The Efficacy of an Instructional Model on the Quality of Teaching and Learning Using Assessment

By

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DECLARATION

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material that has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text.

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DEDICATION

My inspirational biblical scripture in Jeremiah Chapter 1, verse 5: "**Before I formed you in the womb I knew you, before you were born I set you apart; I appointed you as a prophet to the nations**" kept me going until completion of my thesis on the 60th year of living and loving.

This doctoral thesis is dedicated to my parents, my late father, Lebohang Peter, and my mother, Gadihele Dorothy, brothers, the late Letshabo Billy, Seeco Jerry, my only sister, Kebogile Lilian, the late Pogisho Eric, and Boitumelo Sylvester.

Last but not least, my lovely, wonderful and supportive family, my wife, Moipone Nerea, my son, Keolopile Gomolemo, my daughter, Boipelo Naledi, , and my stepson, Itumeleng Sidwell, for altruistically allowing me time and space to express myself to the highest academic achievement and performance. I am because you are!

The Almighty God, Bless Us All!

ABSTRACT

The key aim of this study was to investigate the efficacy of the student-centric Integrated Teaching and Learning Model Using Assessment (ITLMUA) to enhance the effectiveness, efficiency and quality of student learning and teaching in a Clinical Technology programme. The ITLMUA provides a pragmatic theoretical framework for developing and enhancing perceptions and conceptions of pedagogics and associated educational and psychological theories, particulary assessment information to review, reflect and improve educational constructs of teaching, learning, assessment and educational research. The efficacy of ITLMUA uses effectiveness, usability and participants' satisfaction as the key criteria in evaluating the impact of ITLMUA on the quality of student learning. The ITLMUA's efficacy is judged in terms of participants finding it academically beneficial, valuable, suitable, useful and meaningful to instructional strategies and practices in higher education (HE).

The motivation for the study is premise on lecturers' adherence to conventional instructional strategies and practices and lack of instructional model that guides and measures the effectiveness and the quality of student learning and teaching. Increased workloads and superfluity of academic gatherings are some of the factors that exacerbate adherence to conventional instructional practices, including lack of academic qualification to understand the princples of educational practice in HE.

This study promote and encourage integrated, authentic, dynamic and innovative instructional practices that demonstrate theoretical interest and practical relevance, such as active learning (AL) that is underpinned by learning theories and pedagogical principles. Furthermore, the study analyzed and identified some of the implementation challenges in introducing the integrated instructional model in a conventional learning environment in order to justify how and why it is imperative to adopt an integrated performance-based instructional model in the face-to-face (F2F) learning environment. The study proposed to provide an instrument that can be utilized to enhance the quality of student learning and teaching. The integrated instructional model can

assist lecturers to reflect on their pedagogical practices with the intention of enhancing their subsequent pedagogical practices and strategies. The theoretical and conceptual framework of ITLMUA offered the lecturers an opportunity to integrate conventional and contemporary instructional practices. These frameworks have previously been underpinned by learning theories and pedagogical principles to enhance the quality of learning and teaching.

Design-based research (DBR) methodology was utilized as it offered a systematic, flexible methodology that is theory-driven, and involves contextually-sensitive design principles and theories of the learning environment. It also offers the opportunity to review and redesign the ITLMUA as the research process develops, and new theoretical and conceptual framework information emerges. In addition, the DBR integrates research, design and practice into a single useful process which results into a usable product that is supported by a theoretical framework. Active learning is one of the teaching strategies that is supported and promoted by this study to improve quality learning and teaching in order for students to comply with and satisfy the academic quality standards and learning outcomes expected of them. This is can be achieved through meaningful engagement and active involvement in academic activities that promote critical analytical skills and competencies through collaborative and cooperative learning, and within a structured, supportive and facilitated learning environment. The learning environment should be characterized by student-centered and lecturer-facilitated instructional practices such as active learning teaching strategies. To enhance the quality of learning and teaching, lecturers attempt to match and modify their teaching strategies to accommodate the wide range of students in their classes, all of whom have different needs and expectations.

Qualitative and quantitative research methods were used to gather data. Data analysis techniques included content analysis, the constant comparative method, factor analysis (FA) to reduce data in order to correlate and relate variables to components. Cronbach's alpha was used to determine reliability of items. The study has demonstrated the utility, usability and efficacy of the ITLMUA as indicated, in the main, by participants' satisfaction with the instructional model. The study reports on some of the enablers and barriers in the implementation and evaluation of the integrated instructional model and articulated the lessons that have been learned in this academic journey.

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LIST OF ACRONYMS

AA	Authentic Assessment
AL	Active Learning
AML	Assessment Model of Learners
BBT	Blooming Biology Tool
BHSAI	Blooming Health Science Assessment Instrument
BTS	Bartlett's Test of Sphericity
CA	Continuous Assessment
CATM	Concept Attainment Teaching Model
CBLM	Competency-Based Learning Models
CMAU	Conceptual Model of Assessment Unit
CHE	Council of Higher Education
CPD	Continued Professional Development
CTMs	Collaborative Teaching Models
DA	Dynamic Assessment
DoBCT	Department of Biomedical and Clinical Technology
DEL	Distance Education Learning
DBR	Design-Based Research
DBRC	Design Based Research Collective
DUT	Durban University of Technology
EFA	Exploratory Factor Analysis
EDMAL	Effective Dynamic Model of Assessment and Learning
FA	Factor Analysis
F2F	Face-to-Face
FoHS	Faculty of Health Sciences
HE	Higher Education
HEIs	Higher Education Institutions
ICT	Information and Communication Technology
IMUAL	Integration Models Using Adventure Learning
IREC	Institutional Research Committee
ITLMUA	Integrated Teaching and Learning Model Using Assessment
IWB	Interactive Whiteboard
KMOMSA	Kaiser-Meyer-Olkin Test of Measure Sampling Adequacy
LPM	Learning Process Model
LPREIIS	Lecturers' Pre-Intervention Interview Schedule
LPREISQ	Lecturers' Pre-Intervention Survey Questionnaire
LPOSTISQ	Lecturers' Post-Intervention Survey Questionnaire
LPOSTIIS	Lecturers' Post-Intervention Interview Schedule
LE	Learning Events
LEM	Learning Events Model
LEQ	Lecturer Evaluation Questionnaire

