmission of information and skills) to a student-centred, collaborative, constructivist approach (encouraged to become cognitively engaged and construct meanings). Wilson (2005) states that it requires a paradigm shift in the educational model of today's classroom towards a new epistemology and ontology—towards a more qualitative, non-reductive understanding of human agency and activity, assisted by various learning technologies and resources.

New technology increases the potential for constructivist learning processes. The instructional methodologies that were difficult to implement due to the inability to provide the much needed individualized attention to students, have now become more practical with recent advances in information and communication technologies. Some of these technology tools are email, discussion forums, conferencing, web sites, search engines, etc. According to Melloy (1997) a fascinating synergy can emerge between learner-centred and collaborative models and instructional technologies.

Further, technology has the potential to expand the breadth and depth of the curriculum to a great extent; for example, students can now access information far beyond the scope of their instructors and traditional textbooks. Curricula can be customised to students' specific learning styles. Instructional technology has the potential to enhance knowledge construction and to equip today's learners with the kind of skills required for all aspects of their lives, rather than just focusing on content mastery, thus bringing about a transformation in the higher education landscape.

Technology continues to play an important role in the development and emergence of new pedagogies, because developments in areas such as social networking tools, artificial intelligence[6], virtual reality and multimedia affect the kind of information available online, and how we interact with each other; by this, control of the learning

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[6] *The term artificial intelligence (AI) was coined in 1956 by John McCarthy at the Massachusetts Institute of Technology.*

environment is shifting from the teacher to an increasingly more autonomous learner. Thus, emerging developments in ICT will undoubtedly have the potential to revolutionise higher education. However, it has to be noted that technology does not altogether replace teachers because technology innovation is all about integrating instructional technology in student-centred and teacher-supported collaborative learning environments.

2.2.8   *Technology as a research tool*

More than ever before, there is a critical need for connecting research to teaching practice by teachers in order to adopt the ideals of the scholarship of teaching and learning (SoTL), and optimise their roles and expertises. The scholarship of teaching and learning is about improving classroom practices through research and dissemination of research outcomes. Participating in SoTL helps to add new strategies and practices to our teaching repertoire.

To be successful in research projects and to develop quality work requires iterative processes; in turn, it requires active collaboration with colleagues and experts in the field at its various stages of development. Collecting and analyzing data, authoring, publishing and archiving information are all integral to the everyday work of researchers—with collaboration, and search and discovery augmenting the entire process (Microsoft Microsoft External Research Fact Sheet, 2009). Technology-supported collaborative platforms could be used more effectively to promote research activities by sharing evolving data and ideas, to reflect on others' views and to refine one's own ideas. The Scholarship of Teaching and Learning is greatly enhanced by the creative, cooperative and collaborative communication systems already available as mainstream activities on the World Wide Web (Kurtz, and Sponder, 2010). Technology helps researchers and students especially who are novices in research plan and reflect on their research work.

According to Microsoft's External Research Team on the use of technologies for educational research, new interactive technologies can:

➢ Optimize for data-driven research and science;

➢ Enable broad community engagement through greater interoperability;

➢ Help ensure that data storage is reliable and secure for the long term;

➢ Build on existing community protocols, practices and guidelines;

➢ Harness collective intelligence through social networking and semantic knowledge discovery.

With these technology affordances in mind, Microsoft (2009) has developed a toolkit called Zentity to help universities and research communities worldwide to use it as a repository platform for their research outputs. It allows them to present data in new ways. From research perspective (Microsoft Zentity, 2009), it is a great platform for research organizations to capture their research output and the relationships between the various entities to be stored—dynamically stored, navigated, visualized, and so on. It is flexible enough to evolve as their data evolves, as new concepts and new relationships emerge.

From the perspective of teaching (Hasegawa, Tanida, and Kashihara, 2008) teachers can provide samples of exemplary research work, especially of students from previous cohorts with well organised formats that comprise salient elements that include "Background", "Purpose", "Ideas", "Products", "Experiment", and "Findings" of the research. This can help students who are generally novices in research planning through scholarly communications, effectively at different stages in research projects such as *Setting Research Theme*, *Discussion and Collaboration*, *Data Storage/Preservation*, *Presentation and Publication/dissemination*. Besides the LMS, 'cloud computing' tools such the Google Docs[7] and Microsoft's SkyDrive[8] provide user-friendly environment / platform for this type of collaboration. These tools are also crucial in reaching out and engaging the community as well as in spearheading academic-industrial collaboration.

2.2.9   *Challenges and debates about technology use in education*

The use of emerging technologies in teaching is a relatively new phenomenon for most educators within higher education. One of the reasons for the slow intake of technology in education is that research investigating the benefits of new technologies in student learning has been inconclusive as illustrated by the Clark and Kozma debate which started by Prof. Robert Clark's (1983) statement that medium does not

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[7]   Available at: //docs.google.com
[8]   Available at: //skydrive.live.com

influence student's learning; it is only a 'merely a vehicle' that delivers the instruction to learners. As a result, there has been a long-standing debate amongst researchers and educators as to whether or not a particular delivery medium improves learning (Beynon, 2007) because technology is often viewed as pedagogically neutral[9].

However, Prof. Richard Kozma (1994, 2000), in response to Clark (1983, 1985, 1994a, 1994b), claims that it is not the computer or its attributes per se that makes students learn, but the capability of some of its attributes to design real-life models and simulations, and students' interaction with those models and simulations that can shape the development of unique "cognitive processes". Both Clark and Kozma rationalized their arguments by calling on Russell's (1999) study on, so called, "no-significant-difference" research according to which the learning outcomes from distance education courses were not significantly different from those of traditional courses. Clark uses this phenomenon as evidence for his argument, whereas Kozma (1994) uses this phenomenon as indicative of insufficient evidence for Clark's position. Some educators and researchers (such as Lou, Bernard, and Abrami, 2006; Russell, 1999; Jonassen, Campbell, and Davidson, 1994; Cuban, 2001; and Ehrmann, 1999), agreed with Clark, and are of the view that there is no significant difference in learning between technologically based and traditional instructional approaches.

Further, some educators question the legitimacy of online courses (Mendels, 1998; Reich, 1999; Stancill, 1999) because they view online courses as inferior to the traditional classroom lecture. Some others find technology's benefits as a lot of wishful thinking because of the gap between the technology's promises in education and the reality. Robleyer and Knezek (2003) claim that research findings that confirm the benefits of modern technologies for learning may "simply not hold true". Larry Cuban (2001) argues that educational technology has been in schools for several decades; however, it still lags behind expectations for its use. He lamented that the past technologies had very little impact on teaching and learning.

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[9] *It can either enable or inhibit learning (Moll, 2001). It is only as good as the teacher using it.*

On the contrary, as cited earlier in Section 2.2.5 there are many studies that document technology's potential for:

➢ providing a richer and more exciting learning environments (e.g., Jonassen, 2002; Reeves, 2000; Tileston, 2000; Jonassen and Reeves, 1996) than face-to-face classrooms;

➢ increased student engagement (Chen et al., 2008; Parker et al., 2008; Jacobson, 2001);

➢ extending students' limited working memory acting as a cognitive partner (Jonassen, 2002);

➢ promoting lifelong learning (Grabe and Grabe, 2004; Damoense, 2003); and

➢ enhancing students' learning performance (e.g., Schulman and Sims, 1999; Khalili and Shashaani, 1994; Jiang and Ting, 2000) when technology is used appropriately (Olson and Wisher, 2002; Saunders and Klemmings, 2003).

Reeves (2000) argues that in the years since Clark's work, both media and theories of learning and instruction have changed so much that new research methodologies are required to describe and guide them. Clark's analysis depends on a non-interactive model of learning (when technologies were traditionally used to convert classroom-based content to an electronic format while still retaining its traditional distinctive knowledge-centric nature and as conveyors of information through a load of instruction which was packaged for delivery to learners, who passively received it), while in the present era of constructivism and distributed cognition, learning has been redefined as a highly interactive set of events shared between a learner and various human/nonhuman agents, tools, and media. By this view, isolated variables like method, medium, or even learner make little sense.

Others believe that because the research is so varied and technology tools largely unexamined that there may be some student learning outcomes that are affected by the use of technology in the classroom that are still unknown (e.g., Ehrmann, 1999; Kozma, 1994). Jonassen, Campbell, and Davidson (1994) argue that this type of discussion distracts from the main purpose of media by over-focusing on the objectivist and instructionist conceptions of media. Robleyer and Knezek (2003) claim that the invalidity of much of instructional technology research is to be found in behaviourist-cognitivist approaches to assessing learning benefits and comparisons

between technology mediated learning environments and traditional face-to-face course deliveries using experimental or quasi-experimental methodologies. One of the reasons for the reluctance or the slow pace of technology adoption by educators has been the prevalent instructivist philosophical orientation in instructional technology (Duffy and Jonassen, 1991).

According to Rossett (2002), "online learning has many promises, but it takes commitment and resources, and must be done right. Doing it right means that online learning materials must be designed properly, with the learners and learning in focus, and that adequate support must be provided." Course design determines the effectiveness of the learning (Rovai, 2002). The literature indicates that technology integration varied according to individual teacher beliefs, perceptions towards technology innovations, and how the teacher practiced and put technology to work in the classroom. Hamalainen, Whintson, and Vishik (1996) argue that we can expect only marginal improvements in student performance if web developers continue to re-implement traditional and conventional models borrowed from the classroom.

Kozma (2000:13) argues, "Real world educational technology research and development demands a shift in focus from the design of instruction to the design of learning environments". Computer technology, according to Jonassen, Peck, and Wilson (2000:12), refers to "the designs and environments that engage learners". The design of computer-based learning environments has undergone a paradigm shift, moving students away from instruction that was grounded in objectivism to the application of computers to the use of cognitive tools for intellectual partnerships in constructivist environments in which students are able to learn. The computer cannot influence positively or facilitate student learning unless it is used as a cognitive tool. The perception of computers as cognitive tools has shed some new light on the long-standing debate about whether or not media influences learning.

Technology's affordances do not originate from the technology itself, but the careful selection of a technology tool for a given instructional strategy and the pedagogically sound ways in which it may be used to support human cognitive processes, and to engage learners. Thus, this is not about technology for technology's sake and we need to use technology when it is effective and appropriate to do so. As noted by Laurillard (2002), instructional designers should drive elearning, not technologists. Those who are innovative educators will be those who maximise elearning and ensure its further

development. Bates and Poole (2003) reiterate that the question of teaching with technology is about serving learners and not about using technology. Further, studies show that integrating technology into instruction can definitely improve access to information. The goal of the resulting computer-based learning environment design principles is to have students learn *with* technology, rather than *from* technology. Jonassen (2002) argues that learning *with* cognitive tools refers to the mindful engagement of learners in the tasks afforded by these tools.

Newman (2000) claims that the debate about the advantages and disadvantages of using technology in instruction is a false issue. She believes that the way technology is used should be based on what educators believe about the teaching/learning process and that the truly important questions that need to be answered deal with curriculum and instructional design. She maintains that technological applications offer potential as a teaching and learning tool–but ". . .the way we are using them looks to me like we are following a yellow brick road" (p. 774). They [Teachers] need an understanding of how elearning can be meaningfully integrated in teaching and learning to fully exploit its potential to enhance a student's learning experience (Kent, 2003). According to Kearsley (n.d, online):

> "the real problem with educational technology is not that it doesn't always work, but that it is employed in the context of dysfunctional ontology. We need a different kind of belief structure about education, one that does not assume or expect rationality, in order to make better use of technology. Until we pay attention to the real problems of education (which include ineffectual teachers, inept administrators, irrelevant curricula, and weak leadership), there is no reason to expect educational technology to make much difference."

Given below is an important extract from the book, *Technologies for Education* (Haddad and Jurich, 2002):

> "Evidence from large studies and meta-analysis suggests that use of ICTs, in particular computer technologies, is correlated to positive academic outcomes, including higher test scores, better attitudes towards schools, and better understanding of abstract concepts. A longitudinal study of a statewide experiment with computers in the classroom found that those most in need of help - low-income, low-achieving students, and students with disabilities - made the most gains. In addition to better performance in traditional measures of academic achievements, a secondary benefit of ICTs in education is to

familiarize new generations with the technologies that have become integral components of the modern world."

The above quote throws light on two key benefits of ICTs in education:

- ➢ Using ICT can result in improved learning;

- ➢ ICT offers the greatest support to learners from disadvantaged backgrounds; and

- ➢ ICT impacts the society that the learners are in.

Fosnot (1996) encourages us to understand that changing beliefs about knowledge is an essential ingredient in educational change.

> "If there is a key to reinventing our educational system, it lies in what our teachers believe about the nature of knowing. Without a re-examination and change in beliefs about the nature of knowing, there will be no substantial change in the enterprise of education; we will stay in a vicious cycle". (p. 202)

Chris Dede, Professor of Learning Technologies at Harvard's Graduate School of Education, sheds some light on what education would look like in the future. He claims that three interfaces will be dominant in any learning environment:

- ➢ the computer interface, which gives learners access to archives and experts and provides a virtual space for collaboration, mentoring, and practice;

- ➢ Multi-user virtual environments interfaces, where digital spaces are filled with avatars and artifacts; and

- ➢ Ubiquitous computing interfaces, in which portable wireless devices such as wearables augment our reality and allow us to interact with smart objects (Dede, 2004).

According to OECD's Policy Brief: E-learning in Tertiary Education (OECD, 2005):

> "E-learning is becoming increasingly prominent in tertiary education, with universities increasing provision and more students signing up…. Tertiary education institutions generally feel that e-learning has a broadly positive effect on the quality of teaching and learning, although few have been able to offer detailed evidence…. Universities

are now thinking through and negotiating the potential contribution of e-learning to their organisational future."

To note a similar sentiment, the UK Department for Education and Skills (DfES, 2003) in its work entitled, "Towards a Unified eLearning Strategy" encourages and promotes the use of learning technology to support learners in a Higher Education (HE) setting in the United Kingdom (UK).

> "eLearning exploits interactive technologies and communication systems to improve the learning experience. It has the potential to transform the way we teach and learn across the board. It can raise standards, and widen participation in lifelong learning. It cannot replace teachers and lecturers, but alongside existing methods it can enhance the quality and reach of their teaching."

During the announcement of the prototype of the $100 laptop, the United Nations' Secretary General Kofi Annan pronounced at the press conference on November 16, 2005:

> "When they [laptops] start reaching the hands of the worlds' children, these robust, versatile machines will enable kids to become more active in their learning. Children will be able to learn by doing, not just through instruction or rote memorization. They will be able to open new fronts for their education, particularly by peer to peer learning..." (Annan, 2005).

Although the literature is replete with evidence for the potential of technology to enhance student achievement and teacher learning, it is also clear from the literature that ICTs per se do not necessarily lead to educational enhancement but only if it is used appropriately (e.g. Warschauer, 1998; Dede, 1998, 2005). The key determinant of the educational value of ICT is how it is used in specific contexts (Schacter, 1999; Squires, 1997).

However, Teo, Chang, and Leng (2006) argue that the bulk of today's elearning systems still consist of simple conversion of classroom-based content to an electronic format while still retaining its traditional distinctive knowledge-centric nature that view knowledge and reality as existing external to the learner. The emphasis was on the need to complete a task, with the use of traditional computer-based tutorials, like drill and practice sequences. This deceives the purpose of using technology in education, and served as basis for the long standing media-technology debate.

Furthermore, as technology is now an inevitable component of the 21st century society, there is a critical need for educators to use it with students as a cognitive tool for creating the knowledge workers who can think critically, analyse and synthesis information to solve problems in a variety of contexts and work effectively. As a result, integration of technology is a societal necessity that may no longer be able to be ignored due to its potential to impact education. UB's aspiration to utilise the transformative impact of technology in learning and teaching is quite evident in its official documents such as the Learning and Teaching Policy (LTP).

For these reasons, technology adoption is now worldwide at the top of the agenda of most public and higher education institutions; many of them are integrating instructional technologies into their teaching programs, and are now exploring ways to extend their presence as widely as possible even beyond their national and regional boundaries in order to reach new clients. Middlesex University (2006) has several policies in place addressing the institution's elearning strategy and home working provision. According to the MU Corporate Plan,

> "new approaches to teaching and learning are needed involving web technology; higher productivity; increased access to higher education for people previously excluded by barriers of time, place and finance; growing international competition between universities (including new for profit corporate universities); and a developing culture of lifelong learning as a response by employers and employees to the pace of change in an increasingly knowledge-based economy."

In the light of all the above points, my contention is that, if appropriately used, technology can help redesign education environments that better meet the needs of learners in the information society and offer them more choice and flexibility in how and where they learn; its potential can be truly realised by applying learner-centred principles, in which the instructional objectives of the class are directly linked both to the needs of the 21st century student and the capability and interest of the teacher in the classroom, which in turn determine the appropriate type and use of instructional technology.

Further, assumptions are made that integrating technology into learning radically changes the way we design instruction, teach, and learn because there is a strong case in the literature for increased student engagement and satisfaction in technology-enhanced contexts. However, it has to be noted that engagement and satisfaction alone

do not bring enhanced learning. Therefore, the Researcher does not make a claim that elearning *will* deliver the total learning experience at the present moment as it was once proclaimed by the Great Thomas Edison in 1922: "…the motion picture is destined to revolutionize our educational system" or as commented by Apple Inc (n.d.): 'At Apple, we believe that the effective integration of technology into classroom instruction can and *will* result in higher levels of student achievement'. The Researcher only wants to contend that with recent advances in internet and Web-based technologies, new learning interaction that were not possible a decade ago can now be facilitated with instantaneous access to huge information sources, peers, teachers and experts from around the world. Interactions can lead to providing collaborative learning environments that are conducive for meaningful knowledge creation. Thus, the effective use of technology has the potential to enhance learning, but whether it will actually occur depends on several other factors also such as students' learning styles, interests, motivation, abilities depending on the proportion of their multiple intelligences in them, intellectual skills and the like.

Technological advances are occurring so rapidly that by the time this study is completed, innovative learning technologies that are more compatible and user friendly than today's will become available for educational applications; some possible ones that are currently reaching some level of maturity are: Artificial Intelligence (AI) techniques, Semantic Web, Web 2.0 tools and three-dimensional video[10] that can help to offer innovative and intelligent ways to support collaboration; and, cell phones, PDAs, and Podcasting technologies that can help to package and distribute course content. Some of the new technologies might be capable of providing learners with personalised learning environments that respond intelligently to their needs, preferences, learning styles, and cognitive abilities, and incorporating suitable information for example, materials that provide links to learners' prior knowledge or clear their misconceptions in order to make learning easier for them.

Based on my personal experience as a teacher as well as an online instructional designer, the study of extant literature and my own intuitive thinking, my premises are that:

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[10] *Advocates of 3-D video say it has the potential to revolutionize the way students learn. (www.eschoolnews.com/2009/11/01/esn-special-report-learning-in-3-d/).*

➢ with appropriate instructional design, emerging ICT capabilities can support and facilitate the achievement of relevant learning outcomes that are of a different kind for the 21st century workplace;

➢ the extent of ICT's impact depends on how it is used as a learning/teaching tool for which a good knowledge of the characteristics of today's "net generation" learners and their learning styles, how they can be best taught and how resources might more efficiently be organized to deliver instruction to such learners is essential;

➢ the conventional model of a teacher standing in front of students and delivering instruction is untenable because it cannot adequately equip learners with the essential skills required for the 21st century society;

➢ the computer will surely, though slowly, revolutionize higher education because of its potential in creating the "learning community" model that enables learners to conduct collaborative projects, engage in teamwork, create portfolios, and adopt a variety of roles, all aspects of the contemporary workplace.

It has been demonstrated within the developed world that learners who have participated in online learning, mostly report that they perceive this mode of learning as being convenient and flexible (Leasure, Davis and Thievon, 2000), offering a greater access to learning resources (Sener and Stover, 2000), increasing student motivation and self-esteem (Kearsley, 1996), enhancing learner participation and interactivity (Maeroff, 2004), and more significantly, improving the quality of learning (Fjermestad, Hiltz, and Zhang, 2005). Despite several constraints, online learning is receiving increasing recognition as the only and best possible solution to the problem of access to quality higher education in Sub-Saharan Africa. The University of Botswana believe that emerging technologies have the potential to address many of the pressures they have from various corners regarding quality and access to as well as delivery of education, and it is moving towards technology adoption.

Given this changing scenario and technology's increasing impact on education, the Researcher wants to argue that our biggest challenge for educators in this century is

to stay current with the emerging communication technologies and on how best to tap its potential in different professions to benefit the future generations.

Aforementioned discussions address the first specific objective: "*To understand the characteristics, benefits, challenges, and the impact of ICT on HE learners and their learning, and thus to bring emerging technologies into core teaching and learning*".

2.3 Traditional face-to-face versus online instruction: Benefits and challenges

The traditional face-to-face mode of delivery in the form of lecturing and story telling has been the norm ever since the establishment of the world's first university, *The Academy*, by Plato in 387 BC. Knowledge used to be something acquired on the basis of experience over time. Experts knew a lot about a particular subject matter, and they transmitted it to the novices.

In the traditional face-to-face approaches, teachers tend to continue with their long embraced lecture-based instructivist approaches which rely on the development of a set of instructional sequences with predetermined outcomes based on an 'one-size-fits-all' approach. Teachers practise by talking most of the time at an abstract level, disconnected from practice and experience. Thus, gaps currently exist between practice and what is actually required to address the learning needs, styles, and preferences of majority of today's students who prefer to learn in context. Further, the concept of knowledge and its nature have changed dramatically in the recent past especially with the advent of the World Wide Web and the Internet; the kind of skills students need to develop to be prepared for the workforce of the 21st century is a lot different from their predecessors. Over the years, increasing demands for access to higher education, dwindling resources, and burgeoning calls for better quality education have led universities to explore alternative methods of teaching and course offerings. Thus, an evolutionary transformation of teaching and learning in HE is considered inevitable.

Gerbic (2006) distinguishes between face-to-face and online approaches to instruction in terms of three major areas of difference which throws light on their strengths and weaknesses in addressing learner needs.

Table 2.1:   A comparison of face-to-face and online delivery approaches

	Face-to-face	**Online**
Visual /Oral cues	- a rich nonverbal communication environment; - high levels of monitoring and feedback; - conversation is competitive and requires confidence, especially to disagree; and - it is easier to build rapport and trust.	- a more impersonal medium with reduced social cues; - messages are more difficult to understand; - there is less social togetherness eg., less responsibility for the conversation; and - free to communicate for some participants.
Response time	- synchronous; - rapid spontaneous and free flowing dialogue; and - fixed time, and place a particular time and place.	- both synchronous and asynchronous; - asynchronous is more common; - space to reflect and think at one's own pace; - no time and distance barriers, anytime, anywhere; and - often takes more time.
Oral/text-based Communication	- the emphasis is on listening and talking; - communication is quick and easy for confident speakers; and - brief and short-lived.	- the emphasis is on reading and writing, so there is a record; - messages / responses are often carefully thought out and written down; - participation takes time; and - can increase overload.

Despite the concerns about traditional face-to-face learning, it has also significant strengths of its own such as the possibility of strong human interaction which is generally more powerful than in the online mode due to its capability for visual cues.

Although earlier studies have indicated that distance and online learning courses are usually as effective as classroom-based instruction (Russell, 1999), a more recent detailed analysis of existing online learning research by the U.S. Department of Education (Cited in Stansbury, eSchool News, 2009) found that, students who took all or part of their class online performed not just as good as but better, on average, than those taking the same course through traditional face-to-face instruction.

Unique strengths of online technology include its capability to expand instructional options and strategies, and to facilitate and extend the interaction between students and the tutor (resulting in personalised learning), as well as among the students

through synchronous (real time) and asynchronous (delayed) methods. A study by Schoenfield-Tacher, McConnell, and Graham (2001) to compare the extent of student interactions indicated that interactions in an online course may surpass those in traditional classroom courses. Interactions in technology-supported practices can be through tutor-students contact by email; developing Communities of Practice; online discussions, engaging in active learning; and providing quick, rich feedback, all these supporting collaborative and cooperative learning. Though a possibility of higher interaction is commonly assumed as a possibility in face-to-face classrooms, it is not always the case; the fact is that usually interactions run out of time unlike in the online mode which can be anytime anywhere.

Another opportunity accorded to students by online technology is the "increased time on task" through the availability of learning materials anytime anywhere and the use of asynchronous online communication tools; long time possible for a task allows deep engagement with the learning activities and results in self-paced learning. The time lag possible in asynchronous communication (e.g., discussion and email) enables students to control, to some extent, the pace and timing of their learning, allows for and encourages reflective learning, and hence higher level cognitive transactions.

Thus both the traditional face-to-face and online instruction have their own unique strengths and weaknesses. That is why a strong case is now being made for a blended approach (discussed in section 2.4) whereby both online and face-to-face modes of delivery are appropriately integrated to maximise the strengths and minimise the weaknesses of both. Blended learning approach is the best way of unlocking the educational potential of new technology.