LOs	Learning Outcomes
MAHE	Model of Assessment in Higher Education
MAS	Model of an Assessment System
MCQs	Multiple-Choice Questions
MDAM	Mindladder Dynamic Assessment Model
MLE	Mediated Learning Experience
MTM	Mastery Teaching Method
OBL	Observational Learning Model
OCLPOA	Observation Checklist for Lecturers' Performance Outcomes Assessment
PA	Peer Assessment
PBT	Problem-Based Teaching
PBAS	Project-Based Assessment System
PC	Personal Coaching
PCA	Principal Component Analysis
PIs	Performance Indicators
3PLM	3P Learning Model
QR	Qualitative Research
RBTEO	Revised Bloom’s Taxonomy of Educational Objectives
RTM	Reflective Teaching Model
SPREIIS	Students' Pre-Intervention Interview Schedule
SPREISQ	Students' Pre-Intervention Survey Questionnaire
SPOSTISQ	Students' Post-Intervention Survey Questionnaire
SPOSTIIS	Students' Post-Intervention Interview Schedule
SEQ	Subject Evaluation Questionnaire
TLA	Teaching, Learning and Assessment
TMAAT	Theoretical Model of Authentic Assessment of Teaching

CHAPTER 1 : INTRODUCTION TO THE RESEARCH STUDY

1.1 INTRODUCTION

The restructured South African educational system is faced with fundamental challenges such as increased and broadened participation in higher education (HE), dwindling fiscal support, and deterioration in the quality of teaching and learning (Department of Education [DoE], 2001). The latter challenge is the focus of this research study. Most instructional practices are still rooted primarily in traditional teaching practices dominated by the behaviorist (stimulus-response) theory, which values students' external behavior rather than internal cognitive state (Graham, 2010; Batson, 2011). This study proposes that a suitable response to the maintenance and promotion of the quality of teaching and learning is the utilization of alternative instructional practices that are dynamic, innovative and authentic in nature (Ryan et al., 2000; Alexandra, 2001; Engelbrecht, 2003; De Civita et al., 2004; Donovan et al., 2004; Scott & Fortune, 2011; Stavroula et al., 2011;). These alternative instructional practices cannot be effected within the currently available instructional models because these are primarily based on behaviourism with some snippets of constructivist learning theory with a focus on making knowledge meaningful and useful.

A challenge in identifying an alternative instructional model by which principles of effective and quality student learning, teaching and assessment could be enhanced, and that will challenge and motivate students and lecturers alike (Dunlap et al., 2012). The researcher designed, implemented and evaluated an instructional model, namely, Integrated Teaching and Learning Model Using Assessment (ITLMUA) using active learning (AL) as a teaching strategy to encourage active participation and engagement in the academic activities of the Clinical Technology programme. The ITLMUA intend to enhance the efficacy and quality of teaching and student learning through influencing the qualitative changes in participants' perceptions, beliefs and performance. The conceptual framework and the underlying rationale for ITLMUA emanates from a variety of learning theories such as cognitivism, constructivism, and socially situated. These theories broadly integrate constructs and principles that describe, explain or predict how people generally learn, and learning is an interactive enterprise among people in the context of their environment (Yuan & McKelvey, 2004; Braungart & Braungart, 2007). Furthermore, these theories propose that the teaching and learning process is improved through active participation, collaboration, cooperation and reflection. Learning processes are theorized to influence learning outcomes (LOs), hence the importance of paying attention to the learning and teaching processes.

The ITLMUA systematically integrates instructional theories and pedagogical principles with the intention of impacting on the quality of instructional practices in HE (Reigeluth, 1999; Keegan, 2000; Engelbrecht, 2003; Noordin et al., 2011; Stavroula et al., 2011; South African Department of Higher Education and Training, 2013). The quality of instruction is gauged by the positive effect on student learning in terms of integration and mastery of content knowledge and pedagogical skills, and students' socio-cultural diversities, and is linked with ongoing reflection on pedagogical practices (Hightower et al., 2011). Quality teaching sets out to help students achieve their expectations and improve outcomes (Hightower et al., 2011). The ITLMUA is not regarded as a one-fits-all instructional model as it is amenable to continuous improvement through iterative and cyclic implementation and evaluation through formative assessment.

The education and health care system in South Africa has undergone rapid and unprecedented evolution and transformation, and as a result, students are expected to engage in continued professional development and life-long learning if they are to remain relevant to their related professional field (Bellack et al., 1999; L'Eplattenier, 2001; Akinsanya & Williams, 2004; William, 2004; van Eekelen., 2005). The HE institutions are expected to deal with fast and fundamental change as a result of the growing need for a new generation of knowledge practitioners who possess higher levels of relevant applicable skills, as well as ability to perform at their optimum under constantly changing and diverse environments. Therefore, the restructuring of the South African HE system and curriculum renewal processes must be undertaken as a direct response to the evolutionary and transformative processes in HE, thereby contributing to social and economic development and growth (DoE, 2001). The transformation principles post-1994 together with the goals of the National Plan for Higher Education (DoE, 2001) emphasized the need for the HE system to produce high quality graduates with the appropriate and requisite knowledge, skills and competencies. The education system needs to ensure the fitness-for-purpose of the HE system, that is, the elements constituting the structures and operations of the system need to be suitable and well-equipped to fulfil the functions which are its raison d'être (DoE, 2001).

The researcher has noted that HE lecturers are faced with the most challenging issue of assessing complex LOs authentically and suggesting alternatives to the conventional instructional models (Moallem, 2007). The assertion that the majority of lecturers in HE never intended to teach, and their reliance on their professional experiences to inform their teaching, confirms lack of most of the lecturers' knowledge of how to teach (Jansen, 2011). The situation is exacerbated by the fact that most lecturers do not possess academic qualifications and do not utilize instructional models to facilitate their teaching, learning and assessment (TLA) practices. The design of the ITLMUA is to assist lecturers to make sense of the educational context in which TLA takes place, and to identify critical points that need intervention to enhance TLA practices in HE sector (Joughin & Macdonald, 2003).

This study used survey questionnaires to elicit participants' responses regarding the efficiency, effectiveness, usability and satisfaction of the efficacy of the ITLMUA. The participants' satisfaction is expressed when participants articulate their appreciation and valuing of the quality of education they experienced in the two academic subjects which were the focus in this study. Semi-structured interviews and class observation assisted in the triangulation of the research data thereby complementing the survey questionnaires results. At the center of this exercise is the lecturers' responsibility to encourage and support students in their academic achievement and performance by providing an environment that enables students to experience a useful and meaningful learning experience (Manaf, 2010).

1.2 INTEGRATED TEACHING AND LEARNING MODEL USING ASSESSMENT (ITLMUA)

The ITLMUA is primarily a student-centric instructional model which was influenced by a review of the literature relating to various instructional models and their associated theoretical philosophies and explanations. The assessment strategy built into ITLMUA is formative in nature and assisted to modify, refine and improve the instructional model design through iterative and cyclical implementation and evaluation of the model (Lin & Hsieh, 2001; Joughin & McDonald, 2003; Osman et al., 2013). It must be noted that the summative assessment results for the two subjects, namely, Biomedical Apparatus & Procedure 2 and Organ & System Pathophysiology 2, were used in the data analysis to determine the effects of ITLMUA interventional strategies. The ITLMUA uses active learning (AL) as influenced by social changes which obligate HE institutions to be responsive to the dynamic and complex reality by educating students to function in professional practice (Mocinic, 2012). Bonwell and Eison (1991) concluded that AL leads to better student attitudes and improvements in student thinking, writing and discussion, surpassing conventional lecturers for retention of subject content material and motivation of students for further study.

The impetus of institutional curriculum renewal occurring at DUT during the time this study was being undertaken, together with the intention to improve the quality of the student learning and the teaching competency and capacity, has influenced the design of the ITLMUA (McLoughlin, 1999; Joughin & Macdonald, 2003). The researcher is of the view that the prototype ITLMUA adequately answers concerns regarding espoused teaching theory, knowledge of students' socio-cultural diversity and dispositions, as well as the lecturers' conceptions of their role and disposition in teaching in HE (Biggs, 2001). The flexible and adaptive nature of the ITLMUA arises from the intricate relationships of interaction and interdependence of its components.

The ITLMUA (Figure 1) was designed to offer lecturers a systematic and transferable methodology to overcome academic structural and operational barriers thereby enhancing the quality of academic activities, which intentionally, will advance sequential academic progress (Malnarich & Lardner, 2003; Fitzgerald, 2012). The researcher is convinced that the utilization of this model and the interaction of this model with other such models will generate ideas and further development of the model which can be powerful in stimulating both lecturers and curriculum development (Malnarich & Lardner, 2003). The ITLMUA represents what lecturers already know, therefore helping them to perceive the pedagogical practices being employed and encouraging them to pursue alternatives so as to enhance the effectiveness and quality of their instructional practices (Joughin & Macdonald, 2003). In the design and development of an instructional model, the variables involved were specified and the relationships between the variables were identified while recognizing that any model needs to be constantly modified to reflect better understanding or address additional dimensions needing further investigation (Joughin & Macdonald, 2003). The major goal of ITLMUA is to put emphasis on educational planning, develop, implement, evaluate, and reflect on learning activities effectively that will cater for diversity of student population ensuring competent performance and academic achievement of students (Isman, 2011). Simply put, effective management of the instructional processes is to apply the instructional model successfully in order to enable students to acquire competency through the impact and efficacy of the model and self-motivation.

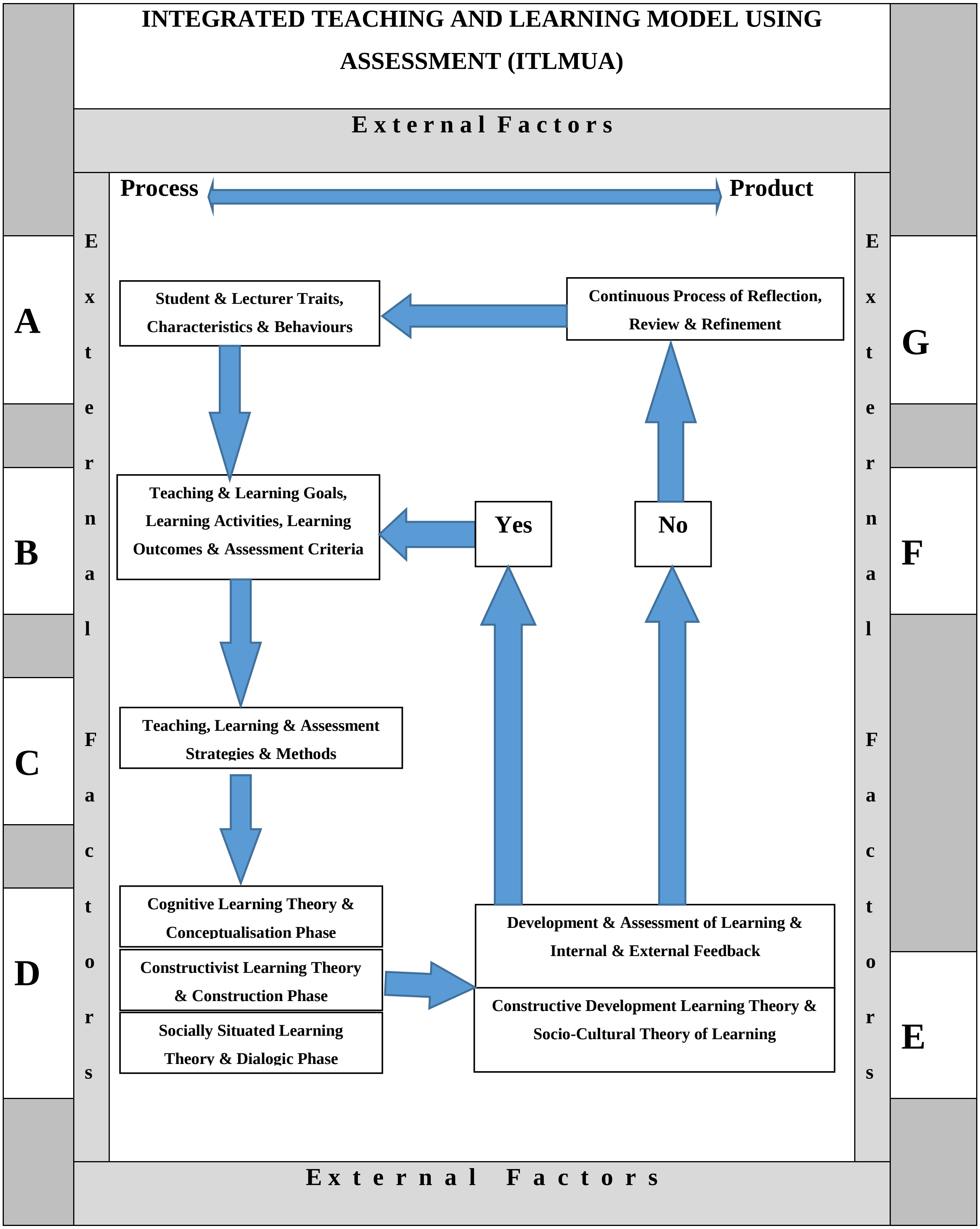

Figure 1: Integrated Teaching and Learning Model Using Assessment (ITLMUA)

Sources: Hadjerrouit, 2008; Yi & Davis, 2003; Anderson & Krathwohl's, (2001); Alonso et al., (2005) The ITLMUA is designed to function within an environment in which learning is being facilitated and its success is dependent on the willingness and commitment of the management and the lecturers involved in the instructional practices of the programmes to follow the model design. The arrows depict the interaction between the components of the model, and demonstrate a cyclical and synergistic relationship among the components and function of the instructional model. The components of ITLMUA are complementary and work in unison to provide quality teaching leading in order to enhanced quality of learning, and in the process promoting systematic and integrative forms of teaching and student learning (Clark, 1999; Nicol, 2007).