2.3.1 *Constructivism versus traditional approaches and its practical challenges*

The traditional lecture-based instructivist approaches could not stand the test of time especially in the 1990s with the widespread move towards Constructivism. Constructivist approach is considered as the most recognised and preferred method of instruction over the last two decades. Constructivism is a philosophy of learning based on the premise that knowledge is constructed by the individual through his or her interactions with the environment, including other learners (discussed further in Section 2.7.3). The main areas emphasised in traditional and constructivist approaches

as applicable in higher education learning environments are summarised in the following table.

Table 2.2: Elements of emphasis in higher education traditional and constructivist learning environments

Areas	Traditional	Constructivist
Instructional emphasis	Teaching, knowledge reproduction, independent learning, and competition.	Learning, knowledge construction, collaboration, reflection, and learning 'how to learn'.
Classroom activities	Teacher-centred, direct instruction, didactic, and individual work.	Learner-centred, Socratic, authentic, and individual as well as group work.
Instructor roles	All-knowing "sage on the stage", expert, and lecturer.	Collaborator, tutor, coach, facilitator, promoter, community builder, member of a learning community, co-learner, researcher, consultant, mentor, and resource person.
Student roles	Passive listener, consumer of knowledge, and note taker.	Active, collaborator, constructor of knowledge, and self-monitoring.
Assessments	Recall of facts *after* the learning has taken place (largely summative).	Authentic knowledge application, portfolios, projects, and performances (largely diagnostic, formative, and much less summative).

Adapted from: Rovai (2004)

However, it has been noted that even those who preached constructivism seldom use it practically in their own teaching due to several reasons, one of them being the practical difficulty in its implementation. Given below are the major problems that militate against the implementation of constructivist approaches in traditional face-to-face classrooms:

(i)   Large class size and fixed face-to-face meeting schedules;

(ii)   The need for more individualized attention to students than it is possible in traditional classrooms, and that is one of the basic tenets of constructivism;

(iii) The emphasis of traditional approaches on information transmission; as a result, more often the focus on learning outcomes revolve around the lower levels of Bloom's revised taxonomy of educational objectives (Remembering and Understanding) leaving the highest levels (Evaluating and Creating) simply to chance.

(iv)   The need for changes in teaching strategies, new planning and design processes or radically different learning paradigms in constructivism; unfortunately, most educators prefer to stick with their familiar long-embraced instructivist practices rather than venturing into uncharted territories of constructivism.

(v)   Assessment of student learning cannot be easily measured or quantified through the use of traditional assessment tools. 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 which can be done only through alternative assessment strategies such eportfolios and qualitative approaches, such as interviews, observations, user logs, focus groups, expert critiques, and student feedback.

As one of the main roles of higher education is considered to be preparing skilled workforces, the traditional instructivist approaches alone do not meet the expectations of the society. More pertinent details about constructivism are provided in sections 2.7.3.

2.3.2   Constructivism and the new technology

There is also a growing body of evidence (e.g., Bell and Garofalo, 2005; Johnson, 2000; Salinas, 2008; Nix, DeBella, Gierhart, Gill, Harader, Richerson, and Tomlinson, 2004; Owston, 2000) that traditional classroom instruction can be enhanced through the use of web-based multimedia and communication tools. The fact that technology can play an integral part in the constructivist learning environment is being increasingly recognised by all stake holders in HE. Several researchers (Meyer, 1998; Bitter and Pierson, 2002; Dalgarno, 2001; Forster and Taylor, 2000; Nanjappa and Grant, 2003) agree that technology plays a crucial role in facilitating constructivist approaches. The focus of both constructivism and technology are on the creation of engaging and collaborative learning environments.

Lunenberg, (1998, p. 75) argues that constructivism and the integration of computer technology in the curriculum offer real promise for improving the achievement of all learners in the core subject areas. According to them, there is a mutualistic

relationship between computer technology and constructivism, each one benefiting from the other through developing constructivist course modules using technology as cognitive tools or mind tools and thus, providing enhanced opportunities for more authentic content, learning activities and assessments, and student interaction with content, classmates and teachers enriching possibilities for knowledge construction. This relationship promotes an increased level of motivation, knowledge construction and the development of social and communication skills among learners (Scheepers, 2000).

Meyer (1998) summarises the complementing and mutual relationship between constructivism and computer technology, the associated strategies, and instructional techniques in Table 2.3 below.

Table 2.3: The mutualistic relationship between computer technology and constructivism

What computers bring to Constructivism	**What Constructivism brings to computers**
Computers and educators: ➢ Opportunity for a virtual working environment and cognitive tool, containing curriculum based programmes; ➢ Instructional design programmes in relation to real-life issues, and outcome-based objectives; ➢ Computer as surrogate teacher for setting tasks; ➢ Gender free classroom.	**Educators and computers:** ➢ Development of cognitive strategies, prompting ideas, presenting the setting, which is conductive to learning in virtual environment.
Computers and learners: ➢ Engage and hold learners' attention; ➢ Unique access to learning experiences; ➢ Central aim of most instructional software is cognitive development; ➢ Externalise learners' thinking; ➢ Presentation of problems for individual development of cognitive skills; ➢ Opportunities to investigate and discover through simultaneous use of multiple media (sound, text and images); ➢ Modelling software for cognitive learning.	**Learners and computers:** ➢ Cognitive behaviour: knowing and thinking about virtual learning environment; ➢ Learner-computer interaction: formation and use of concepts, organisation of knowledge, problem solving experiences; ➢ Locus of control centred on learner; ➢ Individual learning styles are present; ➢ Learners maintain high level of control over their learning experience.

Intervention: ➢ Provide use of cognitive models of instruction built into multimedia software, related to experiential, and activity-based education; ➢ Use of mnemonics.	**Facilitation** ➢ Facilitation of cognitive skills development activities with the aid of multimedia, including management of situated learning opportunities and facilities; ➢ Use of questions, or discovering answers.
Individualised learning programs: ➢ Getting each learner involved with learning plans designed to meet individual needs, interests and abilities; ➢ Individualised/natural learning environments.	**Working as individuals:** ➢ Selection and modulation of own *internal processes* of *thinking*, selection and absorption of information and decisions/choices at own pace; ➢ Cognitive focus: memory, application of knowledge to find new solutions.
Software and Cognition: ➢ Metacognition and mental models: problem solving in collaborative setting, scaffolding; ➢ Materials and support process, transfer: restructuring and application of knowledge in new virtual situations; ➢ Application of modelling software and databases.	**Working in groups:** ➢ Cooperative and individual group learning, group interaction: communication between group members, including cooperative problem solving exercise with the aid of multimedia software; ➢ Scaffolding by peers.
Evaluation: ➢ Responsibility for learner success rests with instruction: time available for all learners to achieve same level of learning.	**Evaluation:** ➢ Mastery learning: learners work independently and are evaluated on their own work achievements.
Feedback ability: ➢ Programmed feedback mode in software.	**Feed back:** ➢ Selecting and reacting to feedback data: assessment, corrections before the next level or experiential learning situation.
Motivation: ➢ Virtual presentation of practical results.	**Motivation:** ➢ Intrinsic award: experience of achievements/ solutions to problems.
Playing: ➢ Learning medium with opportunities for discovery and imaginative thinking, such as adventure games, problem solving and identical learning; ➢ Accommodation of integrated learning.	**Discovery:** ➢ Exploration of images, sounds, text, stories and ideas, facts, figures and consequences; ➢ Exploration to develop physical and social skills and general cognitive processes.

Proponents of Constructivism attempt to show connections between constructivist teaching/learning strategies and educational technology in instruction (Beldarrain, 2006; Churchill, 2006; Lee, 2006; Nanjappa and Grant, 2003; Machnaik, 2002; Rakes, Fields, and Cox, 2006; Wepner, Tao, and Ziomek, 2003). The richness of the technology permits us to provide a richer and more exciting (entertaining) learning environment (Duffy and Cunningham, 1996, p. 187). The utilisation of this environment aims at introducing learners to constructivist practice through collaborative problem solving techniques and processes. It is used to present thematics related to the curricula of particular educational levels in the form of simulation scripts / scenarios. In technology-supported collaborative learning environments, the multiple forms of synchronous and asynchronous communication tools help to facilitate dialogue, a key element in pedagogies based on socio-constructivist principles, where the emphasis is on co-construction of knowledge among a community of learners.

2.3.3   Online learning and its challenges

Although elearning emerged as an alternative to overcome the disadvantages of the face-to-face delivery, it may not be holistically accepted for now as an effective alternative for certain inherent issues surrounding purely online instruction as discussed below.

a)   Pure elearning is perceived as 'isolating' without any human interaction and does not fit well with the ethos of the campus-based higher education institution where success in student learning is based on, among others, the instructor's ability to perceive nonverbal student cues, modify instructional methods accordingly, and provide timely responses to student questions. Laurillard (1997) argues that although the extent of student interactions in elearning courses may surpass those in traditional classroom courses, research has shown that the quality of elearning suffers from the lack of human interaction.

b)   Constraints of limited resources (financial hardware, and software constraints); for example, although elearning has been found successful in some developed countries with certain type of learners, their use in developing countries

require supplements for success due to poor infrastructure including limited telephone connections, poor Internet bandwidths, shortage of trained personnel and limited computer skills among both teachers and students. Most of the ICT infrastructure is limited to capital cities and major centres and is unavailable to the great majority of rural and remote area dwellers, leading to uneven access (Sagna, 2005).

c)   Besides, some courses (e.g., engineering courses), no matter how well designed, will need face-to-face and hands-on components to be effective and successful.

From the forgoing discussions it is evident that both approaches are not without concerns and criticisms, and further, they both have strengths and weaknesses. The need for a compromise between the conventional face-to-face sessions and online learning leads us towards a new approach to teaching and learning, the so called hybrid or blended learning (Rogers, 2001). Verkoost, Meijerink, Lintsent, and Veen (2008) also support the view that the concept of blended learning was developed in an effort to maximize the strengths and minimize the weaknesses of web-based and face-to-face approaches to teaching. Thus, the discussions above have helped to address the first objective: *To understand the strengths of ICT in higher education context and the rationale of using it in teaching and learning in relation to conventional face-to-face instructional approaches, and to identify the way forward to realise these strengths*; a Web-based blended approach to instructional delivery has been identified as the way forward.

The next section explores what blended learning is all about, and its current status and future directions in Higher Education.

2.4   A review of current global trends in blended learning: Establishing the terrain

This section discusses how the concept of blended learning is being perceived, accepted and practised generally in higher education with a view to justifying the relevance of this study. Specifically, it reviews current global trends in higher education with regard to blended learning, describes what blended learning is, reviews various definitions, and discusses the characteristics of blended learning, the blended learning practices, the benefits of blended learning, and the challenges to its

implementation. Thus it addresses the second research objective, *"To examine the distinct characteristics of web-based blended learning, how it is perceived, accepted and practised generally in higher education and to justify the relevance of this approach in the study"*.

It is widely believed that integrating technology with conventional teaching practices can have a synergistic effect because it can improve teaching and learning by maximising the strengths and minimising the weaknesses of each component (New York Times, 2010; Diaz, 2009; Davis and Fill, 2007; Kim and Bonk, 2006; Hensley, 2005; Yildirim, 2005; Aldrich, 2004; Bates and Poole, 2003; Driscoll, 2002; Aycock et al., 2002; Young, 2002). Chickering and Ehrmann's (1997) seven conditions for improving teaching practices advocate the use of a blended model with new technology combined with traditional, face-to-face approaches. There is ample evidence in the literature for the need for convergence of new student-centred pedagogies, computer- and World Wide Web-based technologies, and social theories of learning to enable the development of transformative teaching and learning models/ paradigms (Dziuban, Hartman, and Moskal, 2004). Young (2002) argues that the convergence between online and residential instruction is the single-greatest unrecognized trend in higher education today. As a result, interests in blended learning is rapidly increasing (Duhaney, 2004; Thomson NETg, 2003).

Institutions of higher education around the world are using blended learning to meet institutional goals, enhance student learning, facilitate student access and find solutions to address diminishing resources (7th Annual Sloan Consortium Blended Learning Conference, 2009)[11]. As a result, blended learning has garnered a great deal of attention from education, particularly the higher education landscape, around the world as an opportunity to improve the teaching and learning process. Millions of learners around the planet, in fact, are actually learning in this fashion each day (Bonk and Graham, 2006).

Due to its increasing popularity and acceptance, a wide variety of blended learning models are described in the literature (e.g., Singh, 2003; Yoon and Lim; 2007; Thorne, 2003; Bonk and Graham, 2006), ranging from supplementing the face-to-face learning process with online materials, as in most traditional universities (Shemla and

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[11] http://www.sloanconsortium.org/blended

Nachmias, 2006), to conducting the learning using an LMS supplemented by a few face-to-face orientation meetings which is common in most open or distance universities (Guri-Rosenblit, 2005).

Several studies that compare the effectiveness of blended courses with face-to-face as well as online courses have been found in the literature. A meta-analysis of prior studies on the effectiveness of Web-based instruction compared to classroom instruction conducted by Sitzmann and her colleagues (Sitzmann, Kraiger, Stewart, and Wisher, 2006) provides preliminary evidence related to the effectiveness of blended learning programs. Chamberlain, Davis, and Kumar (2005) found that blending traditional teaching approaches with learning technologies allow for more interaction between instructor and students or among students than in face-to-face classroom instruction such as in large classroom lectures.

In a comparative analysis of fully online, blended and fully face-to-face courses, Rovai and Jordan (2004) report that students in the blended course created the strongest sense of community, as evidenced by higher connectedness and mean learning scores and the researchers (e.g., Caruso, 2004; Kvavik and Caruso, 2005) ascribed this to the convenience of fully online courses and the role of face-to-face contact in nurturing community. Most of such studies suggest that learner satisfaction (Albrecht, 2006; Gray, 1999; Sanders and Morrison-Shetlar, 2001; Black, 2002, Bates and Poole, 2003; Aldrich, 2004; Hensley, 2005; Yildirim, 2005), and learning outcomes can be superior in blended learning settings compared to those in online settings (Boyle, Bradley, Chalk, Jones, and Pickard, 2003; Lee and Im, 2006; Lim, Morris, and Kupritz, 2006). Enhanced interaction and flexibility on a 24x7 basis from anywhere are the key attributes of hybrid instructional approach that make it more preferred by students than online alone or face-to-face alone.

Yoon and Lim (2007) report that blended learning is a promising approach for resolving problems around elearning. Young (2002) suggests that there has been marked shift in the vision for online education, moving from the idea of fully online courses, with no face-to-face meetings to hybrid courses that offer the best of both worlds. Lewis and Allen (2005) describe the growth in the use of virtual learning communities that are centred on online communication but they acknowledge that many such communities meet face-to-face in a blended learning approach and claim that participants rate such blended communities more highly than fully online

communities. Lewis and Allen (2005) describe growth in the use of virtual learning communities that are centred on online communication but they acknowledge that many such communities meet face-to-face in a blended learning approach and claim that participants rate such blended communities more highly than fully online communities. A study by Kim and Bonk (2006) reports that in the next decade more emphasis is expected to be placed on blended learning formats than on courses offered in a fully online format.

Bonk and Graham (2005) found among learners "unequivocal enthusiasm for implementation of both the on-line and classroom components of the program". A study by *The eLearning Guild* (2003) found that the top three reasons for using blended learning were:

➢ More effective than classroom alone (76.0 percent);

➢ Higher learner value and impact; the effectiveness greater than for non-blended approaches (73.6 percent).

➢ Learners like it (68.6 percent).

Vaughan and Garrison, (2006a) has reported faculty satisfaction with blended learning. This is also consistent with a survey by Marquis (2004) that found that 94 percent of lecturers believed that blended learning "is more effective than classroom-based teaching alone." A survey of instructors from higher education institutions across Britain found that 85 percent believe learning technologies are improving access to education and 94 percent think that a mix of online and classroom-based teaching is more effective than classroom teaching alone (Marquis, 2004). According to researchers at Carnegie Mellon University (2008), "by combining the open-learning software with two weekly 50-minute class sessions in an intro-level statistics course, they found that they could get students to learn the same amount of material in half the time." It is the immediate and targeted feedback that leads to this significant reduction in the time it takes students to achieve a desired level of performance (Anderson, Conrad, and Corbett, 1989).

Aycock et al. (2002) report on a research at the University of Wisconsin-Milwaukee that they found that both teachers and students were positive about the blended approach- with 100% of teachers recommending the approach to others and planning to teach again using the hybrid model; the main reasons were, "student interactivity

increased, performance improved, and the faculty could accomplish course goals that had not been possible in their traditional courses"; substantial majority (80%) of their students thought the hybrid model was worthwhile, and that they would recommend a course offered in the hybrid mode to others. Based on the experience of 17 instructors (from five University of Wisconsin campuses, representing disciplines from the humanities, social sciences, engineering, and professions) in a collaborative Hybrid Course project[12] that supported them in their efforts to design, develop, and teach their first hybrid courses, Carla Garnham and Robert Kaleta (2002) report:

> "Hybrid courses offer a number of advantages over face-to-face teaching and totally online courses. Instructors reported that the hybrid course model allows them to accomplish course learning objectives more successfully than traditional courses do. Most faculty noted increased interaction and contact among their students and between the students and themselves."

In a parallel study in at the same university, Sands (2002) proposed general guidelines for instructors who planned to combine online teaching elements within their courses. He listed five simple principles that may help teachers better connect their online work with face-to-face teaching:

(i)   Start small and work backward from your final goals;

(i)   Imagine interactivity rather than delivery;

(ii)   Prepare yourself for loss of power and a distribution of demands on your time more evenly throughout the week;

(iii)   Be explicit about time-management issues and be prepared to teach new skills;

(iv)   Plan for effective uses of classroom time that connect with the online work.

Data from the University of Central Florida indicates, "students in hybrid courses achieve better grades than students in traditional face-to-face courses or totally online courses" (Garnham and Kaleta, 2002) and that the hybrid courses have lower dropout rates than do fully online courses. Based on teachers' reports of the positive influence of online use over their face-to-face teaching, some researchers conclude that a blended environment using the advantages of both modes was the best outcome for

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[12] *Coordinated by University of Wisconsin-Milwaukee's Learning Technology Centre*

ongoing practice (Stacey and Wiesenberg, 2007; Heaton-Shrestha, Edirisingha, Burke and Linsey, 2005). A new study from South Texas College (2009) suggests that hybrid courses can produce better outcome than those that are exclusively on the Web or in the classroom; further, it found that retention rates are higher in hybrid courses than in the Web and in the classroom.

According to Garrison and Vaughan (2008) blended learning redesign is a proven approach that can enhance and expand, and ultimately transform, both the effectiveness and efficiency of the teaching and learning experience in higher education. Analysing the data from a three-year national professional development project involving 149 schools in the US, Chen et al. (2008) report that technology also provides capabilities to complement students' learning styles and multiple intelligences. Several other studies (e.g., Eastmond, Nickel, Du Plessis, and Smith, 2001; Garrison, 2002; Twigg, 2003; Albrecht, 2006; Vaughan, 2007; Owston, Wideman, and Murphy, 2008) recommend a hybrid approach to implementing online courses, retaining some contact, face-to-face time and gradually increasing online activities on an incremental basis. This gradual increment is necessary as most students and instructors are more used to face-to-face approach and then they need time to change to the online culture.

More recently, many colleges and Universities particularly in the western world consider blended learning as an option to ensure continuity of learning in their contingency plans against unexpected closure of their physical campus in case of campus security threats or other natural disasters such as flood, fire or epidemics (e.g., possible H1N1 virus pandemic).

Further concerns about the traditional campus education as expensive, ineffective and inexplicably irrelevant to address today's workplace needs need to be addressed with new innovative instructional strategies and models especially in the context of the recent downturn in the financial sector. The blended learning approach aims at providing increased access and flexibility in a cost-effective manner to even those who otherwise will not have had access to HE. Thus, it can offer immense help in student learning, allowing us to attain higher education for more people, if not all more effectively and efficiently.

With the emerging innovative affordances offered by Artificial Intelligence (AI) techniques, Semantic Web[13], Web 2.0 technologies and 3-D video to support collaboration, it could become possible for teachers and students to engage one another in a give-and-take manner that replicates face-to-face classrooms. The integration of 3D interactive graphics and web technologies (Web3D) will allow educators to develop highly interactive and realistic learning environments to enhance online learning (Chittaro and Ranon, 2007). Interactive lab sessions redesigned with new web-based interactive learning activities, and simulations may be a common thing in the future. One of the most exciting recent developments in online learning is the use of web-based applications that allow streaming of audio and video within web pages, enabling the integration of several types of media within a single space. Another significant development in the technology for blending is the increase in access through the use of portable and mobile wireless computing devices. With all such advances in technology, blended learning approach might be instrumental in taking the higher education landscape to new heights in the near future.

From this literature survey it is evident, blended learning has emerged as a major break-through to enhance students' educational experience in an effective and efficient manner. Blended learning is now constantly positioned as one of the emerging trends in higher education (e.g., Allen, Seaman and Garrett, 2007; Graham, 2006), not just for campus-based courses but for courses designed for students studying at a distance as well as for communities of professional learning and practice (Stacey and Gerbic, 2009). Thus, the extant literature indicates that blended learning approach presents an opportunity to revamp and transform higher education.

As a result of the above mentioned numerous reasons and benefits, indications are that blended learning has the potential of offering courses that, through the optimal choice of the blend, can have results that are better that the sum of the parts, and that blended learning approach will be the future way forward in higher education. As we move into the future, the quality of blending is largely going to depend on the creativity, calibre and experience of the Instructional Designer and the Course Tutor to

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[13] *The Semantic Web is an evolving concept of the World Wide Web in which the meaning (semantics) of information and services on the web is defined, making it possible for the web to "understand" and satisfy the requests of people and machines to use the web content. In the context of this study, it web provides an environment in which content can be manipulated, stored, searched and computed automatically through autonomous agent technologies. Such capacity will allow development of much more useful teacher and learner agents, encouraging migration to content-based forms of interaction from the two other human-based forms of interaction- student-student and student-teacher.*

understand the affordances of emerging technologies and to capitalise on the unique affordances available in both face-to-face and online learning environments. For the reasons stated above, the Researcher believes that blended learning is an apt approach to address the research question in this study.

The discussions hitherto (in Section 2.4) address the second specific research objective: *To examine the distinct characteristics of web-supported blended learning, how it is perceived, accepted and practised generally in higher education and to justify the relevance of this approach in this study.*

2.4.1   What is blended learning?

According to the Danish theorist Gynther (2005), the term blended learning was first used in the American literature and it meant a blend of traditional teaching and technology-based teaching using different forms for technology to support a wide variety of pedagogical methods. With the continuing advancement of digital technology, blended learning continues to develop along new dimensions merging the best features of conventional face-to-face instruction and online learning (Graham, 2006). What actually is being addressed as blended learning is a variety of instructional approaches to meet students' pedagogical needs based on their unique learning styles and preferences. Therefore, it is often called 'hybrid instruction'.

'Blending' is a complex construct with several interpretations in diverse educational contexts. Driscoll (2002) points out that blended learning can mean different things to different people. It can mean:

(i)   mixing affordances of web-based technology (e.g., live virtual classroom, self-paced instruction, collaborative learning, streaming video, audio, and text) to accomplish an educational goal;

(ii)   combining various pedagogical approaches (e.g., constructivism, behaviorism, cognitivism) to produce an optimal learning outcome with or with out instructional technology;

(iii) combining any form of instructional technology (e.g., videotape, CD-ROM, web-based training) with face-to-face instructor-led training;

(iv) a powerful integration of synchronous and asynchronous learning styles, enabling students to master core content online while deepening critical thinking, problem solving and application of content mastery in a face-to-face setting.

(v) combining instructional technology with actual job tasks in order to create a harmonious effect of learning and working.

In general, blended learning is learning that is facilitated by the effective combination of different modes of delivery, models of teaching and styles of learning, and founded on transparent communication amongst all parties involved with a course (Heinze and Procter 2004). But none of the processes sighted above precisely refers to the type of web-based blending proposed in this study although the points (iii) and (iv) have some closeness to it.

Verkoost, Meijerink, Lintsent, and Veen (2008) content that a primary purpose of the blended approach is to alleviate many of the feelings of isolation or lack of community that students may have, and promote traditional student-teacher relationships that evolve during face-to-face instruction. It takes advantage of the best features of face-to-face teaching with the best features of online facilitation, to promote active and self-directed learning opportunities for students. Johnson (2000) found that traditional educational activities in courses can become more active, meaningful, and authentic when enhanced by technology. The use of blended activities enhances face-to-face interaction with online reflection and discourse, enhancing access and learner engagement. The key assumptions of a blended learning design are:

➢ thoughtfully integrating face-to-face and online learning to provide more engaged learning experiences through an enhanced pedagogical approach;

➢ fundamentally rethinking the course design to optimise student engagement;

➢ reconstructing and reducing traditional class contact hours; and

➢ making learning more accessible and affordable to a greater number of learners.

For optimal learning to take place, the framework for this study also advocates a blending of the pedagogical philosophies of objectivist and cognitivist learning theories, based on instructivist and constructivist epistemologies in a complementary

manner. Alessi and Trollip (2001, p.38) argue, "the current world of educational theories is really a triangle, with behaviorism, cognitivism and constructivism at the vertices. Most educators are somewhere in the *middle* of that triangle." Merrill, Li, and Jones (1990a), Lebow (1993), Reigeluth and Squire (1998), and Alonso, López, Manrique, andViñe (2005) argue from a pragmatic perspective that elements of objectivism, cognitivism, and constructivism can and should be combined in instructional models. They argue that the three basic theoretical perspectives on learning are interdependent and have a capacity to be combined to "…build instructional design heuristics" (p. 219) and facilitate student learning. This is further discussed under the theoretical framework for this study in section 2.5.

In a blended learning approach, F2F sessions are made more active and effective by moving the boring aspects of basic instruction to the online environment where technological affordances can make them more engaging and interactive. Further, lectures are replaced with a variety of learning activities that move students from a passive, note-taking role to an active, learning orientation. In a more practical sense, where possible teachers modify activities that are objectivist in nature into student-centred or group-oriented online activities in more authentic formats (e.g., simulations, video presentations, just-in-time feedback, reinforcement of concepts, computer conferencing, discussions, collaborative group projects/presentations, etc). In other words, the affordances of technology is utilised to change these events into student-centred activities that enable learners to be cognitively active and guided by instructors during learning. When students meet in the classroom with the tutor, they can focus on higher-level skills since the basics are known by all students and were even tested using the online assessment tool.

Johnson (2000), Salinas (2008) and Nix et al. (2004) demonstrate how traditional educational activities can become more active, meaningful, and authentic when enhanced by technology, and thus, supporting the role of technology as a tool for creating a student-centred learning environment. When instructional activities are appropriately designed, pedagogical changes enabled by the affordances of technology occur in a manner shown below in Table 2.4.

Table 2.4: Comparison of Traditional and Blended Learning Environments*

Traditional Learning Environments		Blended Learning Environments
Instructivist	→	Shift in focus to the constructivist pedagogical philosophy
Behaviourist	→	Shift in focus to the cognitivist learning theory
Teacher-centred instruction	→	Student-centred learning
Single-sense stimulation	→	Multi-sense stimulation; Access and exchange information in a variety of ways
Single-path progression	→	Multi-path progression
Single medium	→	Multimedia
Isolated work	→	Collaborative work
Information delivery	→	Information exchange
Passive learning	→	Active/exploratory/inquiry-based learning
Factual, knowledge-based learning	→	Critical thinking and informed decision-making
Reactive response	→	Proactive/planned action
Isolated, artificial context	→	Authentic, real-world context

Adapted from Bell and Garofalo (2005).

Based on Mayer's work in laboratory settings, multimedia presentation holds great practical promise in increasing the quality of lecture-based presentations, more active pedagogies might be employed to enhance student learning not only in equation-heavy fields of study, but in the arts, humanities, social sciences, and professional fields (Bransford, Brown, and Cocking, 1999). Results of an experiment conducted in a natural educational context indicate enhanced transfer of lecture information in the video formats relative to the live condition, with students also responding more positively to personalized video presentation (Dey et al., 2009). A helpful tip is to use online approach for topics that focus on practical issues that require authentic tasks and face-to-face instruction for more theoretical topics (Precel, Eshet-Alkalai, and Alberton, 2009).

From a different perspective, some people utilise elearning to enrich the face-to-face instructional process while some others use the other way round with some occasional face-to-face contacts to overcome the shortcoming of purely online approaches. As emerging technologies become more accessible and they become really part of the new net generations of learners (who grow up with technology), students might become tolerant with the type of isolation inherent in online learning, and then they

might well accept online learning with limited face-to-face interactions such that students learn themselves rather than being taught. However, the aim is not to replace teachers completely, but to use them more effectively as it leverages the opportunity for teachers to interact directly with individual students. A teacher meeting dozens of students in a lecture hall does not have this opportunity.

The purpose of blending at UB is well reflected in Dziuban, Hartman, and Moskal's (2004) explanation that the instructional model of the entire course is to be reconceptualised and redesigned, retaining the face-to-face component, yet shifting "from lecture to student-centred instruction in which students become active and interactive learners". To be precise, in the context of this study, blended instruction is the use of traditional face-to-face instruction with online instruction in a such way that students get the best of both –the real as well as the virtual environments – offering them increased flexibility and interactivity of online learning without losing the advantages of face-to-face contact.

2.4.1.1   Definition of blended learning

Though the concept of blended learning is not new, Graham (2006) notes that research around it is still in its infancy and therefore, it is not surprising to find that there is not a uniform definition that all researchers have adopted. As is the case in any new and emerging field of research, there are a number of interesting opportunities for exploration, and it makes it even more difficult to agree on a single definition statement.

Whitelock and Jelfs (2003) published a journal as a special issue on blended learning where they introduced three definitions of the term 'blended learning' as:

(i)   the integrated combination of traditional learning with web-based online approaches;

(ii)   the combination of a number of pedagogical approaches, irrespective of learning technology use; and

(iii) the combination of media and tools employed in an elearning environment.

The first two definitions closely match with the focus of this study. According to Garrison and Vaughan (2008), the basic principle of blended learning is that face-to-

face oral communication and online written communication are optimally integrated such that the strengths of each are blended into a unique learning experience congruent with the context and intended educational purpose (p. 42). This is the underlying principle embraced in the web-based blended learning concept in this study; it combines the affordances of the two modes of delivery in a multiplicative (not additive) manner to go beyond the capabilities of each separately and to help manage large classes.

In broad terms, the term 'blended learning' may be defined as a combination of various instructional modalities combined with synchronous and asynchronous web-technologies to facilitate interactive and reflective individual as well as collective learning. Thorne (2003) defined blended learning as "a way of meeting the challenges of tailoring learning and development to the needs of individuals by integrating the innovative and technological advances offered by online learning with the interaction and participation offered in the best traditional learning" (p. 184). Another commonly used definition of blended learning is a combination of face-to-face instruction combined with computer-mediated instruction to facilitate interactive and reflective higher-order learning (Graham, 2006). Colis and Moonen (2001) define blended learning as a hybrid of traditional face-to-face and online learning so that teaching and learning occur both in the classroom and online, and where the online component becomes a natural extension of traditional classroom learning.

To Sharpe, Benfield, Roberts and Francis (2006), blended learning is difficult to define. Garrison and Kanuka (2004) describe blended learning as "the thoughtful integration of classroom face-to-face learning experiences with online learning experiences" (pp. 95-105.).

For the purpose of this study, the Researcher wants to define blended learning as *a planned yet flexible integration of face-to-face and online instructional delivery approaches to optimize the learning experience of a variety of students.*

2.4.2   *Characteristics of Web-based Blended Learning*

The basic principle of Web-based blended learning is that face-to-face and online delivery approaches are seamlessly and appropriately integrated such that the strengths of each are synergistically blended to increase student engagement beyond

classrooms, and thus to enhance students' unique learning experience. According to Dziuban, Hartman, and Moskal (2004), blended learning should be viewed as a pedagogical approach that combines the effectiveness and socialization opportunities of the classroom with the technologically enhanced active learning possibilities of the online environment.

Given the specific features of learning and individual students, it is obvious that hybrid instruction cannot be designed as a conventional task with "fixed menu" of teaching strategies. This is because learning is a by-product of understanding rather than an activity that can be supported directly (Mayes and Fowler, 1999). Thus, according to Twigg (2003) students learn in different ways, and therefore, the "right way" to design a high-quality course depends entirely on the type of students involved. Based on the nature and extent of technology integration, he identified five distinct course (re)design models based on their design, similarities and differences as discussed in Section 3.5.7. Thus, blended learning generally involves a mixture of instructional modalities, delivery media, instructional methods, and web-based technologies (Graham, 2006).

It has to be borne in mind that blending is not simply about combining face-to-face approaches with online mode or posting content or supplementary activities online, but it is potentially a transformative process. The positive outcome of blended learning is neither from the face-to-face approach nor from the technology itself, it is from the design of the learning environment whereby traditional courses are reorganised and redesigned into hybrids with increased interactivity, engagement and flexibility such that students get meaningful learning experience. It is altogether a new pedagogical approach. Therefore, appropriate blending requires several factors in place, for example, a careful analysis of the context, content, and the choice as well as availability of relevant technology tools, and above all an intelligent design of a learning environment. This means that it is critical to pay utmost attention to the design aspect when blended learning is considered for instructional delivery. Blending will become bland if only some online material is simply added to augment face-to-face approaches and it does not add any value to student learning.

One of the most often asked questions that arises when designing blended courses or programs is what the optimal blends are (Rossett and Frazee, 2006). Kerres and DeWitt (2003) note that the major challenge for blended learning is how to find the

right "mix" of formats and delivery. Though a numeric description or positioning within the continuum seems to offer clarity, it is not always possible. According to Dziuban, Hartman, and Moskal (2005), the general criterion for blending could be that it has to suit the purpose of learning which depends on several parameters such as learning goals and objectives; the context of learning, which takes into account of how the tutor's and student's preferred approaches to teaching and learning will influence the optimal blend; characteristics of the content, selection and they way they are organised and integrated into the classroom teaching; instructor experience; and situational / institutional demands.

According to Chris Dede (2005), hybrid models can be superior to traditional classes, and what proportion that mixture should be would vary from course to course. Garrison and Kanuka (2004) argue that the real indicator of blended learning is not the amount of face-to-face or online learning but their effective integration within a course. It also has very much to do with expectations and perceptions of teachers and other stakeholders. Successful blending requires careful consideration of all these factors and the ways in which each will impact upon the others. This means that the blend will be different as each factor changes. It would be advisable to stay focussed on the expected performance outcomes when determining the "right" blend.

According to Garrison and Vaughan (2008), blended learning must be approached with the awareness of broad range of flexible design possibilities and the challenges of doing things differently. All learners are unique and therefore, all students may not learn in the same way: people learn by listening, reading, doing or watching others performing. Young (2002) reports that some students thrive in the classroom setting and learn by listening to and speaking with other students, while other students respond better in the online environment because they are given the time to consider their responses and are less reluctant to respond. Mann (2001) states, "There is nothing that works for every purpose, for every learner, and all the time." Some students work better in groups, and some others alone; some are good speakers, others better writers; some think quickly, others need time to reflect and therefore, the traditional approach is not ideal for all students. The notion is that, if appropriately blended, this model is appropriate and flexible enough to acknowledge different learning styles (Jung, 1992) as well as multiple intelligences (Gardner, 1999), constructivist principles and practices that suit learners' unique needs for the digital

age. Further, if a "buffet" style of face-to-face instruction with elements of online instruction is adopted, students have a choice of classroom or virtual instructional activities depending on their own comfortable attention spans and lifestyles. Thus, the blended course development process permits the creation of an instructional environment that can be positive for different type of learners.

From a course design perspective, a blended course can lie anywhere between the continuum anchored at opposite ends by fully face-to-face and fully online learning environments (Rovai and Jordan, 2004). Some people utilise elearning to enrich the face-to-face instructional process while some others use the other way round with some occasional face-to-face contacts to overcome the shortcoming of purely online approaches.

This Researcher does not advocate for any fixed formula for the blending; instead prefers to suggest that, based on specific learning objectives, learning tasks, and learner characteristics, teachers may choose a range of possible pedagogical choices eg., lectures, laboratories, small group sessions, multimedia tutorials, online resources and interaction in a systematic manner as discussed below; the correct choice of strategies and the appropriate use of technology depend largely on the creativity of designers; whatever may be the choice, it should result in a transformative process out of synergy from the two approaches with increased interactivity, engagement and flexibility such that students get meaningful learning experience.

Blended learning practices are particularly suited for educational experiences through activities that link the academic with real-world activities and contexts. According to Merrill (2001), current work in cognitive psychology indicates that students learn better when they are engaged in solving real-world problems (p. 5). Therefore, students get the added advantage of learning in various ways possible by connecting the content and classroom practices with real-world contexts (e.g., problem-based and activity-based learning). Thus, blended learning is also underpinned by the theory of situated learning which refers to learning in terms of activity and participation in a community of practice.

Blended learning model does not have a pedagogy of its own. However, it is strongly supported by social learning theories such as social constructivism, situated cognition, engagement theory, variation theory and cognitive flexibility theory, and the synergy

from these. Accordingly, the backbone of the blended learning is a pedagogical approach that provides flexibility, learner-centredness, enhanced interactions, discourse and reflection, continuing opportunity to learn beyond the classroom, and opportunity to deal with differentiation more efficiently with a variety of learning resources in multiple formats, and student engagement.

In short, blended learning supports student engagement, dialogue, collaborative activities, online community of learners, and good assessment strategies. This is quite beneficial as large conventional classroom instruction generally lacks student engagement and provides limited opportunities for reflection on course content by the students.

2.4.2.1   Community of learners

Today, the Internet has evolved into a global workspace for communication, collaboration, and community; most students are engaging in online social communities daily. Social networking tools such as Web 2.0 will continue to evolve. New instructional practices have to evolve in order to adapt the affordances of new technology for learning. One of the critical factors is to develop a 'sense of community' among the learners; it is supported by social constructivism and engagement theory (Section 2.7.6). The concept of "community of learners" is an important aspect of distance / online education. It helps to minimise feelings of isolation that is inherent with online education. Rovai and Jordan (2004) assert that blended courses produce a stronger sense of community among students than either traditional or fully online courses.

Lewis and Allen (2005) define a learning community very widely as "a supportive group of people who come together to collaborate and learn together, they are usually facilitated or guided to achieve a specific outcome or agreed learning objectives" (p. 9).

Recognition of the fact that full cognitive development requires social interaction (Vygotsky's theory of social cognitive development, 1978 and Bandura's social cognition, 1982) supports the learning community model. The concept of the community model is grounded in a collaborative constructivist view of higher education and assumes that effective online learning requires the development of a

course community (Shea, 2006; pp. 35-44.). Online learning offers [learners] the ability to be part of a dynamic and sustained community of learners engaged in critical discourse and reflection with the express purpose to construct meaning and confirm knowledge (Garrison and Anderson, 2003). The face-to-face component in blended learning provides the online learning community with a social basis to increase motivation and collaboration, to decrease the sense of isolation, and to stay motivated on tasks; online interaction allows for reflection and cognitive transformation. A study on students and technology reported that students "want to be linked in the network, but they want a lot of face-to-face time" (Kvavik, 2005).

According to Rovai, Wighting, and Lucking (2004), sense of community in an educational setting includes *social community* and *learning community*. The social component refers to the feelings of the members regarding their cohesion, connectedness, mutual trust, safety, interdependence, and sense of belonging. Learning community, on the other hand, consists of the feelings of the members regarding the degree to which they share group norms and values, and the extent to which their educational goals and expectations are satisfied by group membership. In a community model, most students do not feel intimidated by peers and interact deeply among themselves; in fact, peers serve as confidence builders.

According to Wenger (2003), a community of practice model integrates the three dimensions: it is *a joint enterprise* understood and continually renegotiated by its members, *a mutual engagement* that binds members together into a social entity and *a shared repertoire of communal resources*. Building a community of learners is a great way for the learner to connect with an engaged group of peers, explore new concepts collaboratively and share new ideas.

Learning in a social context is vital to the success of online and blended learning. The development of teams who focus on shared understanding can also provide the foundation for the establishment of "communities of practice" where the shared learning and interest of its members keep it functional (Wenger, 2003). According to Wenger, each learner may be initially at the edge of a learning community, but as their skills and knowledge increase, they will integrate within the community. Community members may interact independently of space and time, but they often use a range of media that is appropriate to the community type.

2.4.3   Benefits of blended learning delivery

The so-called "digital natives" are in frequent communication with their peers, and it is only natural for them to expect similar interconnectedness in their learning environments. They expect the use of technology to trigger interaction among themselves and with the tutor. Hybrid instruction aims to provide interactive, participative, individualised, flexible and technologically-enabled learning environments to enable learners construct knowledge through deep intellectual engagement and dialogue with peers and the teacher with the use of synchronous and asynchronous web-based technologies. It leads to more personalised instruction, intellectual scaffolding, increased time on task (mastery learning), and opportunity for learners to pace their own learning processes. Students with demanding schedules and various technology comfort levels, institutions with physical space constraints, and demand for more flexible scheduling options make the blended learning model one of the fastest growing delivery modes in higher education. Also students with increasingly shorter attention span can benefit a lot from the blended learning approach. Thus, increased student engagement beyond the four walls of the classroom, enhanced flexibility to learn at learners' own pace, greater opportunity for both social and personalized learning, and new opportunities for better forms of assessment are the key benefits of blended learning.

With the use of technology, learners can be assessed while the learning is taking place, not necessarily after the learning has taken place as it is normally done in traditional settings; thus, assessment is largely diagnostic and formative in order to monitor how students learn, and how it can be improved. According to Woods, Baker, and Hopper (2004), blended approach permits more reliable assessment strategies to be utilized by the instructor as well as direct observation, class discussions, and oral questioning in the classroom.

The potential of blended learning approach seems to be addressing the three main forces that call for a major change in the current higher education landscape: the unprecedented advances in ICT and the corresponding information and knowledge explosion, budgetary constraints to meet the increasing focus on research and demand for HE, and the dissatisfaction with the current quality of HE that do not match with

the needs of the changing knowledge- and communication-based society. A significant goal of the blending approach in the UB context is the possibility for increased access and participation. This goal is considered quite significant towards addressing UB's strategic priority areas.

In the blended approach, face-to-face learning becomes more effective because the boring aspects of basic instruction are moved to the elearning environment, where technological affordances can make them more engaging and interactive. When students meet in the classroom with a tutor, they can focus on higher-level skills since the basics are known by all students and were even tested using the online assessment tool. In the process, students are empowered to assume increased responsibility for their own learning experience. Therefore, blended learning is often introduced to improve the quality of learning and student engagement, and reduce the usual passivity of students in face-to-face classrooms. The outcome of a funded project[14] that aimed to examine how integrating recent technical developments with digital content will improve the learning experience of students indicated that blended learning, the combination of traditional face-to-face teaching methods with authentic online learning activities, has the potential to transform student learning experiences and outcomes (Davis and Fill, 2007).

In a virtual classroom, students can log in when it is convenient for them, and they can review lectures either in print or audio format if they miss them in the face-to-face classroom. Some students who rarely take part in classroom discussions feel comfortable and confident to participate online due to its asynchronous nature. For students with part-time employment, family commitments or who are shy to talk, online and blended environments offer extended opportunities. A face-to-face classroom dynamic may provide such students the best opportunity to create a sense of belonging and to begin the formation of a community, and online communities can extend the opportunity for sustained and flexible communication. A community of inquiry would benefit from the integrated strengths of blending face-to-face and online learning and capitalising on their inherent strengths. All these benefits come mostly from the elearning component because of its potential in providing powerful

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[14] *The DialogPLUS was a collaborative project between Pennsylvania State University, the University of Leeds, UCSB, and the University of Southampton. It began in February 2003 to investigate 'Digital Libraries in Support of Innovative Approaches to Teaching and Learning in Geography'. The project was funded for three years by the Joint Information Systems Committee (JISC) in the UK and the National Science Foundation (NSF) in the USA under the Digital Libraries in the Classroom Programme.*

learner support through, among others, online collaboration with lecturers and fellow students, and ubiquitous learning environments that support learning beyond the classroom and even outside the campus through web-based virtual classrooms.

The blending of classroom and online provides ample opportunities for verbal, written and visual communication to support and facilitate interactive reflective higher-order learning. Availability of a variety of information sources is part of any good blend because it allows participants to receive the same message in various formats over time. It also enables them to move back and forth between symbolic representations of phenomena and the real-life referent. For instance, a topic is introduced in a traditional classroom, and it is further elaborated on in the online community. In addition, tutors may launch online chats and discussions to practise key concepts.

Blended learning model is very appropriate in the context of a traditional institution as even those lecturers who may not be comfortable with elearning approach, get opportunity to improve their IT skills and adequate time to develop online teaching skills gradually. Driscoll (2002) sees blended learning primarily as a strategy to help starting elearning in organisations: "blended learning allows organizations to gradually move learners from traditional classrooms to elearning in small steps making change easier to accept" (p. 1). Young (2002) reports, "Instructors hesitant to engage in totally online course delivery find hybrid delivery methods less controversial and adopt them more readily." Blended learning becomes a vehicle through which a new subject is learnt at the same time as learning the technology itself because it addresses the needs of both technophilic and technophobic students. A project done by Motteram (2006) illustrates how important the blend is for student teachers to get a balanced programme that upgrades skills and knowledge as it also enables them to reflect on past and future practice.

In a study by Vaughan (2007) to explore the benefits of blended learning in higher education from the perspectives of students, faculty, and administration, students indicate that a blended learning model provided them with greater time flexibility and improved learning outcomes, and further, it allowed them to take greater responsibility for their own learning. Faculty finds blended learning as a means of enhancing teacher-student interaction, increasing student engagement in learning, and adding flexibility in the teaching and learning environment. Most importantly, it provides opportunities for continuously improving courses.

From the literature (Albrecht, 2006; Garrison, 2002; Graham, 2006; Moore, 2004; Picciano, 2006; Twigg, 2003; Vaughan, 2007), the potential benefits of blended learning can be summarised as below:

➢ pedagogical richness; blended learning could be an effective means of enhancing learning by blending traditional classroom learning and online learning;

➢ different pathways to student learning;

➢ benefit to students with increasingly shorter attention span;

➢ students can pace their own learning and become self-directed learners;

➢ engaging learners outside of class and thus extending learning beyond the classrooms;

➢ greater access to personalized learning, to resources and experts;

➢ greater flexibility offered by blended learning through the use of ICT, thus reducing the on campus face-to-face hours;

➢ greater accommodation for learners and teachers from diverse backgrounds;

➢ increased student-teacher as well as student-student interactions, and a sense of community;

➢ opportunity to evaluate student learning using more reliable authentic assessment strategies;

➢ learners can be assessed while the learning is taking place, not necessarily after the learning has taken place as it is normally done in traditional settings;

➢ increased cost-effectiveness;

➢ rich and immediate feedback which leads to significant reductions in time taken by students to achieve a desired level of performance (Anderson, Conrad and Corbett, 1989);

➢ asynchronous communication and learning opportunities (anytime, anyplace, extended beyond the classroom by email and discussion forums);

➢ more diagnostic self-tests and formative evaluation of teaching;

➢ access to new learner groups;

➢ possibility for increased access and participation;

➢ multiple presentation of content to suit varying needs and preferences of students;

➢ provision for co-teaching which helps students to get the expertise of more than one teacher in a given course (Remember, excellent teachers are few!);

➢ many students are technology savvy, but at the same time, others are technophobic. This was a consideration in designing the hybrid model in this study;

➢ opportunity to improve their IT skills; and

➢ enrolment in the course could grow eliminating the need for the University to provide additional physical space to accommodate the growing student population;

Blending is also helping instructors to successfully facilitate and evaluate self-directed learning in relatively large classrooms. From an administrative perspective, blended learning presents the opportunity to enhance an institution's reputation, expand access to an institution's educational offerings, and reduce operating costs. Web-based blended approach is being increasingly recognised as the driving force for the envisaged transformation in higher education, most notably in the way students have access to learning opportunities.

Based on the above discussions, anecdotal evidences, the literature on blended learning, and personal experiences, blended learning is arguably the most effective and efficient strategy humanity has ever developed over millennia for learning and skills development. With the adoption of blended learning, there is no need for additional classrooms, full-fledged satellite campuses or even more universities. As a result, interest in blended learning is rapidly increasing in education and training organisations all over the world. The Researcher believes the blended model is the future of education.

2.4.4   Barriers to blended learning delivery

Despite the increasing importance of blended learning approach in education and training, several studies (e.g., Cook, Owston, & Garrison, 2004; and Dziuban, Hartman, & Moskal, 2004; Muilenberg & Berge, 2005; Vaughan, 2007; Kim, Teng, Son, Oh, & Bonk, 2008) report various challenges and barriers in transforming instruction into a blended learning format. These factors can adversely affect their strategic plans for plan for blended learning and subsequent implementation strategies. The common challenges and mistakes are:

i)   Administrative challenges (e.g., absence of a visionary leadership, lack of awareness, policies, plans, goals, support and implementation plans related to blended learning);

ii) Lack of faculty preparedness and quality assurance systems in place;

Educators in some institutions are forced to adopt new technologies in their instructional approaches before they are adequately trained to align affordances of the tools to what they can offer for learning, and even without a clear pedagogical framework for attending to students' various needs; as a result, they engage in trial-and-error methods resulting more often in more errors than trials.