Implementation Stages of the ITLMUA

First Stage (A): Determination of Personality and Educational Needs

Knowing student personality is important because the students are the target of instructional activities to be implemented, therefore it is important to get and know information about student characteristics in order to design effective instruction (Isman, 2011). This stage deals with establishing lecturers' and students' characteristics, traits, behaviours and educational needs, i.e. the innate make-up of individuals on which further experiences can be built. It constitutes the foundation for teaching and learning (Voorhees, 2001). Differences in traits and characteristics explain why people possess different learning styles, pursue different learning experiences and acquire different levels and kinds of skills, abilities, knowledge and attitudes. The students' experiences provide opportunities to students to think about subject content in different ways through reflection, i.e. making meaning on personal experiences, as well as kinaesthetic activity and all manner of interaction among subjects, texts and contexts (Fenwick, 2000). The lecturers should make a concerted effort to collect reliable data about the students' backgrounds and their prerequisite learning, particularly an understanding of their individual learning styles to enable tailor-made support (Buckler, 1996; Isman, 2011; Dunlap et al., 2012;). These characteristics, traits, behaviours and educational needs lay a foundation on which learning goals, programme objective and LOs can be built in the second stage (B).

Second Stage (B): Goals, Learning Activities and Outcomes, and Assessment Criteria

The focus is on specifying LOs of each lesson and setting of teaching and learning goals which ignite the teaching and learning cycle (Grant, 2001a) in order to determine the relationship between subject content with students' prior learning experience and to establish individual student and teams responsibilities in order for them to learn and practice what they have learned (Ostad & Soleymanpour, 2014). Lecturers make decisions ahead of time about the nature and type of learning experience to be included, and how they want it to unfold. At this stage, the lecturers and students are developing upfront content performance standards linked to learning outcomes and assessment criteria in order to ensure successful academic responses to instructional strategies as determined in the subsequent stage (Frantz & King, 2000; Bingham, 2002).

Third Stage (C): Instructional Strategies and Methods

According to Lee and Choi (2010), learning strategies are related to students' characteristics such as cognitive intelligence level, motivation and self-esteem which are known as a necessary support in HE and essential for effective lifelong learning as it is difficult to learn something without learning strategies. Weinstein and May (1986) defined learning strategies as behaviours and thoughts that student use to select, organize and integrate new knowledge. The instructional strategies of the ITLMUA pays attention to instruction from both the student perspective and content perspective (Isman, 2011). The focal point is to identify and develop instructional strategies most likely to achieve the anticipated outcomes by matching and aligning instructional strategies with instructional methods and LOs so that teaching and learning process can be facilitated. It is at this point where the lecturers should modify their teaching styles to accommodate the diverse learning styles of the students. The lessons LOs are clarified and differentiated to ensure that all students sufficiently benefit from the lesson and develop learning activities that engage students as active students. In addition, the lecturers need to ensure the acquisition of resources and supplies needed for the lesson and appropriate accommodation for special needs students. It is at this stage where classroom rules, expectations and procedures are articulated to minimize down time and maintain student discipline, reinforces positive student behaviour, and modeling of honesty, integrity and personal responsibility and accountability. Expectation reflects excellent and adequate performance, not just effort, and has little or no connection to effectiveness. Furthermore, students are encouraged to be active participants in the teaching-learning process, and to comply with timely completion of assigned learning activities.

Fourth Stage (D): Learning Theories

The theoretical foundation of the ITLMUA emanates from a blend of cognitive, constructivist and socially situtated learning theories views. The cognitivist view is to construct new knowledge based on students' lecturer's designed meaningful experiences in the learning environment, which encourages students' to engage in discussions and collaborative learning activities (Isman, 2011). The constructivist view focuses on learning by doing through AL strategies, where students are urged to be actively involved in the teaching-learning-assessment processes representative of the real-life environment (Isman, 2011). At this stage, the lecturers use a subtle combination of learning to explain the new subjects concepts and principles in an attempt to help the students in better understanding, and trying to reinforce learning stability and creativity (Ostad & Soleymanpour, 2014). The learning theories are integrated at three different levels during the lesson to enable provision of an appropriate learning environment to improve the quality of teaching and learning effectiveness (Osman et al., 2012). It is at this stage, the lecturers are expected to support and guide students' assumptions with regard to teaching, learning and assessment practices in HE environment, and allowed to be involved in the practice teaching and assessment (Ostad & Soleymanpour, 2014). The lectures correct students' mistakes and commend their academic achievement to boost their intrinsic motivation.

Fifth Stage (E): Assessment and Feedback

This stage focus on assessment and monitoring of student learning outcomes in a systematic, integrated and authentic manner and consists of components of assessment that complement each other (McGourty et al., 2000; Zhang et al., 2006). Constructive-development theories could be used not only to monitor students' progress towards attainment of learning goals, but also to support students in achieving their goal. Thereby, contributing directly to the developmental outcomes of HE (Taylor & Marienau, 1997). The understanding of the impact of formative assessment on student learning and development could be used to evaluate programme's assessment approaches and practices (Taylor & Marienau, 1997). Assessment information can be used to enhance the effectiveness and quality of TLA and to refine and modify the ITLMUA (Seok-Hoon et al., 2005).

Sixth Stage (F): Evaluation of Learning and Teaching

This stage evaluates the academic achievement of the LOs and meeting of the teaching and learning goals as evident in the assessment practices in the fifth stage, such as effective and quality student learning and teaching as return on investment (Eseryel, 2002). The ITLMUA encourages lecturers to engage in a continuous and iterative process of reviewing and reflection of their subject content and sequencing, teaching, learning and assessment practices (Taylor & Marienau, 1997). The positive outcome leads to the seventh stage (G), and the negative outcome leads to the second stage (B) to review all instructional activities alignment with regard to purpose and objectives, including possibility of redesigning the ITLMUA. The ITLMUA is sensitive and responsive to external factors such as the restructuring of South African HE system and curriculum renewal process geared to be evolutionary and transformative by design.