Online course developers and tutors try to emulate the traditional classroom by giving more importance to delivery of content than to interactivity among learners and with the tutor, often without utilising its potential for good pedagogy. This is particularly true in the UB context;

iii) Technical barriers: lack of appropriate infrastructure and inadequate technical support to students and tutors;

iv) Lack of expertise in technology; Professional development is an important part of successful educational technology implementation;

v)   Lack of skills in time and workload management;

vi) Lack of understanding of the term 'blended learning' itself, and their lack of expertise in deciding the optimal blended learning approach appropriate in their own context;

vii) Lack of alignment of blended learning philosophy with institutional goals and priorities;

viii) Resistance to organizational change;

ix)   Tutors' concerns about losing control over the course;

x)   Lack of certain critical skills among some students;

Tutors need to bear in mind that not all students are ready for many learner-centred practices, and further, self-directed learning is a learned behaviour that develops over time; so these strategies need to be introduced incrementally so that students are prepared for them.

Some of these challenges and barriers are generic and are applicable to all organizations while others are peculiars to certain organisations only. Therefore, it is critical to conduct surveys to identify challenges and barriers in a given context and address them by providing teachers with guidance on how to overcome them.

2.5   Theoretical Framework

> *When blended learning is well understood and implemented, higher education will be*
> *transformed in a way not seen since the expansion of higher education in the late*
> *1940s.*   (Garrison and Vaughan, 2008, p. x)

(i)   Introduction

The aim of this study is to develop a student-centred, intellectually stimulating and technologically advanced blended learning environment to help students get quality learning experience through extended opportunities for active engagement in authentic activities and collaboration with peers and experts in the field. From discussions on the scope of ICT in higher education (Section 2.2), the benefits and challenges of traditional face-to-face instructional approach versus elearning with constructivist views as a basis (Section 2.2), and the current global trends in blended learning (Section 2.4), the Web-based blended learning approach has been identified to achieve this aim. Against this backdrop, this study is guided by the research question, "*How can a web-based blended learning environment be designed, developed and implemented at the University of Botswana?*"

The need to provide more engaged, meaningful learning experiences, to equip learners with various skills ranging from lower to higher levels and to educate many more students is at the core of the interest in blended learning. Besides, today's

knowledge-based society expects high level educational environments that make it possible for distributed learners to learn collaboratively anytime, and anywhere. Building from the discussions around the guidelines for good teaching practice highlighted above, the blended learning in Section 2.4, and the literature review on the scope of ICT in HE in Section 2.2, the Researcher proposes that a model of curriculum (re)design based on a student-centred pedagogical approach that combines synergistically the effectiveness of traditional face-to- face classroom with the technologically enhanced socialization and active learning opportunities of the online environment can realise such kind of engaged educational environments. Thus a blend of face-to-face and online instruction can be more effective to support students to construct meaning more efficiently than what is possible through either of the approaches independently.

(ii)   Underlying theories and principles

There is no single learning theory to follow in the applications of educational technologies or blended learning approaches. However, the blended learning model developed in the study has a solid theoretical foundation built up on numerous established theories, principles and the literature on online learning from which several threads were pulled together to draw up the psychological foundation and the theoretical framework. These theories and principles include Behaviourism (Section 2.7.1), Cognitivism (Section 2.7.2), Constructivism (Section 2.7.3), Activity theory (Section 2.7.4), Situated learning (Section 2.7.5), Engagement theory (Section 2.7.6), Cognitive load theory (Section 2.7.9), Cognitive theory of multimedia learning (Section 2.7.10), Merrill's first principles of instruction (See Section 3.4.9.4), the Seven Principles for good practice in online courses (discussed in Section 3.5.6), Laurillard's Conversational Framework (Section 3.9.6), Bloom's (1956) taxonomy of learning outcomes (Section 2.7.1.2), Variation theory of learning (Section 2.7.8), Connectivism theory of learning (Section 2.7.12), and Keller's ARCS model of learner motivation (Section 3.5.2). Social constructivism which emphasizes the critical need for social interaction and cultural practice for the construction of knowledge has a significant role in this study.

The aspect of extended engagement, often done collaboratively, in complex problem solving in ill-structured domains is the core element of all the theories and principles that underpin this study. Extended engagement provides learners with increased time for discourse, critical reflection, self-paced learning and developing thinking skills that can be transferred across domains, and enables them get more meaningful learning experiences and higher-order cognitive skills than what is possible in a typical lecture room. In the process, students are expected to be empowered to learn at their own pace, to assume increased responsibility for their own learning, to become independent learners, and acquire the skills for lifelong learning.

Individual learners are unique, and therefore, learning can be a complex process. Student learning can be influenced by several other factors that include the interplay between complex interactions, and a number of factors such as learning styles (Kolb, 1984; Gardner, 1983, 1993, 1999), personality types (Jung, 1971)[15] and unique combination of multiple intelligences (Gardner, 1999)[16].   In order to address all these in their instructional design, teachers are required to know how a variety of individuals learn and how to individualise curriculum and adapt to students' specific needs and characteristics. In addition, Teachers must understand how to apply the technologies and related approaches that will work best for their students.

(iii)   Instructivist-constructivist dualism

The LAPTEL model supports the pedagogical philosophy of both objectivist and cognitivist learning theories, based on instructivist and constructivist epistemologies. The main basis for using instructivist and constructivist approaches in the same study has emanated from Vygotsky's (1978) concept of learning that it is not a purely internal process, nor is it a passive shaping of behaviour. Realistic learning practices include a large range of activities, some active, some passive, some creative, some reactive, some directed, some exploratory (Hammond, 1992). Technology can also be successfully used for mundane drill, and practice in addition to providing the means

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[15] Jung posited that individual personality types influence various elements of human behaviour including learning. According to him each of the personality types and their psychological dimensions can influence an individual's learning style, and it is likely that overall learning styles are based on a combination of these dimensions.

[16] In his theory of multiple intelligences, Gardner argues that intelligence is not a singular entity; each individual can have at about ten basic intelligences; different individuals have different measures of these intelligences and have their own preferences, interests, or abilities depending on the proportion of these intelligence(s) in them.

for higher level instruction, such as problem solving, and for increased learner control. Therefore traditional design will always have a place in computer-based learning environments as certain learning situations are best suited to prescriptive and defined learning environments (Willis and Wright, 2000).

Although some people take this marriage of the traditionally conflicting instructivist and constructivist pedagogical approaches as completely incompatible, some others support it. Smith and Ragan's (2005) model of cognitive load and information processing indicates that elements from *both* sides are important because education comprises both generative and supplantive elements. Cronjé (2000) proposes that they are not mutually exclusive and he portrays them as complementary approaches, since, in practice, many learning events incorporate aspects based on objectivist traditions as well as elements of constructivism.

The Researcher considers this marriage as essential for learning to occur in its totality as learners should be able to acquire procedural knowledge as well as solve complex problems. Designers can use either objectivist or cognitive approach or a mix of the two depending on the nature of the materials to be developed and the context in which materials will be used. For example, objectivist approaches focussed on the transmission of low level attributes on the Bloom's cognitive taxonomies while cognitivist approaches are more appropriate for advanced skills development. When mixed, the two approaches will be used in a complementary manner (rather than oppositional). This type of "mixing" is also recommended by Passerini and Granger (2000) as the ideal paradigm of online course design. Since technology is used to transform objectivist tasks into student-centred learning activities in this study, the Researcher does not want to call the use of objectivist and cognitivist approaches as a sort of blending as it could confuse readers with the main blending planned in this study.

Rather than taking this marriage as a simple mix of two traditionally conflicting approaches, they may be seen as part of one singular theoretical paradigm—an instructivist-constructivist continuum or a "dualism" of a different nature that promotes a balance between the two extremes; by stating "of a different nature", the Researcher means a shift from the traditional dualist framework of thinking. To distinguish it from traditional dualism, the Researcher wants to call this as "new dualism" in which instructivist and constructivist approaches are used appropriately

(to suit the content, the learner and the context with emphasis changing between the objective and the subjective, the world and the mind) in a complementary manner.

Because of this new duality in this study, the use of the term *instruction* is not entirely eliminated in this work though it has strong connotations with the behaviourist school of thought. The Researcher also wants to point out that the term 'learner' is used when discussing learning in general terms but it is changed to the term 'student' while discussing teaching activities. Accordingly, the Researcher has also used the terms *learning design* and *instructional design* corresponding to learning and teaching contexts respectively. The Researcher takes Duffy and Cunningham's (1996) position that instruction is a process of supporting that construction rather than communicating knowledge (p. 171). By this notion, instructional design is viewed as the systematic process of planning events to facilitate learning.

One of the underpinning tenets of blended learning is that, with appropriate pedagogical design, teacher-centred instructivist tasks may be redesigned appropriately to support student-centred learning that requires students to engage with others in a community of practice (CoP), thus maintaining the foundation of the overall approach constructivist.

(iv)   The establishment of a 'community of practice' for shared understanding

Learning as a social practice involves learners operating as part of a community of practice. The possibility of *more* interactive and engaged learning experiences through a CoP approach may be considered as an important aspect of the "meta-pedagogy" for blended learning. Based on these views, at the core of this study is the adoption of a *learning community model* that promotes interactive engagement and supports personally meaningful and educationally worthwhile collaborative learning experiences, focusing on the social nature of knowledge. Web-based collaborative tools are utilised to engage students in a CoP and bring life to blended learning environments. These tools can connect instructors and learners in remote locations when they choose, rather than according to a classroom schedule. More features of Cop are discussed in Section 2.4.2.1. Learning in a CoP environment is vital to the success of online and blended learning.

Building from the notion of social presence in online discussion, this study has also bearing on the concept of the 'Community of Inquiry' (CoI) to support an "engaged community of inquiry" that integrates social, cognitive, and teaching elements (Garrison and Vaughan, 2008) in a way that will initiate and sustain critical reflection and discourse. It builds upon two central concepts that are critical to today's higher education—*community* and *inquiry*. Community recognizes the social nature of education and the role that interaction, collaboration, and discourse play in constructing knowledge, while inquiry reflects the process of constructing meaning through personal responsibility and choice. According to Garrison and Vaughan (2008), a community of inquiry is a cohesive and interactive community of learners whose purpose is to critically analyze, construct, and confirm worthwhile knowledge.

The tutor has a major role in fostering a sense of community by creating a safe environment where students can express their views in a non-threatening atmosphere; the tutor also promotes socialization, communicates respect for diverse perspectives and backgrounds, and provides timely feedback that gives direction and keeps information flowing, responding to the educational needs of students, and in overall, maintaining an online social presence.

(v)   *Framework for technology-supported blended learning*

Conceptually, the blended learning framework refers to a blend of learning theory, teaching practice, student-centred learning, and new technologies in order to provide students with rich, meaningful learning experiences that extend beyond the classrooms as depicted below.
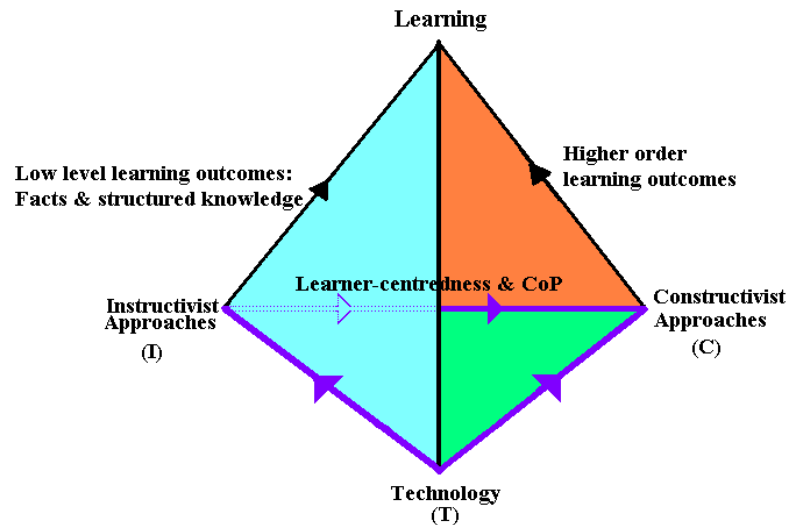
Figure 2.1: Framework for technology-supported blended learning

Although principles from different theories were made use of, the theoretical framework is still constructivist in nature; the teacher assumes the role of a facilitator[17], providing an environment in which technology is integrated with conventional approaches to facilitate engaged learning, by moving away from static standalone content toward active, dynamic processes (as illustrated in Figure 2.1 above) in which knowledge production is supported through activation of prior knowledge and online collaborative activities, critical discourse, supportive learning community, and good assessment strategies. This assumption is critical because of the constructivist epistemological assumptions.

However, it has to be noted that technology is considered pedagogically neutral. It can help create rich learning environments where it becomes the main agent to: a) catalyse the implementation of pedagogical strategies and b) engage learners in complex, collaborative and authentic learning activities. Whether it would really enhance student achievement depends on a several factors such as students' ability and their level of motivation to learn. Schraw, Brooks, and Crippen (2005) argue, "Ability is a code word for intelligence… motivation means paying attention…. Motivation is the conscious or subconscious allocation of working memory to a learning task".

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[17] Facilitation is referred to as a method of teaching that requires instructors to remain sensitive to the interests of their learners in order to foster intrinsic motivation and empower learners to take control of their learning needs.

(vi)   Development of the theoretical framework

Based on the discussions above, the rationales of blended learning design in a nutshell include:

➢ increasing student engagement through communities of learners for deeper and more meaningful learning experiences than what is possible in a typical lecture room;

➢ teaching large groups requires blended curriculum designs;

➢ the need to engage learners outside of classrooms;

➢ addressing timely the individual learning styles, needs and preferences of each student;

➢ developing professional skills of today's employees and future professionals;

In order to address the research question, the Researcher designed a blended learning model that could guide the development of a web-based learning environment to provide students with opportunities based on all the rationales listed above, and a *grounded-learning systems design*[18] approach, founded on psychological, pedagogical, technological, cultural, and pragmatic implications (as discussed in Section 3.8) (Hannafin and Land, 1997; Land and Hannafin, 2000). The framework focuses on developing a learning environment within the theoretical framework of flexible learning, learning communities, and Communities of Practice (Lave and Wenger, 1999; Wenger, 2003).

Five pedagogical dimensions considered as essential components for developing student-centred learning environments were identified in the literature (e.g., Gunawardena and Zittle, 1997; Salmon, 2000; Jonassen, 1999; Jonassen, Strobel, and Gottdenker, 2005); these dimensions are— *Social presence, Collaborative learning, Cognitive strategies, Learner-centeredness, and Authentic context and assessment.* The Researcher added *motivation* as another dimension to the list of pedagogical dimensions as he considers it crucial for effective and efficient learning to occur.

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[18] *The grounded design is the systematic implementation of processes and procedures rooted in established theory and research in human learning. The four conditions for a design to be considered grounded (Hannafin et al, 1997) are:*
(a) It must be based on a defensible theoretical framework that can be differentiated from others.
(b) Methods and strategies must have been empirically validated.
(c) The design should be generalizable to other contexts or problems.
(d) Grounded design and their frameworks are iteratively validated though successive implementation.
Methods are tested for effectiveness according to their theoretical basis and the framework is refined as needed.

These six elements were then aligned with appropriate technological affordances and instructional design principles.

Though the dimension of motivation might look subsumed in the other five dimensions, the Researcher wants to believe it should be considered as a separate dimension because teachers often ignore this important element, and is critical especially in online learning. The literature on motivation is replete with indications that high motivation levels are critical to individual and group performance (Roberts, Hann and Slaughter, 2006). Up to thirty-eight percent of student achievement is due to motivation (Fyans and Maehr, 1987). The need for motivation as a critical factor is further elaborated in Section 2.9.2.

The dimensions listed above aim to involve students and make them responsible for their own learning, attempting to cater for the needs of all students. The strategies surrounding these dimensions range from students' independent interaction with a variety of resources (both online and print) that foster collaboration and reflection in a technology supported learning environment. The theoretical framework has led to the development of the LAPTEL model as discussed in Section 5.8.1.

(vii) Salient components of the theoretical framework

The following attributes comprise the theoretical framework of the LAPTEL model developed in the study:

> ➢ The framework is underpinned by the pedagogical philosophy of both objectivist and cognitivist learning theories, based on instructivist and constructivist epistemologies, yet maintaining the foundation of the overall approach constructivist.

> ➢ Social constructivism has a significant role in the study: effective and efficient learning cannot be viewed as a product of the individual efforts;

> ➢ The adoption of a 'community of practice' approach promotes interactive engagement in learning activities and with other members of the community;

> ➢ Community of practice supports personally meaningful and educationally worthwhile collaborative learning experiences, focusing on the social nature of knowledge.

➢ Collaboration and discourse with other members of the community play a major role in facilitating personally meaningful and educationally worthwhile through enhanced engagement, social negotiation, and reflection;

➢ Extended engagement is essential for increased time for discourse, critical reflection, self-paced learning and developing thinking skills that can be transferred across domains;

➢ Complex topics require more interactive and collaborative engagement for students to construct meaning than what is possible in a typical lecture;

➢ Learners select and engage in appropriate activities suited to their own learning style, needs, abilities, aspirations, and preferred learning approaches;

➢ Individualised curriculum is essential to suit the learner's unique learning styles, preferences and combination of multiple intelligences;

➢ Motivation is central to student participation and engagement;

➢ Prior knowledge is important. New information must fit with what is already known if it is to be learnt through interaction with the environment and others;

➢ Realistic learning practices include a large range of activities, to equip learners with various skills ranging from lower to higher-order levels;

➢ Instruction is a process of supporting learning rather than communicating knowledge. Teaching strategies focus on creating collaboration and discourse among members of the learning community;

➢ Instruction is successful if learners have reached the goals established in the beginning; Assessment of learning takes place by observing actual practice within the community;

➢ Learning is situated in authentic settings for contextually meaningful experience; assessment is be seamlessly integrated with the learning activities and processes, and not a separate activity.

➢ Rich learning environments allow students freedom to learn in their own way, rather than in the way a designer prescribes.

➢ Goals of learning can be negotiated with learners.

- ➢ Authentic tasks: Problems / activities should have relevance to the learner's real-world; Learners should be free to select appropriate levels of difficulty, since not all can masters all higher-order skills easily.

- ➢ Instruction should be well-organized. Well-organized materials are easier to learn and to remember.

- ➢ Instruction should be clearly structured;

- ➢ The perceptual features of the task are important. Learners attend selectively to different aspects of the environment. Thus, the way a problem is displayed is important if learners are to comprehend it;

- ➢ Cognitive feedback gives information to learners about their success or failure concerning the task at hand; failure is regarded as an opportunity to analyze their learning deficits;

- ➢ Assessment matches tasks and learning outcomes with opportunities for self-analysis and metacognition; it is paired with detailed, constructive feedback aimed at improving performance;

- ➢ Different evaluation tools are needed to cater for all the levels of Gagné's categories of learning outcomes and Bloom's taxonomy as single approach may not be objective;

- ➢ Assessment and evaluation are on-going processes taking place throughout instruction;

- ➢ The act of learning design draws concepts from 'working memory' research and cognitive load theory which provides models based on research on how the human brain processes, stores and retrieves information;

- ➢ Good technology infrastructure and support are crucial for extended access and participation;

- ➢ Technology is pedagogically neutral and is transparent.

Since the study is all about student learning, the next two sections discuss relevant philosophies about knowledge and learning before discussing the associated learning theories.

2.6   Underlying Epistemological foundations of the study

This section provides a brief overview of the philosophies and theories that underpins the nature of knowledge or epistemology[19] and how it is acquired. An understanding of philosophies and theories is critical to engage in the design and development of learning environments because the design principles and prescriptions arise from philosophies and theories.

One's philosophical orientation will dictate how educators will view teaching, learning, and knowledge (Darkenwald and Merriam, 1982), and this is critical to provide the rationale for the effective and efficient design of learning environments and to achieve educational goals. According to Dewey (1916: 335):

> 'learning means something which the individual *does* when he studies. It is an active, personally conducted affair. The dualism here is between knowledge as something external … and knowing as something purely internal'.

Dewey's dualism in the above quote places the constructivist position along a continuum between an understanding of reality as being objective at one end, and a view of reality that is defined subjectively at the other end.

Driscoll (2000) categorizes learning into three broad epistemological frameworks (pp. 14–17): *Objectivism*, *Pragmatism* and *Interpretivism*. These three epistemologies in turn form the foundation of the three broad learning theories— *Behaviourism*, *Cognitivism*, and *Constructivism*.

(i) Objectivism

According to objectivism, reality is external to the mind (independent of the understanding of individuals), and knowledge and perception are experientially acquired, especially through experience based on perceptual observations by the senses. Statements or views that are not tied to our experiences are therefore meaningless. The objectivism advocates such ideas as:

 ➢ knowledge can be separate from knowing;

 ➢ the user gains knowledge objectively through the senses; and learning involves gaining truth that can be measured with tests (Reeves, 1992).

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[19] The philosophical enquiry of knowledge and its nature is known as epistemology.

Objectivists focussed on the development of a set of instructional sequences with predetermined outcomes. Seels and Glasgow (1990) described the process as "defining what is to be learned, planning an intervention that will allow the learning to occur, and refining the instruction until the objectives are met" (p. 3).

Empiricism[20] and *realism*[21] characterises objectivism. The Empiricist rejects the existence of innate knowledge. Empiricism fits well with the scientific world-view that places an emphasis on experimentation and observation. The empirical emphasis led to Behaviourism which the first major scientific theory of learning.

(ii) Interpretivism

In contrast to objectivism, interpretivism posits that knowledge is an internal construction and is informed through socialization and cultural cues. The mind interprets sensory data and organizes it through active and dynamic processes. *Rationalism*[22] and *idealism*[23] characterises Interpretivism. Rationalism holds that it is reason, not experience that is most important for our acquisition of all of our knowledge. The rationalist argues that there are some truths that can be worked out independent of experience of the world, and some others that, though grounded in part in experience, cannot be derived from experience alone. Rationalists hold that knowledge is primarily (at least in some areas) acquired by *a priori* (inborn) processes or is innate—e.g., in the form of concepts not derived from experience. Interpretivists believe that reality is internal to the organism and that meaning is dependent on individual understanding. Truths and reality are universal in the empiricist theory; they are local and transitory in interpretivist theory (Willis, 1995).

The rise of constructivist view of cognition as a result of the growing influence of postmodernism[24] in the 1980s and 1990s in academic culture is consistent with the interpretivist perspective. The postmodernist view was that all knowledge is "socially constructed" and that there is no such thing as objective truth; the learner is not a

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[20] *Empiricism is the belief that sensory experience is the only valid source of knowledge.*
[21] *Realism is the belief that things in the world can be known directly.*
[22] Rationalism is the belief that reason is the source of knowledge, (i.e., the mind actively constructs knowledge.)
[23] Idealism is the belief that knowledge consists of only ideas or representations about reality.
[24] Some radical theorists rejected the notion that knowledge existed apart from an individual's experience, or that it could be transferred from the teacher to her learners. Some hold that all knowledge is "socially constructed" and that there is no such thing as objective truth. Others merely allow that the learner is not a *tabula rasa* and comes to the lesson with a unique set of experiences, knowledge, skills, and attitudes; and that fact must influence the design and implementation of the lesson.

tabula rasa and comes to the lesson with a unique set of experiences, knowledge, skills, and attitudes; and these facts must influence the design of the lesson.

(iii) Pragmatism

Pragmatism takes a position somewhere between objectivism and interpretivism on the continuum. Although pragmatists, like empiricists, believe that knowledge is acquired through experience, they believe that this knowledge is interpreted through reason and is temporary and tentative. Pragmatically, objectivists tend to reconcile theoretically ideal solutions with those best suited to available resources and constraints. Like interpretivists, pragmatists believe that reality is "constructed" and that meaning is negotiated by individuals based on their interpretation and understanding of reality within a social context. According to Ernst von Glasserfeld (1993), a radical constructivist, realists (objectivists) cause no harm "...as long as you don't tell others that the reality you have constructed is the one they ought to, or, worse, must believe in" (p. 28-29). Pragmatism holds the following beliefs (Driscoll, 2000: p. 14):

> ➢ Reality exists but cannot be known directly;
>
> ➢ Knowledge is provisional, not absolute- sometimes it corresponds with reality and sometimes it doesn't— and it can be obtained through empirical or rational process. It suggests that knowledge is a negotiation between reflection and experience, inquiry and action.

Pragmatists argue that the question of whether there is a "real" reality is an unproductive question, since, if there is a reality, it can never be totally known. They suggest that knowledge in a particular field be negotiated based upon an agreement of experts as to a common interpretation of experience. They would describe knowledge in terms of "truth for now". So Pragmatists propose that knowledge be built up by testing this "truth for now" hypothesis and revising or discarding this "truth" as common experience and interpretation implies it should be modified (Smith and Ragan, 2005). This philosophy works in every instructional and learning design context since it emphasizes testing and checking.

One of the basic assumptions of this study is the existence of an external reality that cannot be delineated directly through experience. Rather individuals construct

knowledge by manipulating information within a social context. Thus the belief that knowledge is constructed within a social context is the epistemological foundation for the Model. This requires the LAPTEL model to take an interpretivist / constructivist perspective with a strong bearing on pragmatic perspectives.