(Huitt, 2003), which might be affected by the internal process of individual components of the model (Lunenburg, 2011). It must be borne in mind that evaluation of the ITLMUA is formative and continuous throughout the process to improve interventions, and use all the variables in the previous steps to predict or relate to the variables measured in sixth stage (F) (Huitt, 2003).

Seventh Stage (G): Critical Reflection

This stage deals with the practice of reflective thinking skills in both the students and the lecturers in their learning and teaching in an attempt to promote and enhance critical thinking, which is the process of analysing and making judgments about their experiences (Choy & Oo, 2012). The students and lecturers are provided with an opportunity to step back and think of the best strategies to achieve learning and teaching goals, respectively (Rudd, 2007). Retrospectively, the reflection can be used to incorporate prior experiences and how these experiences could influence the current instructional practices, that is, the capability to assess the authenticity and relevance of own practices (Choy & Oo, 2012).

1.3 ACTIVE LEARNING (AL) TEACHING STRATEGY

Lecturing has unwittingly dominated HE and remains the most frequent method of instruction as it is a convenient and efficient way to deliver subject content to large numbers of students, notwithstanding strong evidence that quality learning is better achieved through utilization of alternative and dynamic methods and strategies of teaching (Buehl, 2001; Marzano et al., 2001; Svinicki & McKeachie, 2011; Lambert, 2012). The AL, as an independent variable, is student-centred and an effective teaching strategy used in this study. The lecturers' desires are to increase the quality of the student useful and meaningful learning experience by allowing them to be active participants in the development of their knowledge (Weimer, 2002). The AL engages students in the learning process by doing useful and meaningful learning activities where they think about what they are doing during lectures, and engaged in activities that have been designed around important LOs, and think about what they are learning (Ruhl et al., 1987; Prince, 2004).

The most commonly cited definition of AL emanates from Bonwell and Eison (1991): "Involving students in doing things and thinking about what they doing." The students are encouraged to engage in learning activities that involve reading, writing, discussing or problem solving. Zull (2011) uses metacognition to underscore the need for students to think about what they are doing since metacognition lies at the heart of all learning. Ambrose et al. (2010:3) define learning in terms of action and experience that it is "a process that leads to change, which occurs as a result of experience and increases the potential for improved performance and future learning." Four key elements characterize all AL approaches: (1) critical thinking promoted through high-order thinking tasks based on Bloom's (1956) taxonomy: analysis, synthesis, evaluation, and using alternatives ways of approaching problems, (2) individual responsibility for learning, (3) involvement in open-ended activities, and (4) organization of learning activities by the lecturer.

The lecturers are urged to use collaborative and cooperative learning, where students are required to be grouped together for accountability and are individually responsible for their own learning. The group assignments involve students in assessment practices through self and peer assessments, where individual contribution is determined with regard to group assignments. In this instances of AL, the lecturer becomes responsible to engage students in learning, becomes less transmitter of knowledge and more designer and facilitator of learning experiences and opportunities (Smith et al., 2005)

Generally, AL focuses on the provision of meaningful opportunities and active student engagement, interaction and active participation in subject-related activities, rather than being merely passive recipients of information and knowledge (Meyers & Jones, 1993; Huitt, 2003; Felder & Brent, 2009; Eison, 2010). The concepts and principles of AL are championed in this research study by promoting active and participative interaction with learning materials through dialoguing with text in the margins (Bonwell & Eison, 1991). Active learning compels students to learn not only information transfer through memorization, but also higher order thinking about the subject which is a valuable skill in health sciences where the paradigms and ideas are quickly changing and growing in number (Boyer, 1990; Michel et al., 2009; Eison, 2010).

There is extensive and credible evidence that suggests that HE should consider alternative instructional models that would promote dependent variables such as academic achievement and positive student attitudes (Prince, 2004). Studies have noted that student involvement in learning activities that have been designed around significant LOs and activities compels students to thoughtfully and effectively engage in their studies, and significantly improved student performance as a result of the nature of active engagement in worthwhile learning activities (Redish., 1997; Hake, 1998; Laws, 1999;). Student involvement is one of the most significant predictors of improvement in student performance and success in HE (Prince 2004).

In AL, activities such as think-pair-share, think-aloud pair problem solving, clarification pauses, rotational questions and answers and team-based learning, have gained momentous interest among lecturers in HE (Silberman, 1996; Meyers & Jones, 1993; Bonwell & Eison, 1991). Active Learning (AL) activities range from listening, which assists students to absorb what they hear, to writing short notes in which students respond to lecture material, to complex team-based activities where students apply subject material to real-life clinical situations or new problems (Faust & Paulson, 1998). Faust and Paulson (1998) define AL as any learning activity engaged in by students in a classroom other than listening passively to the lecturers' teaching. Prince (2004) considered that AL could be achieved by any method of teaching which actively involves students in the process of authentic learning, and this mode of learning supersedes memorizing and repetition of what is delivered in class. The essence of this type of learning is constant intellectual participation in the learning process. Active Learning was utilized in this research study not as alternative to, but as an enhancement of the lecture-based modes of teaching (Faust & Paulson, 1998). The researcher advised that lectures are very efficient in presenting factual knowledge to students, and lectures could be complemented with variations of AL so that students' learning experience could be enhanced.

The study also utilised student-centric AL instructional methods of collaborative and cooperative learning where students at various performance level are expected to engage in learning activities in small teams toward a common academic goal while being assessed individually (Gokhale, 1995; Prince, 2004). A core element of collaborative learning is the emphasis on student interaction and focuses on how collaboration influences LOs, with the success of one student helping other students to be successful (Gokhale, 1995; Prince, 2004). Collaborative learning improves students' academic achievement, performance and quality of interpersonal interaction (Prince, 2004). In implementing collaborative learning, lecturers are expected to clearly specify the academic tasks, related assessment criteria and the responsibilities of each member (Gokhale, 1995). Cooperative learning maximizes the learning and satisfaction that ensues from working as a high-performance team, and this instructional method used in conjunction with conventional lecture-mode instruction makes cooperative learning an effective teaching strategy in the HE sector (Johnson et al., 2000). Cooperatively taught students tend to demonstrate higher academic achievement, superior determination through graduation, enhanced levels of reasoning and critical thinking skills, deep understanding of learned material, appropriate time on task and less disruptive behaviour in lecture room (Felder & Brent, 2007).

This study investigated the effect of more efficient and effective instructional strategies of quality teaching, such as AL, at a higher educational level for acquisition not only of new knowledge but also skills and attitudes in response to the requirements of rapidly evolving technological, socio-cultural and professional practice changes (Mocinic, 2010). The significant change is the shift from lecturer-centered instructional practice with a focus in transmit knowledge to passive student recipients, to actively engaging and participating students who are focused in the process of construction, creating and applying knowledge in an authentic professional environment. The essence of such an instructional practice encourages and supports constant intellectual participation in the teaching-learning process and relationship (Mocinic, 2010). This study advocates not only engagement and participation but also involvement of students in the teaching and assessment of curriculum content through peer teaching, self and peer assessment (PA), in order to foster development of their procedural knowledge and its integration with declarative and metacognitive knowledge and assessment skills. According to Biggs (1999) PA can provide a close relationship between assessment and intended LOs, especially for team-based work where teamwork is one of the intended LOs. It can facilitate greater learning as it encourages students to reflect more on their learning.

One of the aims of this study was to direct attention to teaching strategies which foster AL and acquisition not only of new knowledge but also skills and attitudes in response to the requirements of the rapid technological development and contemporary labour markets (Mocinic, 2012). Biggs (1999) indicated that peer assessment (PA) can also provide a close relationship between the assessment and intended LOs, especially for team-based work where teamwork is one of the intended LOs, and that it can facilitate greater learning as it encourages students to reflect more on their learning. The Revised Taxonomy of Educational Objectives can assist lecturers in planning their instructional activities to be responsive to students' diversity, the level of complexity and to comply with academic standards and achievement of LOs (Krathwohl, 2002).

1.4 THE AIM AND FOCUS OF THE RESEARCH STUDY

The aim of this study was to provide an instructional model that offers a theoretical framework in developing and enhancing teaching, learning and assessment (TLA), and to provide a tool that can be exploited to enhance the quality of learning and teaching. This study arises partly from the researcher's realization that there may be a mismatch between what lecturers teach and what students learn based on numerous factors such as lack of instructional model, lack of knowledge about teaching and learning styles and students' needs. The ITLMUA can assist lecturers to reflect on their pedagogical practices in order to deliver student-centered teaching strategies. Therefore, the focus of this study is on the utilization of the ITLMUA to enhance the effectiveness and quality of teaching and learning in order to maximize useful and meaningful student learning experiences.

The assertion was premised on the concept that instructional models help lecturers to create and explain their pedagogical practices so that the quality of students' learning experience is positively influenced. The academic benefit accrued as a result of the experience may result in a better understanding of complex educational matters in a structured, supportive and facilitated learning environment (Buckler, 1996; Leclercq & Poumay, 2005). The pillars of focus are the value of the model, its utility and effectiveness as well as participants' satisfaction with the implementation of the instructional model (Stufflebeam, 2001).

1.5 THE OBJECTIVES OF THE RESEARCH STUDY

The objectives were as follows:

- To provide a systematic and integrated instructional model that would assist lecturers in HE to provide quality education based on sound educational theories and pedagogical principles.
- To promote and facilitate continuous enhancement, creativity and innovations in the offering and delivery of quality education in educational programmes in HE to inform the generation of new theory.
- To encourage and support integration and complementary utilization of conventional and alternative instructional strategies and methodologies to positively impact the quality of educational provision in HE.

1.6 THE RESEARCH QUESTIONS

The research questions were as follows:

- What are students' perceptions of the impact of the current pedagogical practices on the quality of their learning, teaching and assessment in the Clinical Technology programme?
- What are the dynamics and effects of the ITLMUA model on enhancement of the quality of teaching and student learning?
- What transformative pedagogical strategies and practices enhance the quality of students' learning experience, teaching and assessment?

It is the researcher's hope that the ITLMUA evaluation of its efficacy on effective and quality student learning and teaching will have an impact on student learning and teaching, particularly on the quality of educational offering in HE.

CHAPTER 2 : LITERATURE REVIEW, THEORETICAL AND CONCEPTUAL FRAMEWORK

2.1 INTRODUCTION

This chapter will discuss previous literature in relation to the ITLMUA. In doing so, this chapter will note emphasis, strengths and weaknesses/limitations of the previous instructional models. The instructional models describe the main ideas and variables in the teaching and learning processes as they detailed valuable representations of the knowledge needed when solving educational problems (Gage & Berliner, 1992; McIlrath & Huitt, 1995). Furthermore, instructional models assist lecturers to create and explain their instructional practices through utilization of the models, and facilitate a learning environment that provide opportunities for innovation and improvement (Kong, 2008; Lunenburg, 2011; Noordin, 2011; ; Osman et al., 2013; Ostad & Soleymanpour, 2014).

This study acknowledged the importance of both students' and lecturers' traits, characteristics and behaviours in students' achievement of LOs and lecturers' expectations as these are the basic for learning and further experience, and predictors of students' attainment and effective and quality teaching (McIlrath & Huitt, 1995; Voorhees, 2001). Individual student diversity helps in explaining why students pursue diverse learning experiences and acquire varied levels and kinds of skills, abilities and knowledge (Voorhees, 2001). In addition, the compatibility of students' varied learning styles and lecturer teaching style through modification to accommodate the varied learning and teaching styles enhances the effectiveness and quality of student learning experiences (Felder & Henriques, 1995).

It is the duty of institutions of HE to provide students with effective and quality education, and to ensure that students are given adequate time and space to learn information taught at the university (McIlrath & Huitt, 1995). The measure of academic quality is based on the lecturers' ability to ensure that the students are actively involved in self-regulated learning by setting authentic learning tasks that are responsive to students' needs (Siong et al., 2010; Cano-Hurtado et al., 2011). Effective and quality instruction means that the lecturers should:

- Organize subject content into manageable learning units;
- Develop specific LOs for each unit and appropriate and relevant methods of assessment;
- Plan and implement appropriate and relevant team teaching strategies, sufficient time allocations, practice opportunities and remedial re-teaching, and where possible, re-assessment, in order for students to attain required benchmarks and standards (Bloom, 1976).