2.7 Theories of Learning

There have been many views that attempted to explain the learning process in the last century. During this period, the view on learning has changed in several ways that have influenced significantly our educational practice and research. However, only three dominant views prevailed in the educational arena (Mayer, 1998). Reigeluth (1999) also reports that three views of learning have emerged during the past 100 years of research on learning: learning as response strengthening, learning as knowledge acquisition, and learning as knowledge construction (p. 143). These three views are behaviorism, cognitivism, and constructivism. They represent broadly the major trends in the way learning is conceptualised and provide some distinctively different guidelines for instructional practice (Orlich et. al, 1998).

Learning theories play explicitly or implicitly a major role in instructional design models upon which the approaches to teaching by instructors are based; they form the foundation for effective instructional models, and provide frameworks for providing the conditions for, and interpreting observations of teaching and learning. Effective instructional models are based on learning theories (Learning technology Service, NC State University, 2006, MEST). Mergel (1998) emphasises the fact that instructional designers must understand the strengths and weaknesses of each learning theory to optimise their use in appropriate instructional design strategies. Mayes (2004) states that for good pedagogical design, there is simply no escaping the need to adopt a theory of learning.

The following sections describe the three different views of learning and also other theories that emanated from these original views such that the developed model benefits from all of them; the derived theories include: *Activity theory*, *Situated learning theory*, *Engagement theory*, *Theory of multiple intelligences, Variation theory of learning*, *Cognitive load theory*, *Cognitive theory of multimedia learning, Cognitive flexibility theory and Connectivism;* together, they informed the

appropriate pedagogical dimensions for the study and the key aspects of the blended learning model proposed in this study. Subsequently, the main characteristics of learning theories were summarised in order to establish how the affordances of new technology could be utilised to provide useful heuristics for creating online and blended learning environments.

Thus, this section addresses the third research 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.*

2.7.1   *Behaviourism*

The behaviourist school of thought was influenced by Thorndike (1913), Pavlov (1927), and Skinner (1974). Behaviourists postulate that learning is a change in observable behaviour caused by external stimuli in the environment. Psychological behaviorism has its roots, in part, in the classical associationism according to which intelligent behavior is the product of associative learning[25].

Behaviorism focuses only on the objectively observable and measurable changes in behavior, acquired through conditioning, being repeated until it becomes automatic. Gredler (2001) expresses behaviorism as being comprised of several theories that make three assumptions about learning:

  i) Observable behaviour is more important than understanding internal activities;

  ii) Behaviour should be focused on simple elements: specific stimuli and responses;

  iii) Learning is about behaviour change.

Behaviorism discounts the internal processing that might be associated with the activity.

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[25] Source: *Stanford Encyclopaedia of Philosophy* (updated in 2007) available at http://plato.stanford.edu/entries/behaviorism/

Table 2.6: Key principles of Behaviourism

Reinforcement	Positive or negative feedback which will lead the learner to form a strong association between the stimulus and the desired behaviour.
Contiguity	The more immediate the feedback, the stronger the association is.
Repetition	The more frequent the stimulus-response the more likely is the desired outcome.
Variation	Varying the pattern of the stimulus generalises the response.
Intermittent Reinforcement	Not rewarding the response every time is found to be more effective than constant reward; it helps keep the learner guessing.
Extinction	If the stimulus-response bond is not reinforced the association will die.

Source: Carlile, Jordan, and Stack (2004, p.9)

Common behavioural approaches to learning are as follows:

➢ The learner takes on a predominantly passive and reactive role.

➢ Instruction is structured and systematic.

➢ Concrete and defined instructional goals, objectives and strategies aimed at learners in general and not on the individual learner.

➢ Learning can be measured.

➢ It assumes that a well-planned instructional intervention can result in a desired learning outcome.

➢ Focus on simplification (start with easy and progress to more difficult) and repetition (rote learning / drill and practice).

➢ Instruction is instructor-controlled.

Although it has the distinction of being the first truly psychological account of learning, it could not stand the *cognitive revolution* of the 1960s. Behaviourism cannot explain ideas around higher level learning, and acquisition of concepts, problem-solving and originality. The main reason for its failure is the kind of view it holds about the mind as a "black box" that totally ignores the possibility of thought processes occurring in the mind. In response, some educators claim that not all learning is observable and there is more to learning than a change in behaviour.

Regardless of what the critics say, behaviourism has advantages as well, and is still a valid form of learning, especially for concepts that require more reactive skills than

cognitive ones. As a result, it has a place in this study as it is about hybrid instruction for the following reasons.

i) Behaviourism is suitable for factual recall as well as teaching and assessment of competencies, where teachers want to test and verify that the student does indeed possess the requisite skills.

ii) Behaviourism builds on aspects of practice that we know are effective and practically useful to teachers. These include the importance of repetition in learning, of presenting strong and varied stimuli, of careful planning and the sequencing of learning events, and of specifying achievable and verifiable learning objectives in the form of learning outcomes. 'Drill and practice' is the epitome of instruction in this behavourist movement (Mayer, 1998). Bloom's taxonomy categorization of learning into the Cognitive, the Affective and the Psychomotor domains is demonstrated in observable behaviour (Bloom, Englehart, Furst, Hill, and Krathwohl, 1956).

iii) The writing of objectives or goals in the form of tangible learning outcomes is a consequence of Behaviourism. It provides the underlying principles of instructional design as shown in the standard ADDIE model (Vide Section 3.4.3) of instructional design.

Although behaviourist-only approach does not fully utilise the full potential of new technology, some of its characteristics map well to affordances of technology which enable trial and error and adaptive responses – such as feedback through e-assessment tools, presentation of content, and use of multiple media to convey information. The legacy of educational technology has been behaviorism (Winn and Snyder, 1996). Although instructional systems technology began rejecting many behaviorist assumptions in the 1980's in favour of the cognitivist view, the theory is the basis for innovations such as computer assisted instruction, mastery learning, minimal competency testing, educational accountability, situated cognition, and even social constructivism.

The idea of presentation of information, although a basic behaviourist principle, is also supported by constructivists, Duffy and Jonassen (1991, p. 197) who suggest that learners should be provided with some explicitly expressed knowledge as a starting point of the learning process. Active learning by doing with immediate feedback on

success is the central principle of behaviourism and it cuts across most other learning perspectives. From the foregoing discussions, it is evident that behaviourism has an influence in the learning field especially in the implementation of blended leaning environments and the attainment of Bloom's low level skills.

2.7.1.1   Gagné's Theory

Robert Gagné was a leading interpreter of learning theory into instructional theory that describes the conditions under which one can intentionally arrange for the learning of specific performance outcomes. His theory of instruction has provided many valuable ideas to instructional designers, trainers, and teachers. Gagné (1985) proposed a theory of knowledge consisting of five categories of learning outcomes:

    (i)   verbal information, both oral and written *(the ability to acquire and recall factual knowledge);*

    (ii)   intellectual skills *(the ability to do mental operations for problem solving and to relate principles to abstract concepts);*

    (iii)   cognitive strategies *(ability to plan and control thinking and problem solving);*

    (iv)   motor skills *(ability to execute physical movements)*; and

    (v)   attitudes that influence personal choice *(predisposition to a positive or negative approach towards a specific object).*

For each outcome, he then identified the conditions / instructional approaches necessary for learning to be efficient and effective, and he formulated his nine practical 'events of instruction' and corresponding cognitive processes which serve as a template for developing and delivering a unit of instruction. This is further discussed in Section 3.4.5. Gagne's events of instruction has important application in the objectivist-constructivist continuum because learning in its totality depends on the use of elements from both sides of the approaches (Smith and Ragan, 2005; Cronje, 2006, pp. 387-416).

2.7.1.2   Bloom's Taxonomy

Benjamin Bloom's (1956) Taxonomy provides a consistent means of developing the single most powerful tool in instruction and the assessment of student learning outcomes. It was originally developed to classify the complexity of questions asked in assessment, but has also become a general system for classifying learning outcomes into three domains of learning: *Cognitive* (what we know or think), *Psychomotor* (what we do, physically) and *Affective* (what we feel, or what attitudes we have). The basic cognitive competences to be demonstrated are: *knowledge, comprehension, application, analysis, synthesis* and *evaluation*. There are also competences for psychomotor and affective learning.

Bloom's Taxonomy is frequently used to identify and categorize types of educational objectives for the cognitive domain, and has become the standard for classifying educational objectives and activities (Reigeluth, 1999). The purpose of writing objectives is to define in explicit terms what students should be able to do if they have learned what the instructor wants them to learn, and to use the objectives as the basis for designing lessons, assignments, and tests. Once the learning objectives have been identified, they are progressively sequenced from lower order to higher order learning—often using Bloom's Taxonomy as a guide. Each learning objective must fall under one of the three categories under the knowledge dimension, and under one of the six categories of the cognitive process dimension.

Dr. Lorin Anderson, a former student of Bloom's, and his colleagues published an updated version of Bloom's Taxonomy that takes into account a broader range of factors. The revised Bloom's revised taxonomy (Anderson and Krathwohl, 2001; Bailey, 2002) incorporates both the kind of knowledge to be learned (*knowing what-the knowledge dimension*) and the cognitive (*knowing how*) process used to learn allowing for the instructional designer to efficiently align objectives to assessment techniques which will realistically test whether the learning outcome has been achieved. The revised version of the skills under the cognitive process dimensions from simplest to most complex are: *remembering, understanding, applying, analyzing, evaluating, and creating.*

Table 2.6: Bloom's taxonomies

Thinking level	Bloom's Revised Taxonomy	Ability to:
Lower order	Remembering	Recall information
	Understanding	Explain ideas or concepts
	Applying	Use information in another familiar situation;
Higher order	Analysing	Break information into parts to explore understandings and relationships
	Evaluating	Justify a decision or course of action
	Creating	Generate new ideas, products, or ways of viewing things

When the goals of instruction and the cognitive processes used to achieve them remain at the lower levels (*Remembering, and Understanding*) the role of the teacher is more that of an authoritative expert, whose strategies include lecturing, demonstrating, assigning, encouraging and reinforcing that require objectivist approaches including drills and mnemonics for memorization. These strategies may be effective for the delivery of facts but are less effective for fostering deep understanding and skills development.

However, when the educational objectives move to the mid levels of Bloom's revised taxonomy (*Applying, and Analysing)*, leading the students towards interaction, participation, experimentation, and peer esteem, then the instructor role shifts to that of a co-learner, collaborator, manager, and environment setter. These outcomes suggest a crucial role for the 'community of practice' approach that provides maximum opportunity for communication and collaboration that facilitate learning activities such as questioning, giving feedback, and opportunities for computer-mediated interaction with the teacher as well as peers.

When the educational goals are the highest levels (*Evaluating, Creating)* that promote complex problem solving, deeper cognitive processing and self-discovery by students, then the teacher's role turns into that of a facilitator, and technology takes its role in operationalising the tutor's facilitatory role.

Bloom's taxonomy has been criticised for concentrating on the cognitive (thinking) domain, with people recognising the need to include affective (feeling) attributes and

skills, including for example reflection, self-motivation and independence (Hughes and Boyle, 2005).

Another popular taxonomy is Biggs' (2003) SOLO (Structure of Observed Learning Outcome) Taxonomy for different levels of understanding as learning outcomes. It describes how learners' performance increases in complexity when mastering academic tasks. While Bloom's taxonomy can be considered as a staged model, with each stage associated with progressively higher-level cognitive skills, the SOLO taxonomy distinguishes between five approaches to learning that might be evident in, for example, a learner's attempt at an assignment.

2.7.2   *Cognitivism*

In the 1960s, the focus on learning research shifted from the 'stimulus-response and observable change of behaviour' to the concept of brain-based learning, that is, from behaviourism to cognitivism with theories and models of learning which focus on the mental processes involved in learning (Jonassen, 1991b). Although cognitive theorists recognized much of the behaviouristic concepts of stimuli and overt behaviour, they viewed "learning as involving the acquisition or reorganization of the cognitive structures through which humans process and store information." (Good and Brophy, 1990, pp. 187). Most importantly, Cognitivists believed that response to environmental stimuli or changes in behaviour are indicators of the unobservable *inner mental processes* that involve the use of memory, motivation, and thinking; thus, to them, learning is as an internal process, and it involves thinking. Many current ideas intended to facilitate student learning draw on our awareness of this mental processing. As a result, cognitive approaches emphasise critical thinking and is increasingly used as a tool in problem-solving in specific disciplines.

Both Gagné (1985) and Merrill (1990), who earlier worked on learning outcomes and objectives moved towards cognitivism by affirming the need for extension of these concepts to address situations where the instructional goal is a combination of several different objectives.

By drawing an analogy of the human mind with a computer, it often takes a computer information processing model, according to which learning is viewed as a process of inputs, managed in short term memory, and processed for long-term recall. Short-term

memory (also referred to as working memory), is a widely accepted theoretical construct within cognitive psychology. Working memory is used for temporarily storing and manipulating information received through the senses; it requires connecting the sensory input with the learner's prior knowledge from the long-term memory. Hartley (1998) argues that 'learning results from inferences, expectations and making connections for which prior knowledge is important' (p. 18). Therefore, the extent of a person's working memory is also an indication of how much of the long-term memory that a learner can activate at a given moment in order to make the prior knowledge available for processing. Cowan (2005) argues that working memory limits how much prior knowledge (stored in long-term memory) can be activated at once. The information received is processed, and then, organised or encoded in order to become stored in long-term memory, whereby learning is said to occur. Long-term memory can hold large amounts of knowledge over long periods of time. Schraw, Brooks, and Crippen (2005) argue,

> "Through learning and practice, the capacity of working memory *appears* to change…. Ability is a code word for intelligence… motivation means paying attention…. Motivation is the conscious or subconscious allocation of working memory to a learning task"

Hartley (1998) has developed the following key principles of learning associated with cognitive psychology.

> ➢ *Instruction should be well-organized*. Well-organized materials are easier to learn and to remember.

> ➢ *Instruction should be clearly structured*. Subject matters are said to have inherent structures - logical relationships between key ideas and concepts - which link the parts together.

> ➢ *The perceptual features of the task are important*. Learners attend selectively to different aspects of the environment. Thus, the way a problem is displayed is important if learners are to comprehend it.

> ➢ *Prior knowledge is important*. Things must fit with what is already known if it is to be learnt.

> ➢ *Differences between individuals are important as they will affect learning*. Differences in 'cognitive style' or methods of approach influence learning.

> ➢ *Cognitive feedback gives information to learners about their success or failure concerning the task at hand.* Reinforcement can come through giving information - a 'knowledge of results' - rather than simply a reward (p. 18).

Theories that are prominent from the domain of cognitivism are *component display theory*, the *second generation paradigm*, and the *instructional transaction theory*. Benjamin Bloom's (1956) *Taxonomy of Educational Objectives* which has become the standard for classifying educational objectives and activities is often used to categorize types of educational objectives for the cognitive domain (Reigeluth, 1999).

Implications of Cognitivism for Practice[26]

> ➢ Promote active listening;
>
> ➢ Don't overload short term memory by presenting too much material at once;
>
> ➢ Don't lecture for more than about twenty minutes without a break;
>
> ➢ Chunk material into groups or categories to facilitate retention;
>
> ➢ Make the structure and patterning of the material explicit for learners;
>
> ➢ Present material in more than one form to facilitate transfer to long term memory;
>
> ➢ Give learners the opportunity to revisit topics to strengthen retention;
>
> ➢ Use key words and terms as memory cues;
>
> ➢ Outline the metacognitive[27] strategies needed for a given subject.

Some of these characteristics of cognitivism map well to affordances of technology which can enable to develop guided, more engaging and student-centred, active, and authentic learning environments with the use of interactive materials.

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[26] Source: Carlile et al. (2004)

[27] Metacognition, which is the ability of an individual to evaluate his/her own cognitive skills, is an intellectual skill considered to be part of the cognitive domain (Reigeluth and Moore, 1999:52).

2.7.3 Constructivism[28]

Constructivism emerged as the leading metaphor of human learning by the 1980s and 1990s as interest waned in behaviourist and information-processing perspectives (Mayer, 1997). Constructivism, derived originally from the works of Piaget (1970), Bruner (1962, 1979), Vygotsky (1962, 1978), and Papert (1980, 1993), is both a philosophical and psychological approach based on social cognitivism that assumes that persons, behaviours and environments interact in reciprocal fashion (Schunk, 2000).

According to constructivism theory:

➢ learners construct knowledge (rather than acquiring it) individually through their interactions with the environment (including other learners) based on their current as well as prior knowledge, authentic experience, mental structures, and beliefs that are used to interpret objects and events in relation to the context and environment in which learning takes place.

➢ the learner is an active processor of information and creator of personal knowledge;

➢ instruction is a process of supporting that construction;

➢ knowledge is not purely objective; and

➢ the instructor's major role is that of a facilitator of learning.

Constructivists put their emphasis on learning rather than instruction implying the need for rich learning environments for students to actively engage with the teacher as well as their peers and construct knowledge. Besides, constructivism requires the learning environment should be learner-centred (Anderson and Kanuka, 1999). Student-centred learning environment is seen as a major enabling element in constructivism.

People learn best when they can contextualize what they learn for immediate application and personal meaning. In the process, according to Mayer (1998), the role of the learner changed from that of a recipient of knowledge to that of a constructor of knowledge, an autonomous learner with metacognitive skills for controlling his/her

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[28] *Constructivism has its foundations in cognitive learning psychology and as a result some writers in education categorise learning theories only into behaviorist and cognitivist. The two broad fields of instructional design approaches—instructivist and constructivist— are, in general, drawn from behaviorist and cognitivist learning theories respectively.*

cognitive processes; the teacher acts as a facilitator who encourages students to discover principles for themselves and to construct knowledge by working to solve realistic problems.

From the epistemological position, constructivism has been a move away from the earlier ideas about objectivism. Its concerns are what "knowing" is and how one "comes to know." Constructivism does not necessarily deny the existence of an objective reality, but it does deny the existence of an objective knowledge. Constructivist reality is one's own interpretation of what exists, obtained through reasoning about one's personal and subjective experiences, beliefs, and perspectives (Jonassen, 1994). Reality is viewed as a constructive process embedded in socio-cultural practices (Duffy and Cunningham, 1996). Tobin and Tippings (1993) state "cognising beings can never know what that reality is actually like" (p. 4). Thus, there is no meaning inherent in the "real world out there". Thus, "there is not a correct meaning that we are striving for" (Duffy and Jonassen, 1992), and there are many meanings or perspectives possible for any event or concept. "Meaning is imposed on the world by us, rather than existing in the world independently of us" (Duffy and Jonassen, 1991, p. 8). It is this rejection of absolutism that characterises constructivist approaches to learning, and it is a radical ontological departure from the previous theories.

People learn by observation, processing, and interpretation as they attempt to understand their experiences based on their previous knowledge (Wilson, 1997; Reeves and Reeves, 1997; Driscoll, 2000, p. 376). The view that knowledge is not purely objective does not mean the possibility of many unique realities as there are learners, and all learners will report in their own way leading to utter confusion. "What someone knows is grounded in perception of the physical and social experiences which are comprehended by the mind" (Jonasson, 1991). Constructivist learning, therefore, is a very personal endeavour, whereby internalized concepts may consequently be applied in a practical real-world context. Constructivists believe that learner should be able to deal with real life situations by interpreting multiple realities and sharing the outcome through a process of social negotiation in order to make sense or resolve an inconsistency, inquisitiveness or puzzlement.

According to Reeves and Reeves (1997), constructivism focuses on such ideas as:

➢ the existence of knowledge only occurs within humans who construct their own reality;

➢ knowledge is constructed subjectively by people based on their earlier experiences and the way people reflect and metacognitively organise these thoughts;

➢ if the learner acquires the strategies that meet the objective then learning has occurred; and

➢ measurement occurs only through estimation with observation or dialogue

The following components comprise the theoretical framework of Constructivism (Wilson, Teslow, and Osman-Jouchoux, 1995):

➢ mind is real: mental events are worthy of study;

➢ knowledge resides in the mind;

➢ knowledge is dynamic;

➢ meaning is constructed;

➢ reflection / abstraction is critical to becoming an expert;

➢ learning includes constructing representations;

➢ teaching is negotiating construction of meaning;

➢ thinking and perception are inseparable;

➢ problem solving is central to cognition;

Merrill's (1991) assumptions of constructivism:

➢ knowledge is constructed from experience;

➢ learning is a personal interpretation of the world;

➢ learning is an active process in which meaning is developed on the basis of experience;

➢ conceptual growth comes from the negotiation of meaning, the sharing of multiple perspectives and the changing of our internal representations through collaborative learning;

> ➢ learning should be situated in realistic settings; testing should be integrated with the task and not a separate activity.

Based on the work of Rorty (1991), Savery and Duffy (1996, pp. 135-148) summarise the characteristics of constructivism in three central propositions as follows:

> ➢ At the core, constructivists hold that understanding comes through interactions with the environment. The results of learning can not be separated from how learning takes place; cognition rests not solely with the individual but is 'distributed' within its context (Salomon, 1993).

> ➢ Further, constructivists hold that cognitive puzzlement stimulates and organises learning. Therefore, the goals of learners need to be centrally considered.

> ➢ A third tenet of constructivism is that knowledge develops through social negotiation and reflection upon individual practices.

Constructivism embraces a range of different viewpoints and perspectives; thus, there are a variety of epistemological positions underlying constructivism learning theory in the literature; four important constructivist positions are: critical, radical, situated and social constructivism (Anderson and Kanuka, 1999). Despite the differences of each position along these dimensions, they all have implications for how knowledge is constructed and how the teachers will facilitate the knowledge construction. Common to each position is a belief that we construct knowledge subjectively based on our earlier experiences (what we already know— there is no *tabula rasa*) and that learning is an active rather than a passive process; we say meaningful learning has occurred only when the learner has acquired the strategies that meet the learning objectives or has the ability to apply what was learned to new situations.

The most prevalent variant of constructivism epistemology for explaining how leaning occurs in HE contexts is the social constructivism (or, at times called, realist constructivism), followed by cognitive constructivism (or personal constructivism, or, sometimes called, radical constructivism). This position is supported by the notion that "knowledge is created by individuals, and is shared through collaboration with others" (Kang and Byun, 2001:48). Further, both social constructivists and cognitive constructivists assert that there is an objective external reality that we strive to understand. Social constructivism is more appropriate because, it fits well with the

operational style and context of most HE institutions. Social constructivism recognises that a learner is affected by those around them, including teachers, peers, friends and society in general. Social constructivism has significant role in this study.

Like Bruner, Vygotsky felt that intellectual development could only be fully understood within the socio-cultural context in which the development was occurring. Social constructivism emphasizes the importance of culture and context in understanding what occurs in society and constructing knowledge based on this understanding (McMahon, 1997). According to him, Constructivism suggests an approach that:

i)   Gives learners the opportunity for concrete, contextually meaningful experience through which they can search for patterns, raise their own questions, and construct their own models;

ii) Facilitates a community of learners to engage in activity, discourse, and reflection;

iii) Encourages students to take on more ownership of the ideas, and to pursue autonomy, mutual reciprocity of social relations, and empowerment to be the goals.

A number of constructivist instructional design models have emerged, based on the increasing influence of social constructivist perspectives within the field of education (e.g., Jonassen, 1999; Mayer, 1999; Willis, 2000). Therefore, instructional designers can bank on the principles of social constructivism for the translation of constructivism into practice.

Constructivism itself has many variations, such as active learning, discovery learning, and knowledge building, all underpinned by inquiry oriented pedagogy. Horton (2000) lists the following exemplars:

➢ Problem-based learning

➢ anchored instruction

➢ cognitive apprenticeships

➢ reciprocal teaching

➢ goal-based scenarios

➤ project-based learning

Regardless of the variety, constructivist pedagogy puts the learner at the centre of the process and sees the teacher as providing support and guidance (Alexander and Boud, 2001) and promotes a student's free exploration within a given framework.

2.7.3.1   Basic comparison of the three theories of learning

The difference between behaviorist and cognitivist views is that cognitivism makes explicit assumptions on how we store and manipulate information and that education should be concerned by analyzing and influencing thought processes. They both view knowledge as external to the learner and the learning process as the act of internalizing knowledge. The difference between cognitivism and constructivism is that cognitivists like behaviorists are "objectivists", knowledge and tasks to be learned can be identified and performance can be measured. Constructivists, on the other hand believe that both learning and teaching is a more open-ended process. Further, while traditional behaviourist/instructivist approaches strive for context independence, a social constructivist paradigm views the context in which the learning occurs as central to the learning itself. Another comparison of the three theories was given by Ertmer and Newby (1993) as below:

> "a behavioral approach can effectively facilitate mastery of the content
> of a profession (knowing what); cognitive strategies are useful in
> teaching problem-solving tactics where defined facts and rules are
> applied in unfamiliar situations (knowing how); and constructivist
> strategies are especially suited to dealing with ill-defined problems
> through reflection-in-action."

2.7.3.2   Assessment of student learning under Constructivism

Since constructivist epistemology allows individuals to construct their own reality individually and socially, the process of evaluation and assessment of learning becomes complex; it requires valid multiple criteria and standards for evaluating that learning. This means that measurement occurs only through estimation with

observation or dialogue (Reeves, 1997) or by using problem-solving transfer tests (Mayer and Wittrock, 1996).