The information from review of seminal literature, particularly regarding instructional models, have assisted in further refinement and theorizing of the researcher's self-designed ITLMUA with the purpose of bridging the gap and restricting the limitation of quality enhancement in student learning and teaching (Hofstee, 2006;Galvan, 2006). The ITLMUA provide alternative instructional strategies to assist students to engage in AL and problem-based learning (PBL) so that students are actively participating and engaging in the learning processes facilitated by the lecturers (Bonwell & Eison, 1991; Meyers & Jones, 1993; Felder & Brent, 2009; Yuan & McKelvey, 2004; Leclercq & Poumay, 2005). Workplace environment expects the 21st century students to possess the skills to analyze, synthesize, and apply knowledge in differentiated situiations, and ability to address new challenges, design solutions, collaborate effectively, and communicate persuasively (Baker, 2008).

The conventional teaching strategies are embedded on superficial learning of rote learning, memorization, recitation and extraction, where the lecturers are tramsmitting informational and factual knowledge to passive students who will recall and regurgitate the same information during assessment (Bonwell & Eison, 1991; Buehl, 2001; Kort & Reilly, undated). The ITLMUA embraces both superficial and deep learning approaches, the latter being focused on abstraction of meaning and interpretative processes of learning, and encourages technology and online integration to further innovative learning and teaching (McLellan, 1994; Richardson, 2005; Doering & Veletsiano, 2008). This research study supports and promotes blended instructional strategies of face-to-face (F2F) in combination with web-based instruction to deliver, assess and provide feedback to students to enhance the quality of learning and teaching through AL (Engelbrecht, 2003; Dureva & Tuparov, 2006; Cao & Chang, 2009; Noordin et al., 2011; Kong, 2008; Osman et al., 2013; Wu, Zhou, & Duan, 2013). The South African education system needs a shift from rote learning to meaningful learning suited for the information and communication technology (ICT) age (Senge, 1990; Reigeluth, 1999).

The ITLMUA encourages to conduct student profiling to ascertain student prior knowledge and experiences in order to set appropriate, relevant and authentic learning tasks that are pertinent to diverse student interpretation and requirements (McLoughlin, 1999; Oxford, 2003; Huitt, 1995; Havnes & Aamodt, 2005; Nicol & Macfarlane, 2006). Academic success is not measured only in terms of what students acquire, retain and retrieve, but what students are capable of doing with what is acquired in the teaching and learning process (Yuan & McKelvey, 2004; Crowe et al., 2008;). The assertion by Parri (2006) that quality standards resonate with astute students to maintain quality output does not augur well in relation to the national call for access to HE of the previously disadvantaged student population. The transformation of the educational system requires academics to reflect on their pedagogical practices with a view to appraise their teaching, learning and assessment (TLA) strategies.

Current instructional models are focused on increasing quantitative indices of test results, and adopt a technocratic and positivist stance that fail to mediate society's needs when stakeholders are more concerned about an instructional model that would develop students' character, self-esteem and social development (Gallup, 1980; Squires et al., 1983; Proctor, 1984; ; Yi & Davis, 2003; Hadjerrouit, 2008; Kong, 2008). The ITLMUA integrates instructional strategies that are underpinned by learning theories and AL strategies to promote content conceptualization, construction and engagement dialogic discussions. The ITLMUA went through a series of iterative and cyclic implementation, evaluation and refinement stages in an authentic real-life educational environment in order to enhance the quality of TLA.

The AL approach is student-centred, promotes meaningful and useful quality learning, and shift power balance to the students, with accrued benefits where students become responsible for their own learning. Students are motivated to yield better LOs and academic achievement that are lecturer-facilitated (Weimer, 2002; Yuen & Hau, 2006; Behar-Horenstein & Niu, 2013). Pascarelli and Terenzini (2007) noted that students learn at their best when engaged in a collaborative, cooperative and engaging learning environment, and the instructional strategies that are integrated as in the implementation of ITLMUA's instructional strategies that are underpinned by learning theories and pedagogical principles. The reliance on conventional instructional strategies and the familiarity with these strategies, has made lecturers to adopt a lackadaisical attitude towards alternative teaching strategies such as AL, and lack of intergrated instructional model like ITLMUA that promote self-awareness and reflective practice (Behar-Horenstein & Niu, 2013). This research study provided effective guidance by initially attempting to understand the currently existing pedagogical practices that lecturers are using in order to gradually persuade them to change. Marchant et al., (2003) noted that lecturers must be proficient in assessing students' achievement and performance in relation to the specified learning outcomes and goals, and be cognizant of the diverse learning strategies and students' needs in order to match and align teaching strategies to accommodate student diversity, and use instructional information to reflect on practices with a view to improve instructional strategies and activities.

The efficacy of the ITLMUA was evaluated formatively on variables such as effectiveness, usability and satisfaction from participants' subjective views, based on their ability to teach and learn how to interpret, integrate and construct knowledge in a meaningful and authentic manner using prior knowledge and experience, and develop self-regulated and self-directed learning (Kegan, 1980; Bruner, 1990; McCauley et al., 2006; Hadjerrouit, 2008). The goal of ITLMUA is to encourage participants to comprehend conceptual interrelationships and interrelatedness of the subject content across disciplines in order to develop the ability to rebuild information in a logical manner by using their own intuition and perceptual experiences, beliefs and values within the social milieu in which education operates by modeling, imitation and observational learning (Kegan, 1980; Merriam et al., 2007; Hadjerrouit, 2008).

2.2 ASSURING AND ENHANCING QUALITY IN HIGHER EDUCATION (HE)

The HE acknowledge quality teaching and learning as the main pillars of the vision, mission and espoused strategy for the educational system, and central to ITLMUA is effective and quality teaching and learning which are shaped by the quality of educational offering and the appropriate academic and professional qualification of the lecturing staff (South African Qualifications Authority [SAQA], 2001; Cochran-Smith, 2001; Darling-Hammond & Bransford, 2006; Barber & Mourshed, 2007; Pouyioutas & Apraksine, 2015). This research study is premised on prospective quality assurance which assures that instructional activities continue to fit the purpose of the university and the subjects offered, and ensure continued professional development through quality enhancement, rather than making summative judgment against external standards and accountability as envisaged in retrospective quality assurance (Biggs, 2001).

There is no one-size-fits-all definition of quality and this study espouses two definitions of quality: (1) fit for the purpose of teaching and research, with emphasis on effective and high quality student learning demonstratable in the achievement of publicly recognizable standards and learning outcomes (Parri, 2006; Goe, 2007), and (2) quality as transforming the mindset of the students in terms of understanding, attitudes and objectives which evolve in the course of the study process (Parri, 2006). A quality definition should meet the students' explicitly articulated needs and wishes, organized and ready to transform students' perceptions of the world in the way they apply their knowledge in the real world (Harvey & Green, 1993; Biggs, 2001). Furthermore, it should transform lecturers' conception of their roles and responsibilities, and the culture of the institutions, since it is applied differently in similar and distinctive situations (Biggs, 2001; Goe, 2007).