Constructivist evaluation criteria proposed by Jonassen (1992) and Cunningham (1992) are discussed below:

(i) Jonassen's evaluation principles

(a) Goals of learning and goals of evaluation

> ➤ Evaluation should be based on needs assessment, and should not be biased by specific project goals.

> ➤ Goals of learning can be negotiated with learners. The negotiation process can be used as evidence of learning. Subsequently, the objectives can be used as a negotiating tool for guiding learners through learning and for self-evaluation.

> ➤ Purpose of evaluation. Evaluation implies an appraisal or value judgment about performance, relative to stated criteria. If learning is the process of knowledge construction, then that itself should be the most appropriate goal in which case the learner is also an appropriate evaluator. Thus, evaluation is a tool for self-analysis and metacognition.

(b) Context of instruction and context of evaluation

> ➤ *Context-driven evaluation*: Constructivism assumes that learning occurs in rich contexts through solving complex domain-dependent problems. Such contexts should also serve as the evaluation environment and, itself, suggest relevant assessment opportunities.

> ➤ *Authentic tasks*: Problems / activities should have relevance to the learner's real-world and should be integrated across the curriculum. Learners should be free to select appropriate levels of difficulty, since not all can become masters in every content area.

> ➤ *Multiple perspectives*: It is important to present multiple approaches in evaluation. Various possible outcomes should be acceptable as evidence of learning. Multiple evaluators should be involved in order have a more holistic and reliable evaluation as a single evaluator's appraisal may not be

> objective. (According to Rorty's philosophy, what a group of evaluators agree could be objective.)

> ➢ *Multimodality*: Several evidences for learning should be used for evaluation; for example, a portfolio and different artefacts representing various perspectives, modes, or dimensions of learning in the domain.

(c) Evaluation of more than just domain knowledge

> ➢ Knowledge construction: use different evaluation tools suitable for all the levels of Gagné's categories of learning outcomes and Bloom's taxonomy.

> ➢ Experiential construction: Learners are to be evaluated by finding out whether they can solve problems assigned to them, checking their self-awareness of the constructive process and looking into the nature of their context-specific interpretations. This means that the assessment should be seamlessly integrated into the learning activities and process, so that both the instructor and learners are aware of their quality and progress in teaching and learning respectively. Assessment is not a separate activity done after the instruction as it is done in traditional approaches; it has to be embedded within an activity and must be in a context of problem solving.

(ii) Cunningham's suggestions for evaluation

According to Cunningham (1992) successful completion of a task demonstrates the success of learning, and no separate test is required. As the assessment is based on context-specific activities and its successful completion, the responsibility for the assessment lies with the instructor, not with the instructional designer. The instructor/facilitator should judge whether a task has been successfully completed by gathering a variety of information - observation, dialogue with learners and other teachers, learners' journals, individual and group tasks, and even scores in standardized tests. A serious issue with constructivist-based assessment is that it is difficult to appraise each individual if a task is done by a group. However, it has to be noted that in collaborative tasks, the purpose is not to promote the attainment of the same objective by each group member. The objective is a joint goal - to solve the problem on hand, and the contributions and attainments of each group member are expected to vary widely (Cunningham, 1992).

(iii) Criteria for constructivist assessment

The general criterion for setting assessments is to ensure that the assessment process is reliable and valid. Reliable assessment should be objective, accurate, repeatable and analytically sound (Knight, 2000). Validity of assessment is primarily concerned with whether what is intended to be assessed is assessed.

A key principle of assessment within a constructively-aligned learning and teaching environment in HE is that it should be criterion-referenced, not norm-referenced (Biggs, 2003). *Criterion referencing*[29] is designed to assess changes in assessment performance as a result of learning that has been undertaken.

Brown (2001) offers the following key principles for devising assessment criteria:

  ➢ decide on the essential criteria;

  ➢ make the criteria or checklist simple to use;

  ➢ allow for brief global impressions;

  ➢ give the criteria to students before they do the assignment;

  ➢ if possible, involve them in the design of the criteria and checklist;

  ➢ encourage students to use the criteria.

She further lists the characteristics of good criteria as below:

  ➢ to match the assessment task and learning outcomes;

  ➢ to enable consistency of marking;

  ➢ to pinpoint areas of disagreement between assessors;

  ➢ to help students to achieve the learning outcomes;

  ➢ to provide helpful feedback to students.

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[29] *The other type called Norm referencing attempts to assess characteristics of individuals relative to other individuals, or against general norms.*

2.7.4   Activity Theory

Activity theory (AT) which originated from the classical German philosophy of Kant and Hegel is a framework for studying various forms of human practice as developmental processes, interlinking individual and social levels (Jonassen and Rohrer-Murphy, 1999). It postulates that learning and activity are interrelated - conscious learning emerges from activity, rather than preceding it. In its most general sense, human knowledge and capabilities revolve around interacting with the world and other people, that is, physical and social situations, in useful ways.

The three prime components of this theory are the *subject*, the *object* of the activity, and the *community* in which they act. The subject is the individual(s) engaged in the activity, and the object is that which results or is sought, i.e., the motivating intention of the activity. In instructional design, a curriculum design may be considered as the object.

AT focuses not on the individual learner, but with the *activity system,* a larger and more social unit of analysis. An activity system consists of a group, of any size, pursuing a specific goal in a purposeful way. They negotiate and coordinate their actions with colleagues.

The core of AT is its focus on mediation, namely mediation of subject-object relations by resources (tools), rules, communities, and divisions of labour (Engeström, 1999). In every purposeful activity, subjects use tools in order to achieve the object, thereby turning the object into an outcome. The tools refer to both physical and psychological. A computer is a hybrid of the two: it is a physical tool that is used for psychological processing. Activity can be understood by comprehending the tools that shaped it and the tool can be understood in the context of the way it was used and the needs it served. Tools change the process and are changed by the process. The community comprises all the actors who work with the subject and share the same object, and the 'division of labour' refers to the way work is divided up between the subject and the community members.

AT is a socio-cultural, socio-historical lens through which designers can analyze human activity systems. It may be used as a framework for designing constructivist learning environments especially in online contexts (Jonassen and Roher-Murphy, 1999). It provides a different lens for analyzing learning processes and outcomes for

the purpose of designing instruction. Jonassen (2000) summarizes the rationale for applying activity theory to learning environments:

> Activity theory provides a different lens for analyzing learning processes and outcomes for the purpose of designing instruction. Rather than focusing on knowledge states, it focuses on the activities in which people are engaged, the nature of the tools they use in those activities, the social and contextual relationships amongst the collaborators in those activities, the goals and intentions for those activities, and the objects or outcomes of those activities. (p. 109)

The implication for designing instruction is that the context of learning and performance is vital, since activity cannot be understood outside its context. Relevant aspects are: the kind of activity, the student (or subject), tools and learning environment (or online tools), its rules and norms, the divisions of labour between community members, and the conventions (rules or protocols) regarding actions.

When an individual interacts creatively with his/her surroundings, his/her mental processes are exteriorized in the form of tools– termed objectification – they become accessible to other people and are therefore useful for social interaction. To other people, via the process of *internalization*, social interactions turn into mental activity. Fundamental to modern AT is the idea that the development of thoughts and cognitive activity requires social interaction and exchange with a physical environment.

AT can inform the key aspects of elearning design: the learning outcomes, the teaching and learning activities, and the assessments. Given below are AT's implications to learning and instruction:

(i) Learning in authentic context: The conception of mediation gives emphasis on the interaction between individuals and the historical and cultural development. There is need to situate learners in an authentic context—the contexts of their activity, and the activity itself.

(ii) Providing scaffolding: The range of skill that can be developed with scaffolding— either adult guidance or peer collaboration – exceeds what can be attained alone. Learning environments must be capable of providing learning experiences that challenge students to work within, and push beyond current levels of performance and develop new abilities. Thus, provide

      external support from the instructor, peers, experts, artefacts or tools as the

      learners construct knowledge.

In an online learning environment then, tutors need guidance in the art of scaffolding as they learn to use online support tools such as email, discussion boards, web video conferencing, etc. (Mayes, 2004). However, it has to be noted that activity theory focuses on practice; it is primarily a descriptive tool rather than a prescriptive theory. It does not offer ready-made techniques and procedures for research, but its application as a lens for analyzing activity has yielded some generally accepted practices (Engeström, 1993). Kuutti (1991) argues, whatever the focus, the activity must be studied in real-life practice with researchers as active participants in the process. It is this view - real-life practice with researchers as active participants in the process- that supports the research methodology chosen for this study.

2.7.5 *Situated Learning Theory*[30]

According to Brown, Collins, and Duguid (1989), for learning to be meaningful it should be situated / embedded within authentic activity, context, community/culture and social engagement in a real-world learning context. In a radical model, they proposed that the need to understand the learning context supersedes the need to understand the mental processes going on inside individual learners; that is, the learner and environment are always interacting. Knowing is inseparable from action and environment; in other words, learning is strongly tied to the context and the activity in which it occurs. Therefore, in order to learn a concept in a useful way it must be learned in the culture in which it has been developed and is used; in other words, the activity of learning, both inside and outside school, must take place in an authentic situation through collaborative social interaction and the social construction of knowledge. Thus, the nature of the *situation* impacts significantly on the process. Situations, activities, and social interactions are constantly challenging the learner's understandings resulting in new meanings. Therefore, the context or the activity, which frames the knowledge, is of equal importance to the learner as the knowledge itself.

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[30] *Adapted from Smith, M. K. (1999) 'The social/situational orientation to learning', the encyclopedia of informal education, www.infed.org/biblio/learning-social.htm.*

Situated learning is related to Vygotsky's notion of learning through social development. Learning is a process of *social* participation (Vygotsky, 1978) in contrast with it as internalization or acquisition of knowledge by individuals (Lave and Wenger, 1999); as a result, learning involves participation in a "community of practice". Situated learning was first proposed by Lave and Wenger as a model of learning in a community of practice. In this model, there is a shift from a focus on the individual and information-focused learning to an emphasis on social learning and collaboration whereby learners become involved in a community of practice which embodies certain beliefs and behaviours to be acquired through of cognitive apprenticeship. As students observe their peers, reflect what they do, and practice apprenticeship, they develop habits, beliefs, identities, and skills that are shared by the community through interaction. The primary objective of cognitive apprenticeship is developing cognitive abilities, rather than the manual skills usually associated with traditional apprenticeship (Newstetter, 2005). In particular, cognitive apprenticeships are designed to teach learners how experts *process* information (Collins, 1991).

The idea of situating learning in rich, real-world contexts is a strategy (Braden, 1996, pp. 5-23), rather than a theory/ philosophy of learning. A similar approach is anchored instruction, rooted in constructivism. It aims to engage learners actively by locating/anchoring instruction in realistic problem-solving environments. Both situated learning and anchored instruction of situated learning provide significant pointers for creating flexible online learning environments; particularly, the use of online discussion forums and chat offering new opportunities to optimise interaction and contact between tutors and students, as well as between students in the WebCT / VLE learning environment cannot be over-emphasised. It allows instructors to set up complex, ill-defined and authentic tasks in real-life contexts, and assign roles for students to assume in the solution of these problems. The instructor might decide to have students 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.

2.7.6   Engagement Theory

The fundamental idea underlying engagement theory (Shneiderman, 1994; Shneiderman, Alavi, Norman, and Borkowski, 1995; Kearsley, 1997) is that students must be meaningfully engaged in learning activities through interaction with others and worthwhile tasks. By engaged learning, they mean that:

> "social interaction and collaboration are essential; that learners become involved in a "community of practice"; and that all students should engage in activities that involve active cognitive processes such as creating, problem-solving, reasoning, decision-making, and evaluation. In addition, students are intrinsically motivated to learn as a result of the meaningful nature of the learning environment and activities."

Although engagement could occur without the use of technology, they believe that technology can facilitate all aspects of engagement in ways which are difficult to achieve otherwise. The use of email, chat, online discussions conferencing, and videoconferencing can significantly increase the extent, and ease of interaction and the kind of creativity and communication needed to nourish engagement amongst all participants. So engagement theory is considered as a conceptual framework for technology-based learning and teaching. According to its advocates, the engagement theory is a new paradigm for learning and teaching in the information age which emphasizes the positive role that technology can play in human interaction and evolution.

Although not directly derived from other theoretical frameworks for learning, it has much in common with the concepts of constructivism, situated learning and experiential learning because all these focus on collaborative efforts and project-based assignments that result in learning that is creative, meaningful, and authentic.

2.7.7   Theory of Multiple Intelligences (MI)

Through his seminal *Theory of multiple intelligences*, Dr. Howard Gardner (1983, 1993, 1999) challenges the notion of intelligence as a single unitary process or feature (based on traditional IQ testing and scholastic aptitude measurement,); given the broad nature of talents exhibited by individuals, he proposes the concept of a diversity in intelligence. Our schools and culture focus most of their attention on linguistic and logical-mathematical intelligence. According to Gardner, "It is widely agreed that

standardized tests do not sample all forms of intelligence. Obvious examples include creativity, wisdom, practical sense and social sensitivity, among others" (American Psychological Association, 1996, Press Release). According to him it is possible to have at least ten different intelligences to account for a broader range of human potential in children and adults.

Nine of these intelligences are:

    (i)   Linguistic intelligence ("word smart")

    (ii)   Logical-mathematical intelligence ("number/reasoning smart")

    (iii)   Spatial intelligence ("picture smart")

    (iv)   Bodily / Kinesthetic intelligence ("body smart")

    (v)   Musical intelligence ("music smart")

    (vi)   Interpersonal intelligence ("people smart")

    (vii)   Intrapersonal intelligence ("self smart")

    (viii) Naturalist intelligence ("nature smart")

    (ix)   Existential or spiritual intelligence ("wondering smart, cosmic smart, spiritually smart, or metaphysical intelligence")

The theory of MI suggests a major transformation in the way teachers design learning environments for their students who have different configuration of these intelligences. Such intelligences constitute a multitude of ways in which individuals take in information, record and manipulate information, and demonstrate understanding of the information to themselves and others (Veenema and Gardner, 1996). The MI theory can also be related to the learning style approaches. The implication is that teachers should design, develop and deliver their lessons in a wide variety of ways in order to facilitate effective learning for a diverse population of students, thus providing them with ample opportunities to develop and utilise the many types of abilities. This may be achieved through creative classroom and curriculum structures, as well as the use of multimedia teaching tools. The web is the first medium that honoured the notion of multiple intelligences. In the blended learning approach, instructional designers and teachers can develop learning environments that enable students to become engaged in a variety of learning activities that expand their horizon beyond the traditional conventional linguistic and logical methods. Veneema and Gardner (1996) believed that technology can enhance

learning for all students by offering a more complex curriculum that addresses these multiple intelligences.

A common criticism is that the concepts of MI theory were derived more strongly from Gardner's own intuitions and reasoning than from a comprehensive and full grounding in empirical research. Of course, Gardner's hypotheses will not be accepted by those who stick to the traditional dualistic view of intelligence. Although the theory of multiple intelligences has not been readily accepted within educational psychology, many educators support it positively because of its applicability in education. It has been embraced by many educators in North America because of its potential in helping them to reflect on their practices and to broaden their focus to cater for the needs of all type of learners.

2.7.8   Variation theory of learning

The variation theory of learning (Marton, 1998) espouses that an effective way of seeing a phenomenon by learners is that they must experience important variations of that phenomenon. According to Oliver and Trigwell (2005), for learning to occur, *variation* must be experienced by the learner. If there is no variation, then there is no discernment, because normally one does not attend to a thing that is always the same. To learn about something implies that the learner must discern that something from its background. Through variation the different aspects can be discerned. The variation helps students to learn new ways of seeing from each other. According to Oliver and Trigwell (2005) discernment is about the experience of difference (2005, p. 21).

It is critical for teachers to carefully design instruction by incorporating strategies to enable learners experience complex concepts in different ways to bring in the necessary variation to various phenomena. According to this theory, learning begins from the level where the learner is able to directly experience the phenomenon. The use of different media tools or strategies could be used to help students experience variation. The use of instructivist and constructivist approaches can also be a source for the critical variation required for learning to occur. Blending may make it easier to help students experience the variation in the critical aspects of the topic being learnt. According to Garrison and Kanuka (2004), the contrasting characters of synchronicity

and asynchronicity and communication through text and human presence may be regarded as providing the necessary variation.

2.7.9   Cognitive load theory

Cognitive load theory is essential element in cognitive theories of learning is (Sweller 1994; pp. 295-312). Cognitive load refers to the ''total amount of mental activity imposed on working memory at an instance in time'' (Cooper, 1998, p. 11). According to Cooper, limitation of working memory is the primary impediment to learning (p. 31). The implication is that the human working memory, also called short-term memory, is limited in capacity; generally speaking, humans can activate 4-8 chunks (discrete units of information or schema) of working memory at a given instant. Processing troubles arise when the learner must attend to too many different elements at the same time. Meaningful learning often requires substantial cognitive processing which is done in the short term memory.

When instructional materials are presented to a learner, the materials use up the available working memory. The input information uses some slots; the schemata stored in long-term memory also use some slots. After processing here, all information and knowledge is stored in the long term memory which has unlimited capacity.

According to this theory, optimum learning occurs in humans when the load on working memory is kept to a minimum. Cognitive load theory has broad implications for instructional design (Sweller, 1999; pp. 295-312); it provides general guidelines that help instructional designers to minimize cognitive load on the working memory of learners. He suggests that instructional designers should limit cognitive load by designing instructional materials like worked-examples, or goal-free problems. Cognitive load theory can inform the design of web-based instruction (Feinberg and Murphy, 2000).

This theory further serves to describe those variables that hinder cognitive processing and schema development. Three types of cognitive load impact working memory over time (Paas, Tuovinen, Tabbers, and van Gerven, 2003). The three distinct types are: intrinsic cognitive load, extraneous cognitive load, and germane cognitive load.

i)   Intrinsic cognitive load

Intrinsic cognitive load (I) refers to the load (*the number of units of information being processed*) placed on the working memory by the nature or complexity of a new learning task. Abstract concepts will put more load than by a simple task. Using known and resolved examples diminish cognitive load and improves comprehension. The worked out example should be followed by a similar but unresolved problem to maximize motivation. It is generally thought that intrinsic cognitive load is unavoidable, and an instructor designer has not much control over this load. However, Sweller and his colleagues (1998) later changed their own this position and argued that instructional designers may artificially reduce the intrinsic load of instruction, by dividing a complex learning tasks into smaller chunks, reducing the intrinsic load of the overall lesson. Sweller describes these smaller pieces as "subschemas" (Clark, Nguyen, and Sweller, 2006). By this approach, learning activities should be simple at any moment, while they may be complex when taken together. For learners to understand the whole lesson / problem, they process the individual pieces of instruction serially, rather than simultaneously, and recombine these individual subschemas, to eventually understand the whole problem. This also explains why Gagné's (1968) learning hierarchies are effective means of presenting instruction.

The Researcher recommends the use of a prior assessment of existing knowledge and the use of Ausubel's (1968) 'advance organisers' whereby teachers can present a patterned outline of material to students before the content is introduced in detail. When involved in complex environments, learners may need to be provided with the prior knowledge required to interact in this new situation (Land, 2000). This strategy works well in blended learning environments resulting in meaningful learning because then the new learning task can be easily linked with or related to what the learner already knows.

iii)   Extraneous cognitive load

Extraneous cognitive load (E) is related to the design and presentation of the instructional materials rather than to learning tasks themselves. Inefficient instructional designs adds unnecessary load. For example, a multimedia presentation format usually has lower extraneous load than a visual plus text format, because in the former case, working memory has less information to process. According to the

traditional sensory stimulation theory (Laird, 1985), effective learning occurs when the senses are stimulated and the vast majority of knowledge held by adults (around 75%) is learned through seeing. Hearing is the next most effective (about 13%) and the other senses - touch, smell and taste account for 12% of what we know. Thus, by stimulating multi-senses through a greater variety of colours, volume levels, strong statements, facts presented visually, use of a variety of techniques and media, learning can be enhanced.

Instructional designers have great control over some of these load-contributing factors because it may be easily varied by the manner in which information is designed and presented to learners. Extraneous cognitive load does not contribute to learning. The use of cognitive tools such as computer-supported instructional approaches can facilitate cognitive processes by reducing the cognitive load. Collaborative approach to learning can also help students to share cognitive load by dividing it up into smaller portions.

iv)   Germane cognitive load

Sweller, van Merrienboer, and Paas (1998) describe the *Germane load* (G) as the load that contributes to cognitive processes that are directly relevant to the construction and automation of schemas. Germane load is sometimes associated with motivation and interest. This is synonymous with the Mayer and Moreno's (2003) *essential processing* which refers to cognitive processes that are required for making sense of the presented material, such as the five core processes in the cognitive theory of multimedia learning—selecting words, selecting images, organizing words, organizing images, and integrating. It is very important that instructional designers try to promote germane load.

For any given learning task, while the intrinsic load cannot be much changed, the other two types of load can be easily changed by teachers and instructional designers. It is also noted that 'G' and 'E' are inversely proportional to each other; the more extraneous load is, the less room for germane load. Hence it is the teachers' and instructional designers' job to limit the amount of extraneous load and to build into their presentations activities that foster germane load.

v)   Implication of cognitive load theory on instructional design

Sweller's cognitive load theory has led to a number of instructional prescriptions, the most important being Mayer's (2001) cognitive theory of multimedia learning that multimedia learning can be created in way that leads to a reduction in cognitive load and optimizes the use of working memory. Derived mainly from this theory is his seven design principles (section 2.7.10) that are useful in the creation of high quality multimedia presentations as well as quality of lecture-based presentations.

The format of instructional materials should be organized to minimize the need for students to mentally integrate disparate sources of information. Instructional designers have great role to play in controlling the cognitive load. They should present the lesson elements in small chunks serially, rather than simultaneously. In line with this, cognitive load theorists recommend learners first, study worked examples to promote schema acquisition; this strategy is recommended as opposed to allowing learners to learn through problem solving (Cooper and Sweller, 1987, pp. 347-362; Sweller, 1988, pp.257-285; Sweller and Cooper, 1985, pp. 59-89). Later as they gain expertise, some researchers suggest fading worked examples (Renkl, Atkinson, and Maier, 2000; Renkl, Atkinson, Maier, and Staley, 2002) to replace problems with partially-completed problems (van Merriënboer and de Croock, 1992; van Merriënboer, and Sweller, 2005) to eventually practise by solving whole problems to facilitate skill automation (Kalyuga, Ayres, Chandler, and Sweller, 2003).

2.7.10 Cognitive Theory of Multimedia Learning

The main tenet of Mayer's (2001) *Cognitive Theory of Multimedia Learning* theory is that multimedia learning can be created in ways that result in a reduction in cognitive load and optimize the use of working memory. It is primarily based on the following three assumptions:

i)   *Dual channel*: Humans possess two somewhat independent channels for receiving and processing visual and verbal information (Paivio 1986; Baddeley 1992); they tend to work in parallel. We can then integrate information from different sensory modalities into one meaningful experience. When information is presented both visually and auditorily, it minimizes any unnecessary cognitive load on the learner.

ii) *Working memory with limited capacity* (Baddeley, 1992)

There is a limit on the amount of information we can process in each channel at any one time. Another core limitation of the brain according to Rene Marios (Xomba, 2008), a neuroscientist and the director of the Human Information Processing Laboratory at Vanderbilt University is an inability to concentrate on two things at once.

iii) *Active processing*: Learning requires substantial cognitive processing in the verbal and visual channels (Chandler and Sweller, 1991). It requires paying attention to the presented material, mentally organizing the presented material into a coherent structure, and integrating the presented material with existing knowledge.

Cognitive Theory of Multimedia Learning coupled with the Cognitive Load Theory has major implications for the design of multimedia-based elearning environments to provide a reduced cognitive load which will be important to all learners especially the low ability learners. The relevance of these two theories arises from the notion that meaningful learning can require a heavy amount of essential cognitive processing. Cognitive load is a central consideration in the design of multimedia instruction.

Based on the the *SOI model*[31] initially presented by Mayer (1999) for the constructivist design of instructional materials, he proposes the following five cognitive processes the learner must undertake for meaningful learning to occur in a multimedia environment:

a) selecting relevant words for processing in verbal working memory, to yield a text base;

b) selecting relevant images for processing in visual working memory, to yield an image base;

c) organizing selected text base into a verbal mental model;

d) organizing selected image base into a visual mental model; and

e) integrating verbal and visual representations.

According to cognitive science, learners apply cognitive processes to make sense of incoming material. Once the externally presented visual or verbal information are

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[31] *Mayer's (1999, 2002) selecting–organizing–integrating theory of active learning.*

selected, they are transferred from *sensory memory* into *working memory*. In the working memory, meaningful learning occurs when a learner selects relevant information in each store, organizes the information in each store into a coherent representation, and makes connections between corresponding representations in each store (Chambliss and Caffee, 1998). In the process, the learner creates connections between new knowledge and stored knowledge. This involves bringing stored knowledge from long-term memory into working memory, which can be further enhanced by following a number of design principles derived from this theoretical perspective (Mayer, 2001).

Based on his cognitive theory of multimedia learning and results derived from experiments carried out in laboratory settings, Mayer (2001) formulated seven design principles intended to increase retention and transfer of material in a multimedia learning environment.

(i) *Multimedia / Multiple representation principle*: It is better to present an explanation in words and pictures than only in words.

Mayer's findings indicate that when text and graphics are combined student retention goes up an average of 42 percent; if the text is spoken rather than read by the students, retention increases by an average of 30 percent.

(ii) *Temporal contiguity principle:* Students learn better when corresponding words and pictures are presented simultaneously rather than successively.

(iii) *Spatial contiguity principle*: Students learn better when corresponding words and pictures are presented close to one another rather than far from each other on the page or screen.

(iv) *Coherence principle* – Use few rather than many superfluous words and pictures.

(v) *Modality principle* – Students learn more easily from animation and narration than from animation and text. Two messages on similar elements should be provided through different sensory modalities. Research suggests that more memory capacity is available when dual modalities were used; however, if care is not taken, it may lead to a

situation what (Sweller, 1999) called *split-attention effect*[32] and excessive animated multimedia may lead to a general overload.

(vi)   *Personalization principle/ Individual differences*: Students learn more effectively when the narration is conversational rather than formal style. Design effects are stronger for low-knowledge learners than for high knowledge learners, and for high-spatial learners rather than for low-spatial learners.

(vii)   *Redundancy principle*: Students learn more effectively from animation and narration than from animation, narration and text combined. Thus, it is better to eliminate redundant material. This is because learners do not learn as well, when they both hear and see the same verbal message during a presentation. This is a special case of the Split attention effect of Sweller and Chandler (1992, pp. 233-246).

In fact, with experts, some of these are inversed, and classical design rules are advisable instead of those based on cognitive load.

However, Mayer (2003) cautions that instructional designers and course developers have to be extremely careful about the extent and quality of interactive activities that they incorporate into courses using multimedia technologies. The benefit of multimedia hinges on the design and delivery. The medium, the message, and the messenger are all important in student learning.

Mayer found that "while a little multimedia may be a good thing, too much of it is often a bad thing." Too much multimedia may interfere with a student's ability to absorb the message and diminish the effectiveness of the medium. Content containing high levels of interactivity among its elements cannot be learned effectively through weak instructional methods that require extra processing by learners. In such situations, interactivity with the material increases negative effects such as split-attention and redundancy effects for the low-ability learners; however, mentally simulating the functioning and interaction of elements allow experts to obtain better results.

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[32]   Split-attention effect occurs when the student's visual attention is split between viewing an animation and reading the related on-screen text when neither of these alone provides sufficient information for understanding. To avoid this, present words as auditory narration rather than as visual on screen text. When individuals split their attention between two sources of information, the portion of working memory required to integrate the two sources is unavailable and learning is ineffective. Based on this finding, Mayer put forward the spatial and temporal contiguity principles

All in all, the experimental results indicate that Mayer's design principles may be useful in the creation of high quality multimedia presentations; it also holds great practical promise in increasing the quality of lecture-based presentations.

2.7.11 *Cognitive flexibility theory*

Cognitive flexibility is the ability to restructure knowledge in multiple ways depending on the changing situational demands (i.e., difficulty or complexity of the situation) (Spiro, Feltovich, Jacobson, and Coulson, 1995) beyond their initial learning situation. Cognitive flexibility theory is an integrated theory of learning, mental representation, and instruction (Spiro et al., 1995). A central claim of cognitive theory is that revisiting the same material, at different times, in rearranged contexts, for different purposes, and from different conceptual perspectives is essential for attaining the goals of advanced knowledge acquisition.

The major goal of cognitive flexibility is to help develop the learner's ability to understand various situations (Graddy, 2001) which focuses on learning in complex and ill-structured domains—which represent many real-life situations from different conceptual perspectives. The theory is strongly related to the importance of knowledge construction and is a complementary approach to constructivist approaches. However, it is with an objectivist grounding (Jonassen 1991b). It provides a number of heuristics for designing instruction that avoids over-simplifying instruction by providing real-world cases, providing interconnected multiple representations of the knowledge in order to enhance transfer, and requiring knowledge construction by learners.

The four primary principles of the theory are:

i)   Learning activities must provide *multiple representations of content*.

ii) Instructional materials should *avoid oversimplifying* the content domain and should support context-dependent knowledge.

iii) Instruction should be *case-based* and emphasize knowledge construction, rather than transmission of information.

iv) Knowledge sources should be highly *interconnected*, rather than compartmentalized.

The potential of the new technologies to present a variety of information sources may help to stimulate the cognitive conflict required within a Piagetian approach. Non-linear computer learning environments allow learners to visit the same material at different times and in rearranged contexts, to serve multiple purposes and conceptual perspectives (Spiro and Jehng, 1990). In this study, WebCT provides the medium for non-linear presentation of material which can be accessed by learners anytime.

2.7.12 Connectivism

Most learning theories are concerned with learning from printed text that does not normally provide interactive and multi-sensory learning environments. Now there is a new learning theory called *connectivism* under discussion (Downes, 2006; Siemens, 2004) and receiving increasing attention in the academia. George Siemens presents *connectivism* as a "learning theory for the digital age" to explain the effect that technology has had on how we live, how we communicate, and how we learn. According to Perrin (2005) the theory of Connectivism combines "relevant elements of many learning theories, social structures, and technology to create a powerful theoretical construct for learning in the digital age."

Siemens (2004, 2006) argues that all the main learning theories were developed at a time when learning was not impacted through technology. Today, due to the information explosion, learning is not fully under the control of the learner; technology performs many of the operations such as information storage and retrieval previously performed by learners. Accordingly, some knowledge will reside in machines while some will reside in humans. The challenge for educators, therefore, is how to design instruction for both machines and humans, and how the two can interact with each other.

Siemens believes that learning is more than knowledge acquisition and it must be aligned with the nature of flow of knowledge in the networked digital age. According to Siemens, knowledge exists in networks and learning is the act of developing and forming diverse, multi-faceted networks (Siemens, 2005a, 2005b). Connectivism is an exciting theoretical framework for understanding learning. The Connectivist pedagogy espouses that earning is building networks of information, contacts and resources that are applied to real problems. This view has some bearing on what

Cronon (1998) thinks about what means to be educated: "More than anything else, being an educated person means being able to see connections so as to be able to make sense of the world and act within it in creative ways" (p. 14).

Principles of connectivism

i) Learning and knowledge rests in diversity of opinions.

ii) Learning is a process of connecting specialized nodes or information sources.

iii) Learning may reside in non-human appliances.

iv) Capacity to know more is more critical than what is currently known.

v) Nurturing and maintaining connections is needed to facilitate continual learning.

vi) Ability to see connections between fields, ideas, and concepts is a core skill.

vii) Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.

viii) Decision-making in itself is a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision.

Siemens (2004) suggests that because of the networked society, globalization, and the constant changes to information and new information, educators need to look at new ways to design learning materials. Though Connectivism focuses on preparing learners to function in the digital and networked age, all of which sounds befitting and exciting, the Researcher wants to believe that connectivism, however, has an important role in the development and emergence of new pedagogies, where control is shifting from the tutor to an increasingly more autonomous learner; therefore, further work needs to be done on how this theory can be used by educators to (re)design and develop learning materials and environments.

There are also several criticisms about Connectivism. For example, Bill Kerr (2007) argues that connectivism is an unnecessary theory; in his opinion, existing theories satisfactorily address the needs of learning in today's technologically connected age. Verhagen (2006) says that learning theories should deal with the instructional level

(how people learn) but that connectivism addresses the curriculum level (what is learned and why it is learned). He further argues that connectivism is not a learning theory, but rather is a "pedagogical view."

2.7.13 Types of learning outcomes

The theories reviewed above ranged from those that are more individual and cognitively focused through to those where the emphasis is on social and situative learning. The type of learning outcomes under the main learning theories can be categorised into three types according to the nature of learner's involvement in the learning process. The three types of learning are transmissive, transactional, and transformative (Miller and Seller, 1990).

i) Transmissive learning assumes that knowledge is content, a transferrable commodity to be gained by demonstration, telling, and modelling. Transmissive learning is the distinctive feature of the instructional paradigm.

ii) *Transactional learning* assumes knowledge is constructed by learners and is characterized by experiential activities, student-to-student collaboration, and acts of discovery through active learning and team-based projects. In this learner-centred approach, the educator is designer, one who facilitates learning.

iii) *Transformative learning* asks the learner to assess new knowledge in relation to existing knowledge, requiring considerable reflection upon the assumptions and biases that the learner has accepted as part of his or her existing knowledge.

According to Mayes and Fowler (1999), learning should not be thought of as a discrete activity but as a process of continuous growth of understanding or as a bi-product of understanding; the growth of understanding depends on frequent feedback, particularly from educators and peers. According to them, the process of understanding and learning form a cycle, the learning cycle, comprising the following phases:

Conceptualisation: This is the user's initial contact with concepts developed by others. It involves an interaction between what the learner already knows and the new knowledge. Conceptualisations are reviewed and further refined during interaction with both the teacher and peers.

Construction: This is the process of integration of concepts, through their use in the performance of meaningful tasks such as hands on activities, laboratory work, writing, and presentations.

Application: This is the testing and tuning of a learner's understanding of concepts by using them in applied contexts, particularly the testing of understanding of abstract concepts.

According to Goodyear (2002) learning in HE can be of three kinds: *academic*, *generic competence* and *individual reflexivity*. *Academic understanding* refers to how learners' performance increases in complexity when mastering academic learning and understanding. It is a measure of what students can do differently as a result of their developing understanding.

Generic Competence includes analytical and flexible learning capabilities that focus on qualities such as confidence, self-discipline, communication, ability to collaborate, reflexivity, questioning attitudes, and other essential skills for the 21st century workplace. In order to develop most of these skills, opportunity for collaborative and cooperative learning situations is critical and that substantiates the use of the community of practice suggested in the theoretical framework of this study.

Regarding the knowledge dimensions of Bloom's taxonomy[33], the focus is on the "knowing what", and has four categories: *factual, conceptual, procedural,* and *metacognitive*.

> ➢ *Factual knowledge* consists of basic elements of facts that include isolated bits of information, such as vocabulary definitions and knowledge about specific details.

> ➢ *Conceptual knowledge* consists of systems of information, such as classifications and categories, interrelationships among elements, how they function, etc.

> ➢ *Procedural knowledge* includes algorithms, techniques, and methods as well as knowledge about how to do a task and when to use these procedures.

> ➢ *Metacognitive knowledge* refers to knowledge of thinking processes and information about how to manipulate these processes to do different tasks

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[33] *Source: http://www97.intel.com/en/ProjectDesign/ThinkingSkills/ThinkingFrameworks/Bloom_Taxonomy2.htm*

effectively, etc.

The next section looks at how the specific characteristics of each theory relates to the affordances of different digital media, and supports elearning pedagogy.

2.8   Elearning pedagogy

The field of elearning has not produced a new theory of learning but instead a new paradigm which reflects the growing connectivity of people and learning resources (Mason, 2002). For all practical purposes, the design for online blended learning is carried out based on practice and theoretical perspectives from constructivism, situated learning, and Merrill's (2002) first principles of instruction (as discussed in Section 3.2.4). Both Constructivism and Situated learning advocate the need for authentic environments whereby learners participate in a community of practice engaging in discourse, reflection, and sharing of real-world experience that are in line with the goals of online learning. Merril's principles define good learning settings for which online technology is a key enabler because the learner gets opportunity to initiate interactions with the tutor and peers when necessary using online communication tools.

All the published work on elearning is practice-based and descriptive. For any type of learning to be effective, whether it is classroom based or computer based, it has to be built on sound pedagogical principles. Even without a theory, elearning has become a buzzword particularly in higher education settings, and a progressive trend that focuses on supporting synchronous as well as asynchronous communication and collaboration in the pedagogic design of learning through the use of ICT is evolving.

The introduction of elearning enables communication between learners and with the tutor without the barriers of time and place. Good (2001) identifies several essential components of e-pedagogy, and suggests that the elearning pedagogue needs to include conventional pedagogy, online awareness, the ability to plan and manage events online, comprehension of the current and future potential of technology, and the ability to interweave technology into the instructional design.

For the purpose of this study, elearning is defined as learning facilitated and supported through the use of ICTs. The term "elearning pedagogy" as used in this study espouses the following: the importance of interactivity in the learning process, the

changing role of the teacher from sage to guide (with a shift from the teacher to an increasingly more autonomous learner), the need for knowledge management skills and for team working abilities, and the move towards resource-based rather than packaged learning. This means that in this new paradigm or what may be called "meta-pedagogy", information and learner support will be easily accessible, and learners will be engaged in seeking out information, making connections with members of learning community.

The new technology continues to play an important role in the development and emergence of new pedagogical paradigms; in other words, online courses are driving pedagogical evolution in higher education. Current pedagogic changes to integrate educational technology seem to be evolutionary rather than revolutionary (Hennessy, Ruthven, and Brindley, 2005, pp. 155-192). Being evolutionary, as research progresses, new theories and practice may emerge and evolve. The theories of learning that are based on distributed and networked contexts, such as *heutagogy* (Phelps, Hase, and Ellis, 2005) and *connectivism* (Siemens, 2004, 2005) are good examples. These theories help us to understand that learning is about making connections with ideas, facts, people, and communities. Technology fosters opportunity to utilise these connections.

2.8.1   *Role of technology in the design of online and blended learning environments*

Four overlapping attributes of effective learning environments are learner-centred[ness], knowledge-centred[ness], assessment-centred[ness], and community-centred[ness] (Bransford, Brown, and Cocking, 1999). They are overlapping because some of the elements that contribute towards these attributes could belong to more than one attribute at the same time.

New technology provides many opportunities as discussed in earlier sections to help learners achieve these attributes in environments with the above characteristics more effectively than through traditional teaching and learning approaches. For example:

Learner-centredness: Technology helps to support individualised learning through multiple formats and selective release of learning materials, and just-in-time feedback

from the teacher to individual students depending on their ability level and learning styles.

Knowledge-centredness: Technology can help provide direct access to vast libraries of learning resources and activities from various sources.

Community-centredness: Technology (e.g., WebCT as discussed in the next section) offers asynchronous and synchronous communication tools (Mail, Chat, Discussion and Who is online) for students to interact with teachers, and collaborate with peers; with the email tool, students can interact with peers in the class and with the teacher, ask questions, submit assignments and receive feedback; using discussion boards, they can post messages to the class, read peers' posts, respond to teacher's questions or receive feedback about their posts; Using the chat tool, students can interact synchronously (in real-time) with each other to share ideas, solve problems and work collaboratively on a project; using the "who is online" tool, a student can find out who is available online while he/she is studying, contact each other to counter the sense of isolation and feel a sense of community. Using these communication tools, the teacher can encourage articulation and dialogue among students. Teachers can use these tools to encourage articulation and dialogue among students, and further provide students with guidance and feedback during learning.

Assessment-centredness: Assessment is not just for awarding scores. For students to be motivated to take an active role in their learning, they need to be aware of their status. Self-assessment is critical to build student confidence and, ultimately, success in learning. Multiple opportunities for formative assessments when learning *is* taking place (rather than *after* it has occurred), by self, peers and teachers, and summative assessment are other forms of assessment. The assessment tools assist in student learning as well as in the evaluation of the course, both formative and summative. In particular, frequent formative assessments increase the learning of low-achieving students (Black and William, 1998).

Further Web technologies have many of the features of audio-visual media (to present content in different formats— text, image, sound and video clips) to present learning material in different formats to reduce learners' cognitive load and to address the needs of different type of learners, as discussed in sections 2.7.9 and 2.7.10.

The interest in blended learning can also be attributed to its potential to open the possibility of creating and sustaining a community of learners beyond the classroom. The potential of the internet and communications technology can be harnessed to converge people, technologies, and services on a single platform that can become a global workspace for communication, collaboration, and community. Technology introduces the possibility for interacting synchronously (in real time) as well as asynchronously (anytime over a period of time). The integration of real and virtual spaces means that communities can form and interact in ways that were previously unimaginable.

According to Jonassen (1999) the learning environment should provide related cases, information resources, cognitive tools, communication tools, and scaffolding which help students acquire an integrated set of cognitive skills. As the online technologies and social networking tools continue to expand and develop, web-based blended learning offer a completely new and learning teaching mode, providing students learners with a wide range of learning opportunities and experiences. For example, recently a range of media resources that allow seamless integration of multiple media e.g., streaming of audio and video within a single course has made communication quite lively almost as it occurs in face-to-face learning environments. All these possibilities make the web-based technology a challenging medium for learning for all types of learners, both visual and auditory type learners. As a result, technology is being widely recognised as a catalyst for a total transformation of the higher education landscape all over the world.

Technology can be used differently based upon different pedagogical philosophies. As it is used in traditional approaches, it may be infused with instruction to augment particular instructional events, for example, through the use of flash animations or by utilising automated online learning activities to assist with teaching specific principles. Traditional computer-based tutorials and drill-and-practice programs fit well with instructivist pedagogies; they are good for learners to meet their low level learning objectives. When the focus is on achieving higher-order learning outcomes, there is need for increased student engagement in learning activities and interaction with peers and the instructor. The need to create more interactive and collaborative learning environments and to educate many more students is at the core of the interest in the use of technology in education.

However, it has to be noted that technology is only a tool, and is considered pedagogically neutral; it is only as good as the teacher using it; its choice for learning and teaching must be based on the needs of the situation; with some topics / concepts, the chalkboard would be better. Therefore, the focus is not on technology per se but the need of "interactive-engagement" over "traditional" face-to-face instruction for higher-order learning.

2.9   Pedagogical dimensions of effective online learning environments

Student learning is a complex process and is influenced by numerous variables or dimensions. Most learning strategies advocate the need to provide learners in with an interactive environment. According to Gynther (2005), the term blended learning should put four different didactical questions in focus:

a) What kind of knowledge should the students get and what kind of pedagogical strategy will be necessary to organize the teaching from?

b) How do you need to organize the learning room?

c) How do you need to organize the learning milieu?

d) What kind of learning resources can build up under your choices?

The design for web-based blended learning environments requires effective use of a wide variety of pedagogical methods and different forms of technology appropriately depending on the needs of the situation.

In this study technological affordances are supported by WebCT. From the learning theories reviewed above, appropriate pedagogical dimensions identified for the study are: *Social presence, Motivation, Collaborative learning, Cognitive strategies, Learner centredness, and Authentic context and assessment*; the first five dimensions are discussed in the following sections. The last component is discussed and seamlessly integrated into the study in different sections. These dimensions are important in order to establish the parameters and scope of the study, and to facilitate support of a wide range of pedagogies in blended learning situations. The next step is to map these pedagogical dimensions to the affordances of different technology tools (Choice of media). Therefore, the pedagogical dimensions indirectly refer to the technological affordances as supported by WebCT to initiate powerful instructional interactions, monitor learner progress, empower effective teachers, accommodate

individual differences, and promote collaborative learning. These dimensions also serve as criteria for evaluating the study.

This section 2.9, and its subsections, together with section 3.12 and its subsections, and sections 5.2-5.7 address the fifth specific objective: *To distil theories, instructional/learning environment design principles/models and technology characteristics, and to synthesize pedagogical dimensions and design criteria for developing an effective blended learning environment.*

2.9.1   Social presence

According to Garrison and Arbaugh (2007), the concept of presence is the result of the dynamic interplay of thought, emotion, and behaviour in the online environment, between the private world (the inner world) and the shared world (the outer world). It is viewed from different perspectives: social, psychological, and emotional.

Social presence refers to the co-presence of students and the teacher to create a climate that supports productive learning environment to accomplish shared educational objectives. It gives learners a feeling of connecting and belonging to a community. It is also the extent to which learners intellectually and emotionally exist as 'real members' of a learning community. Palloff and Pratt (2007) consider social presence to be a critical element in online community building because the absence of face-to-face contact and visual cues may lead to feelings of isolation or lack of connection with other students and instructors.

Developing social presence in online and blended courses is essential for them to develop a sense of community, to feel safe to take risks, to voice opinions and to make mistakes in their meaning-making process. It is an important ingredient for strong community building in online learning environments, and is considered an important element in this study. It has a significant role in motivating all learners and getting them all engaged in the learning process. Studies indicate (e.g., Picciano, 2002) a positive relationship of social presence with student satisfaction, and the development of a community of learners.

The degree of social presence is influenced by various dimensions. Garrison and Anderson (2003) identified three elements that contribute to the development of social presence in online courses – *affective expression, open communication*, and *group*

cohesion – which research suggests are affected by both instructor behaviours (Shea and Bidjeramo, 2008) and course design (Swan and Shih, 2005). Social presence can be enhanced through the careful development of learning objectives, learning engagement, and learner support (Bogle, Cook, Day, and Swan, 2009).

Students do not just exist as neutral persons within a classroom; they bring remnants of their private lives and thoughts, established study habits, and personal beliefs. Another related aspect that is critical for a strong bond between learners from different backgrounds is 'emotional' presence; it is the ability to genuinely show feelings through words, symbols, and interactions with others in the online environment. In this process, learners and instructors are emotionally present when they connect with others during the online learning experience. Stacey (2000) argues that the social dimension of online interaction provides the basis of establishing an environment of trust and motivation for effective learning. In the absence of effective social presence, the learner becomes a passive viewer of web pages, listener of lectures and mouse clicker or may not make use of the online approach at all.

There are many technology tools and applications that can be used to increase student interaction with each other and with the instructor. WebCT has built in discussion boards, email, Chat, and 'Who is online?' There also several tools and applications such as Wiki, Blogs, Podcasting and Twitter that can be integrated with WebCT. Each of these can be a tool for engagement and enhancing the development of social presence, but the need for proper support and adequate training in their educational uses is essential for their effective use. This is where learner support enters the discussion of social presence. It is essential to provide adequate training and support to students for them to feel comfortable and confident in the technology environment and to engage in learning activities. UB gives serious consideration to learner support through the use of Helpdesk which provides support, and training activities for students including assistance with accounts/passwords, computer labs, and student technical support.

2.9.2   Motivation

The single most important factor in online learning is motivation to get online participants through the early stages; if this is ignored, limited participation by students will be the outcome. It is critical to focus learners' attention and maintain engagement. Schraw, Brooks, and Crippen (2005) state, "motivation means paying attention…. Motivation is the conscious or subconscious allocation of working memory to a learning task". According to Prensky (2003), "A *sine qua non* of successful learning is motivation: a motivated learner can't be stopped." Simpson (2008) argues, "if a learner is enabled to be fully motivated … then it is likely they will explore issues of suitable preparation and learning skills development for themselves, be more persistent when facing difficulties, and become an effective independent learner, doing whatever they need to succeed" (pp. 159-170). According to Wlodkowski (1985), an adult educator, "motivation is not only important because it is a necessary causal factor of learning, but because it mediates learning and is a consequence of learning as well" (p. 4).

Wlodkowski (1999) argues that learning can be enhanced by motivation and is greatly enriched by eliciting motivation as an effective teaching tool. He further stresses the concept that motivation is a necessary component of adult learning. There are different theories and strategies of learning motivation that may be applied in different learning contexts, such as Self-determination Theory (Vansteenkiste, 2004), Positive Psychology and the 'Strengths Approach' (Boniwell, 2005; Snyder and Lopez, 2002), Moshinskie's model of *How to Keep E-Learners from E-Scaping* (2001), Self Theory (Dweck, 1999), Proactive Motivational support (Anderson, 2003), Self-perceived Competence Theory (Pajares, 2004), Keller's ARCS model (1983, 1987), and a host of other similar ones. All these theories are based on the importance of motivation to a learner's success, and the critical need to integrate appropriate strategies into the instructional strategies. Although Keller's ARCS model was developed well before the advent of the Internet and elearning, it provides several strategies for designing motivating instructional materials and on how to use technology in enhancing learner motivation (See Table 3.3 in Section 3.5.2.1for details).

Motivation can be categorized as extrinsic and intrinsic. Extrinsic motivation involves the learner's desire for earning rewards and avoiding punishment, while intrinsic motivation is related to the learner's curiosity and desire for achieving lasting, that is,

deep, meaningful learning. For meaningful learning to occur it is important to design for intrinsic motivation on the part of learners (Stoney and Wild, 1998).

According to Wlodkowski (1999), all learners particularly adults possess intrinsic motivation. Hence, the instructor's job is not to 'motivate' students, but rather to elicit and encourage the motivation that is already present within them. It is the intrinsic motivation that causes students to actively engage with peers in the learning activities rather than concerned about the outcome of the task or the activity. As a result, it is critical to create learning environments with activities that are effective and appealing to the learners to make them participate and explore. When students engage in meaningful open-ended tasks, their motivation increases and the effect of learning is more powerful.

Interaction, both peer-to-peer and student-to-instructor is perceived to be the prime motivating force in an online environment. Collaborative learning can increase motivation through communication and social interaction. Norman and Spohrer (1996) argue that active engagement by learners in the learning process is tightly associated with motivation and the provision for rapid compelling interaction and feedback. Feedback and its response time have a strong impact on the motivation of learners. Instructors should commit to a quick response time so that students are motivated to move on with the course. Positive feedback, sense of ownership, and achievement can enhance students' self-efficacy and motivation in learning.

People enjoy having their work and learning achievement appreciated and recognized by others (Malone and Lepper, 1983). After the assignment is completed, students should have an opportunity to share their work, increasing recognition and encouraging articulation. When students are provided opportunities to display their work, motivation increases.

Technology offers many innovative features that allow for the incorporation of the above mentioned motivational strategies easily and to make instruction more appealing to learners; for example, active student engagement, just-in-time feedback from the tutor, on-demand help from different people, display of student work, and the like can be easily achieved with the use of interactive, collaborative online tools. Frequent student-tutor contact / communication in and out of class one of the most important factors in student motivation and involvement, and this is what help

students get through rough times and keep on working. Some strategies of influencing motivation in online courses are provided by Bonk and Dennen (2002). In their research, the respondents favoured intrinsic motivational principles related to content relevancy, timely feedback, goals and product-based activities, personal growth, choice, flexibility, interaction, collaboration, fun, and variety in course materials and activities (p. 90).

2.9.3 Collaborative learning

The concept of 'Communities of learning' is the central tenet of the theoretical framework of this study, and it is underpinned by learning through interaction and collaboration among learners and with the instructor. According to Wenger (2003) the notion of 'communities of practice' has generated renewed thinking about how formal educational curricula are constructed, how learning is supported and how learning is assessed.

Collaborative learning, a construct of social constructivist pedagogy, is a learner-centred instructional strategy that involves social processes by which groups of students work together as teams to complete academic problem-solving tasks designed to promote learning (Benbunan-Fich, Hiltz and Harasim, 2005). From a sociocultural point of view, effective and efficient learning cannot be viewed as a product of the individual efforts; rather, it is the process by which learners engage in co-constructing their knowledge. Social constructivists believe that learning occurs through social dialogue and shared experiences (Jonassen, Davidson, Collins, Campbell, and Haag, 1995). Collaborative dialogue and communication within a community connect minds, either directly or indirectly, engenders deep thinking and fosters cross fertilisation of ideas. From these perspectives, interacting with others and with learning materials seems vital for learners to construct the knowledge internally.

Collaborative learning is more a philosophy of learning than just classroom technique. Students interact each other and learn through exploration and discussion in a non-competitive, supportive, and emotionally secure environment. They work in groups to solve problems. The goal is to share, challenge, and form alternative viewpoints. In such an environment, authority and responsibility are shared within a team, and the underlying premise is consensus building. Students can share learning strategies and

perspectives with each other through social interaction. In a collaborative learning environment, students generate deeper levels of understanding and achieve their common learning goals. There is a bond among students, and therefore, they actively exchange ideas, critique each other's work, and negotiate meaning together in an atmosphere of intellectual openness. Group members will learn to encourage each other and avoid team conflict by working together towards a common goal and by achieving rewards through group performance.

Collaboration seems to work best when students depend on each other to reach a desired goal, when there are rewards for group performance, and when students know how to work together effectively (Driscoll, 2000). It can provide a safe model of a community of practitioners and experts, in which shared striving for knowledge and meaning making is the common vision. The major benefits of interaction and collaboration among students are that peers become resources in the learning process, and further, the synergistic effect of collaborative thinking, intelligence and strengths. The opportunity for users to collaborate is an important design element, particularly for students who may be learning at a distance because it can lead to active learning. The collaborative approach is particularly useful in Project-oriented learning.

Chickering and Gamson (1987) remind us that learning is not a spectator sport or a solo race. Real learning requires active researching, summarizing, synthesizing, and applying knowledge, not rote answers given on cue. Consequently, tasks need to be addressed to a group rather than an individual, and appropriate means of communication need to be established. Working with others often increases involvement in learning. In the collaborative learning process, students often inspire each other. Wood and Gentile (2003) report:

> "Physics educators have led the way in developing and using objective tests to compare student learning gains in different types of courses, and chemists, biologists, and others are now developing similar instruments. These tests provide convincing evidence that students assimilate new knowledge more effectively in courses including active, inquiry-based, and collaborative learning, assisted by information technology, than in traditional courses."

According to George Siemen's Connectivism theory of learning (vide Section 2.7.12), "teaching isn't just about providing content, but facilitating the means for students to connect with each other so they can learn from the content together." Collaboration is

seen as a critical element in constructivist learning in which a community works towards shared goals. The constructivist framework seeks to understand multiple perspectives, and challenges the learners' thinking (Duffy and Cunningham, 1996).

The capabilities of new technology can help create global communities of distributed learners who can interact and collaborate readily anytime and anywhere via communication tools such as discussion boards, chats, email, debates etc. Weigel (2002) argues technology supports deeper level learning by facilitating student collaboration. Study groups, collaborative learning, group problem solving, and discussion of assignments can all be dramatically strengthened through these communication tools. Archee and Duin (1995) argue that the use of the Web is best suited to that of a communications medium for collaborative approaches to learning rather than as a "24 hour a day glorified whiteboard".

Since collaborative methods may be new for many students and teachers, facilitating collaboration among students is a complex issue. Students will need guidance in working together including skills such as project management, scheduling, time management, leadership, consensus-building, etc.

2.9.4   *Learner centeredness*[34]

Constructivists advocate that the learning environment should be learner-centred (Kanuka and Anderson, 1999). Soloway, Duzdial, and Hay (1994) were the first who identified the need for designing learner-centred courses and technologies. It is a philosophy that places the learner at the centre. Learner-centeredness is a key aspect in this study. It is an approach to teaching that moves away from the concept of the teacher as the centre of instruction and pays much more attention to what the *learner* is *doing*; that is, on the active role of the student in the learning process (Jonassen, Davidson, Collins, Campbell, and Haag, 1995), thus bringing a shift of its main emphasis from teaching to learning. In a learner-centred environment, learners are treated as individuals, and they work individually and in small groups to solve authentic problems. It means the students construct knowledge for themselves, building upon what they already know and they are responsible for their own learning. The goal of learner-centred design is to make students more effective learners through

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[34] *The terms learner centredness and student centredness are interchangeably used in this work according to the situation depending on whether the discussion is about learning or teaching respectively.*

active exploration, construction and learning rather than being passive attendance in lecture rooms.

Those who are usually successful in teaching with technology are those who constantly strive to facilitate student-centred learning environments that support and improve the depth and scope of student learning (Cuban, 2001).

Learning is not something that can be passively acquired by students; it is an active, iterative *process*, not a *product*. Teaching is not seen as transferring knowledge or the teachers' interpretation of meaning to the learner, but engaging the learner in interaction and collaboration as described above and thus facilitating individual and social knowledge construction, with a focus on "learner initiated inquiry and exploration" (Gunawardena and Zittle 1996). This means that teachers should adjust teaching and learning activities in a way that they cater for the individual needs and individual differences in ability, prior knowledge and motivational level.

Deep and meaningful learning experiences are best supported by actively engaged learners (Kuh and Associates, 2005). Learner-centred environments provide learners control over pacing, sequence, and actual content, and a greater sense of ownership and participation. From the extant literature and anecdotal evidences, it is becoming increasingly evident that, only through student-directed modes of learning can learners acquire 'productive' skills, independent learning skills and/or skills for lifelong learning (e.g., Pelgrum and Law, 2003).

A focus on learner-centred learning may be the most important contribution of constructivism to education (SEDL, 1999). Constructivist view requires teachers to be creators of intellectual environments that enable learners to actively engage by interacting with content instead of receiving it passively, to engage in critical thinking, to foster the development of understanding/ construction of knowledge and skills, to take responsibility for their own learning and to appreciate the need for life-long learning in the workforce in a fast changing world.

Learner-centred approaches to teaching and learning stress the importance of students' past experiences, exploring individual needs and interests, promoting active participation, stimulating higher-order thinking, and encouraging lifelong learning (Bonk and Cunningham, 1998). In a learner-centered approach to designing elearning courses the primary focus should be on the learner and their existing knowledge and

experience; Today's learners have varied learning styles and preferences, and hence learning environments need to become learner-centered for successful learning to occur for all learners.

Learning environment should embed learning in authentic contexts, present learners with multiple perspectives, encourage self awareness and responsibility for learning and use modern technologies to facilitate telecommunications and the social construction of knowledge (Wilson, 1997). For knowledge to be useful, it is believed that learning must be situated in authentic tasks to enable transfer to similar situations. According to Reeves and Reeves (1999), learnability, usability, and understandability are three important principles for designing learner-centred virtual learning environments; learnability refers to the initial difficulty in learning how to use an application, space, or product; usability reflects the ease of use of a system or product over time; and understandability is an extension of usability, including the thoughtful design of the content.

Technology lends itself to the learner-centred classroom. Careful design of multimedia is of high importance, and the design should be driven by the learning goals and objectives. Media should be designed in order to address the learners' pre-determined learning styles and individual approaches to learning whenever possible (Wild and Quinn, 1998). Salinas (2008) suggests that for applying the use of learner-centred principles, the instructional objectives of the class are to be directly linked both to the needs of the student and the role of the instructor in the classroom, which in turn determine the appropriate type and use of instructional technology.

According to constructivists, individuals construct knowledge and understanding as they personally form and refine concepts by fully and thoughtfully participating in all types of tasks. Learners should feel some degree of control over their learning and assessment. They should be able to evaluate themselves using their metacognitive abilities. Technology makes it possible students to make individual self evaluations.

2.9.5   Cognitive Strategies

Cognition refers to thinking. 'Strategies' are procedures that are consciously and effortfully used to promote understanding (Alexander, 2006, p. 98). According to Flavell (1979) cognitive strategies are invoked to *make* cognitive progress, metacognitive strategies to *monitor* it, p. 909).

Cognitive strategies comprise suitable instructional activities and assessment tasks; they should be appropriately incorporated into the design of learning environments for enhanced cognition. In the process of knowledge construction, cognitive strategies are complemented by the results of social negotiation of knowledge through articulation and dialog with peers, mentors and experts. According to West, Farmer, and Wolff, (1991), "Research shows that students who consciously use such strategies become better able to reflect on their strategies, plan, and monitor their own learning, and check their progress toward goals."

Development of cognitive strategies can also be aided by the use of cognitive tools (Jonassen, 1992) such as through the use of interactive, collaboration technologies. Computers have the ability to mediate cognitive processes (Jonassen, and Reeves, 1996); they can transfer some of the low level tasks such as calculations, storage and information retrieval to the computer; this allows the learner to think more productively, and engage in important processes of articulation and reflection, which are the foundations of higher order thinking skills and knowledge construction (Duffy and Cunningham, 1996).

Some essential components of the constructivist cognitive strategies are: collaboration, critical thinking, discourse, reflection, exploration and meta-cognition as well as the learners' sharing and comparing of these experiences. Mechanisms, such as chunking or grouping like items and interactive mental imagery, intervene between a stimulus and response to promote memory. Winn and Snyder (1996) and West, Farmer and Wolff (1991) propose the following practical cognitive strategies to foster metacognition and facilitate active learning processes. According to them cognitive strategies intervene between a stimulus and response to activate and extend the memory.

> ➢ *Chunking* – rational ordering and classification of knowledge;
>
> ➢ *Frames* – grids to structure concepts, categories, and relationships – either

provided by the instructor or partially developed by learners themselves;

➢ *Concept maps* – visual arrangements with links to represent relationships;

➢ *Advance organizers* – brief prose introductions prior to new material;

➢ *Metaphor/Analogy/Simile* – creative links to show similarity between known and new concepts;

➢ *Rehearsal* – reviewing, asking questions, predicting – with learners playing an active role;

➢ *Imagery* – mental visualization as a learning aid;

➢ *Mnemonics* – artificial memory aids, for example, first letter coding.

As learners can be diverse in terms of learning styles, learning proficiency, as well as learning ability, teachers can use combined approaches to cater for the needs of all students and to create an opportunity to make everyone's learning an equally successful experience. Blended learning can come to the rescue by making it possible for individualized learning. Some of the common cognitive strategies considered important in this study are discussed below:

i)   Cognitive conflict and complexity

According to constructivists, learning materials should not be simplified (as is done in objectivist approaches) because they may not reflect real-world scenarios. Further, simplification could limit learners' mental processing rather than enhancing it. This view is also supported by studies on how the human brain works. Jensen (1995) argues that the human brain processes information on many paths, modalities, levels of consciousness and meaning levels. Thus the brain prefers multi-processing and a linear pace could hinder understanding. It is therefore crucial to design learning scenarios which are not oversimplified but designed in such a way that it simulates the real-world complexity. The challenge posed to lecturers is to create a rich learning environment, which is situated in real-life, or which closely resembles real-life within which the learner can construct meaning (White, 1996, p. 69).

For active participation of students in active learning, they should engage in problems that arouse cognitive conflict or puzzlement. The complexity promotes the learner to interact with peers and the instructor, and negotiate meaning; the complexity requires learners to do so in order to clarify the problem and reduce the complexity

themselves.   For this the problems should be of sufficient depth and complexity to simulate the real world and also to stimulate the intellectual curiosity of students. According to Savery and Duffy (1996, pp. 135-148) cognitive conflict is a stimulus for learning.

ii)   Metacognition and reflection

The shift from transmission to constructivist approaches to instruction has highlighted the necessity for learners to 'learn how to learn', to monitor their learning by critical reflection and metacognition.

Metacognition refers to one's ability to explicitly focus on thinking about himself/ herself and of different possible ways in order to analyse and complete an activity. It is an intellectual skill and an indicator of the ability of learners to plan, and monitor their own cognitive processes and performance, and to select learning strategies for themselves to enhance their progress. Metacognition, which is the ability of an individual to evaluate his/her own cognitive skills, is an intellectual skill considered to be part of the cognitive domain (Reigeluth and Moore, 1999, p. 52). An important instructional implication of the focus on metacognition is that problem solving skills should be learned within the context of realistic problem-solving situation (Mayer, 2004).

The four key metacognitive skills are planning, monitoring, evaluating, and revising. It is fundamental to learning and is a strong predictor of academic success (Dunning, Johnson, Ehrlinger and Kruger, 2003, pp. 83–87). Metacognition comprises two major components: metacognitive knowledge and metacognitive regulation (Schraw and Moshman, 1995, pp.351-371). Metacognitive knowledge refers to knowledge of cognition such as knowledge of skills and strategies that work best for the learner, and how and when to use such skills and strategies. Metacognitive regulation refers to activities that control one's thinking and learning such as planning, monitoring comprehension, and evaluation (Schraw and Dennison, 1994, pp. 460-475).

Metacognitive regulation of learning (Baker, 1989, pp. 3–38) is an important aspect of cognition. It refers to students' ability to track their progress in the learning process and to easily judge what they have to do next to advance further, particularly in response to errors. The role of the teacher to support learners' metacognitive activities and the self-regulation of their knowledge growth in the process cannot be

overemphasised. There is a place for the explicit incorporation of metacognitive strategies within instruction, in addition to content knowledge (De Villiers, 1995).

An important driver of metacognition is *reflection* which is a significant aspect of learning. Reflection is widely considered to have the power to reframe experiences and events in new terms. Engaging regularly in structured reflection leads students to deeper understanding and better application of subject matter knowledge. Reflection is a learning outcome as well as a powerful pedagogical strategy. It runs through most learning perspectives or theories especially when the envisaged learning outcomes are Bloom's mid and higher levels. Therefore, students must be trained to be reflective learners. According to Lee and Sabatino (1998, pp. 162-170) reflective practices in the classroom have also been shown to help learners connect earlier experiences to new content in order to achieve better understanding of the new material. Dewey (2004) reports that there is an extensive body of scholarship on the "reflective teacher" and the "reflective learner". Both skills- reflection and metacognition - are important elements for teaching thinking and problem solving.

Suitable activities and assessment tasks must be incorporated into learning design in order to embed some form of metacognitive awareness in the learning process. Interaction between students is one of the most useful metacognitive strategies. Discussing matters related to learning tasks, evaluating each other's performance, and providing mutual feedback serve to clarify and enhance understanding. New technology provides ample opportunities for authentic problem scenarios (e.g., simulations and interactive videos), to self evaluate one's progress (computer-graded self-tests), and to appropriately employ essential strategies to improve learning performance. Therefore, technology's potential to create interaction among learners offers opportunity to foster metacognition.

iii)   Scaffolding

Generally students need to be scaffolded to learn to be reflective and metacognitive. Scaffolding as instructional procedures is derived from Vygotsky's (1978, p. 86) "zone of proximal developmental" theory. Scaffolding in general helps to reduce the complexity of tasks and focus learners' attention. It can also help in the organization of information in memory (Anderson, 1995, pp. 167-207).

Students should be scaffolded to learn to be reflective and metacognitive. Scaffolding can be provided by the instructor, peers and the technology. Expert scaffolding begins with selection of activities that will promote student engagement. It involves designing assignments that foster critical thinking and promote meaningful learning. It also includes modelling, prompting, and rewarding active participation.

An important strategy for scaffolding is just-in-time feedback from the instructor and on-demand help from different people. It is particularly useful to cater for individual differences in the levels of ability, prior knowledge or motivation. Just-in-time feedback from the instructor results in enhanced motivation and engagement, and is an important variable in student learning because students need to know how they are progressing, as well as have an idea on how they can improve their performance in the course (Chickering and Ehrmann, 1997). Feedback is critical to assessment and provides students information about their progress in the course (Collis, DeBoer, and Slotman, 2001, pp. 306-313).

Herrington and Oliver (2001) report that the need for scaffolding has largely arisen because of the rapid implementation of learning management systems, the increased use of online teaching and learning and the evolution of learner-centred educational paradigms. In an online course, the need for quality prompt feedback is even more critical than in traditional classrooms because an online course lacks face-to-face interaction. Further, it avoids any feeling of isolation, instead it could provide a sense of new personalised learning environment as learners could work at their own pace and schedule. In a technology supported learning environment, the instructor's support can be gradually removed to enable learners become independent problem solvers and take control of their own learning.

iv)   *Learning style*

As a whole, learning is a complicated and complex process; it can be influenced by many factors. One of the significant factors is an individual's personality types (Jung, 1971) which in turn influence their learning style. Jung stated that each individual has a preferred style to perceive information, make decisions, and interact with the world, and combines different levels of each of these three factors to create his own approach to learning. This view is also strongly supported by the "multiple intelligences" view of Howard Gardner (1983, 1993, 1999). This means different individuals will have

unique attitudes and interests that can result in individual patterns of mental functioning, such as information processing, idea development, and judgment formation. These can influence an individual's preferred learning approaches. For example, a person with an extrovert personality type may prefer active, highly collaborative environments while an introvert may prefer less interaction and less collaboration. This suggests that instruction should be designed to allow both types of individuals - the outgoing social organizer as well as the introspective reflective observer - to thrive. Students who did not particularly want to learn in interaction with their peers, and who were not inclined to monitor their learning, were particularly likely to watch lectures online rather than to attend them in class.

Ally (2004) argued that learning strategies within elearning environments should accommodate various learning styles and allow learners to select appropriate activities suited to their own learning style. Lecturers involved in the development of online learning needs to consider how the design of online materials may accommodate students' learning styles and facilitate deep approaches to learning through active engagement with the online materials (Weigel, 2002).

It seems that a breakthrough to help individuals learn is on the way. The eSchoolNews (2008) reports:

> At places such as the Biomedical Imaging Center at Harvard and the Center for the Study of Learning at Georgetown University, researchers are now able to map the effects of various pedagogical techniques on a person's brain activity. It now is possible to observe and catalogue the relationship of sensory input, such as instruction, with brain activity and then correlate that observed activity to learning outcomes. The goal of such work is to identify practices effective with individual learners and, thereby, eventually increase the efficacy of instruction.

Once this has been accepted scientifically, the whole notion of learning styles would become irrelevant as once argued by Jensen (1995, p. 129).

Besides personality, there are many factors contributing towards the vast diversity of students' learning need. Some of these are their social and family status, and attention span. Students' level of knowledge at entry to a course and their individual learning ability are often the greatest challenge for educators. Finally students' disabilities may contribute to the classroom diversity of learning needs. Technology offers flexibility of access from anywhere and anytime, and opportunities to accommodate student

diversities mentioned above individual learning styles to a great extent. The following sections discuss what strategies and support can be provided to learners to address flexibility and individual learning styles.

v) Advance organisers

There is widespread agreement that *prior knowledge* is the largest factor in successful new learning (e.g., Shapiro, 2004) which involves a re-organisation of mental/ cognitive structures. Learning is the incorporation of new knowledge into the network of prior knowledge (Alessi and Trollip, 2001:19-20). The use of advance organiser (Ausubel, 1960) is an instructional strategy for linking learners' prior knowledge with the current requirement and it act as powerful tool for scaffolding. If this knowledge is not provided, learners may develop an inaccurate or incomplete understanding, resulting in the development and retention of faulty themes and misconceptions (Land and Hannafin, 2000; Nicaise and Crane, 1999). Other similar techniques are worked-out examples, and elaborative questions. Advance organizers stimulate higher-level learning (Hannafin, Hannafin, Hooper, Rieber, and Kini, 1996).

vi) Learner control

Unlike instructivist approaches, the constructivist approach suggests that learners should be given control over pacing, sequencing and time period to complete; the actual content is presented on the assumption that learners know what is best for them and are capable of acting appropriately on that knowledge. Deubel (2003) reminds us that the latest interactive multimedia systems and virtual reality environments allow students freedom to learn in their own way, rather than in the way a designer prescribes. A primary teaching strategy is the use of hypertexts that might be used to create learning environments for learning complex, ill-structured knowledge, and that allow students considerable control as they explore and browse through a content domain.

If learners do not meet either assumption, then the computer or teacher is given control of content and learner tasks.

vii) Customisation

Reigeluth (1999) highlights customization as the most important key marker that distinguishes instruction and learning in the Information Age from that of the Industrial Age. Students will require varying degrees of instruction, and there should

be customisation of learning artefacts to the individual learner. Willis and Dickinson (1997) argue that tests and performance evaluations can be customised to the learner's ability, which is a move away from traditional evaluation where all learners do the same test. Customisation in education is made easily possible through the use of ICT. Learner data will be regularly collected through the feedback surveys using tools of the VLE system. This information will inform the instructional designer and course tutor to make necessary changes to the content, and activities. The 'selective tool' of WebCT is a an important tool for customising content and learning activities depending on the needs of the learner, no matter it is a remedial need or advanced learning need.

My view is that learner-control and customization are still necessary and are possible under team-based learning and problem-based learning; this is particularly true with additional support needed by remedial and above-average students.

viii) Variation

Technology can help to present the same phenomenon in different formats to bring the required variation for learning to occur based on the Variation theory of learning. Another theory which calls for more or less multiple presentation of content to enhance learning is the cognitive flexibility. According to these views, instructors can vary the types of content - Images, sounds and text work together to build memory in several areas of the brain and result in better retention of the material.

2.10   Summary

The first part of this chapter discussed the scope of ICTs in HE from various perspectives, the influence of technology on the HE learners, the pressure on higher education institutions to tap the potential of new technology, and the benefits of technology as a cognitive tool; it also outlined the affordances of technology as a research tool in education, as a catalyst for the long-awaited educational transformation in higher education, and finally debates about the impact of technology on education. The literature on the impact of ICT on education revealed that if appropriately used, it can enhance student learning.

Then it reviewed the literature relating to the impact of blended learning approach on higher education and the perceived acceptance of blended learning as a model of

delivery in HE. Having convinced from the literature that the adoption of web-based blended learning can be an effective approach to promote collaboration and engagement in the learning and teaching culture of the University of Botswana, a theoretical framework was formulated. The proposed theoretical framework supports the use of pedagogies that vary between two extremes: instructivist and constructivist approaches with appropriate use of technology to make instructivist activities more student centred, and the entire learning process more interactive and collaborative.

A review of those philosophies and assumptions underlying this study—objectivist, interpretivist, and pragmatic positions— was done. Subsequently, a review of all learning theories appropriate to the framework was done in order to identify appropriate pedagogical dimensions together with their technological affordances to render plausible solutions to the implementation of web-based student-centred learning environments. As blended learning does not have a pedagogy of its own, its strength is drawn from theoretical perspectives of established theories and those derived from them. Subsequently, the technological affordances of technology in general and the WebCT in particular were reviewed in order to match them with the characteristics of blended learning and to provide useful heuristics for creating online and blended learning environments.

Moreover, this chapter addresses the first two specific objectives, the first part of the third one and part of the fifth specific objectives.

The next chapter begins with an overview of instructional and constructivist design principles and models. It further leads to discussion of appropriate approaches to the developments of a blended learning model that will help teachers to design and facilitate blended learning environments for heir students, and thus bring about a shift in focus from instructivist to constructivist student-centred pedagogical approaches.