This study is concerned with effective quality teaching and learning, and compliance and achievement of standards and LOs (Harvey & Green, 1993). The quality of time and effort exerted by students and lecturers in execution of their academic activities has leverage direct relationship with the academic standing of the institution, and students should take advantage of the institutional support and facilitation in meeting their quality standards and LOs (Lomas, 2002; Pascarella & Terenzini, 2005). The academic quality efforts of the institution should be responsive to the needs and desires of the community it serves, and seek to fulfil and meet its statutory mandate of offering high quality education. The quality of education is based on what the institutions of higher learning has promised to offer, and quality is linked to the effectiveness and efficiency of the instruction delivered (Scott et al., 1996; Tam, 2001; Parri, 2006). The institutional objective is to produce quality students who are cognitively transformed, possesses intellectual aptitudes, skills and experience to manage effectively and efficiently the workplace (Parri, 2006).

2.2.1 Lecturers' Conception of Quality Teaching

The underlying conceptions of the quality of teaching is reflected on the different approaches lecturers adopt to teaching, although they are confronted with the same teaching context (Richardson, 2005). The lecturers' conception of quality teaching undergoes conceptual and developmental change with experience and further academic qualifications, with a shift from lecturer-centered and content-orientated to student-centered and learning orientated (Norton, 2005; Richardson, 2005). Although conceptions of teaching are diferent across different disciplines, they are relatively similar in similar disciplines at different academic institutions (Norton et al., 2005). The interviews carried out with the lecturers identified and confirmed the varied conception of teaching of imparting knowledge, facilitating understanding, bringing conceptual change and intellectual development and growth in students (Kember, 1997).

The embeddedness of learning theories, alternative TLA strategies and alternative instructional strategies that are theoretically interesting and demonstrate authentic practical relevance form part of the ITLMUA, which can be exploited by lecturers to define and develop their understanding of instructional strategies and practices used in HE (Richardson, 2005). Enhancement of instructional practices have a significant impact on the quality of instructional activities, and subsequently on students' meaningful and useful learning, and increase knowledge and portable skills in students (Hightower et al., 2011; Lombardi, 2007; Stein et al., 20004; Entwistle & Entwistle, 1992). Biggs (2001), noted that lecturers' conception of their pedagogical roles and responsibilities is enhanced by transformative effective and quality pedagogical processes that would satisfy the students' needs and aspirations.

The increased lecturing and academic administrative loads as consequences of staff shortages, inadequate academic development programs, and plethora of interminable meetings sway lecturers to adhere to conventional instructional practices to the detriment of effective and quality student learning (Alonso et al., 2005; Campbell, 2008). This study supports the possession of teaching qualification over and above the professional qualification, requisite professional work-related experience and expertise, as they are not necessarily related to an improvement in effective, quality, meaningful and useful student learning experience (Marzano et al., 2001; Anspaugh & Ezell, 2007; Crowe et al., 2008; Meeks et al., 2009; Pianta & Hamre, 2009; Hightower et al., 2011).

2.2.2 Students' Conception of Quality of Learning

The students' learning approaches to learning tasks are linked to their conception of the effective and quality instructional practices which could be influenced by programme design, valuable teaching and assessment practices and methods (Richardson, 2005). Quality education is dependent on consistently admitting high achieving students during selection processes, and should satisfy standards and goals of the institution. Each institution should have their own aspiration and goals to attain in order to guarantee high quality, competent and skilled graduates (Braxton & Nordvall, 1985). Admittance of low-to-moderate achievement gap students could be narrowed by specialist lecturers who would adopt alternative pedagogical strategies and practices.

The utilization of AL and problem-solving strategies in ITLMUA could enhance students' conception of quality learning and teaching, and encourage them to actively participate in the teaching-learning process, thereby enhancing student learning (Bonwell & Eison, 1991; Steward-Winfield & Black, 2005; Michel et al., 2009). Passive approach to learning, as evident in the instructional model that utilizes single instructional construct, promotes students surface approach to learning (Marton & Saljo, 1976a). The researcher assumed that ITLMUA might be effective in changing the effects of contextual factors mediated by students' perceptions of their academic environment, and students' approaches to learning (Richardson, 2005).

A systemic pedagogical approach encourages students to shift from an individual-oriented approach to learning to a socially-oriented approach which enables them to integrate learning activities and lecturers' activities (Bigg's, 1993). The systemic approach encourages peer student interaction by promoting and advancing quality independent and interdependent social learning process; asserts the quality of teaching, didactic structures and characteristics of institutional context; determines the quality of information so as to determine the nature and degree of quality of student learning; measures achievement and success; and ensures maintenance of standards (Joughin & Macdonald, 2003). The concept of quality must be transformative to the extent that students' perceptions about quality education is modified and transformed so that they have the capacity and ability to apply their knowledge in real-life situations through problem-solving skills acquired from higher education institutions.

2.2.3 Quality Indicators for Teaching and Learning

The performance indicators (PIs) were used to determine the effectiveness, usability and satisfaction of the impact of the implementation of ITLMUA based on the perceptions and responses of the participants. The PIs provide evidence to determine the extent to which the aims and objectives of the research have been met (Rowe & Lievesley, 2002). The PIs were used to indicate the level of correlation and reliability among the measured variables, and supplemented with qualitative judgments so that they could be used as valuable yardstick by showing aggregate-level of association between the quality of student learning and their perceptions (Ball & Halwachi, 1987; Ramsden, 1991; Rowe & Lievesly, 2002;). The PIs were used to refine the model and assisted in theory generation to justify the efficacy of ITLMUA in enhancing the provision of quality teaching in order to advance the quality of student learning (Rowe & Lievesly, 2002).

It is important for lecturers and students to be conscious of the purpose of the instructional and learning activities to be able to understand what is it that is to be achieved by using appropriate action terms (verbs) as guided by Bloom's Taxonomy, and to be able to ask and answer questions for the purpose of effective and quality teaching and learning (Seymour, 1993). Individual PIs do not represent whole quality as quality does not reside in any one PI but in the way the educational system as a whole functions, and the identified PIs must adequately and directly measure the quality of pedagogical practices and learning (Seymour, 1993; Harvey, 1998). The key factors to quality teaching in higher education includes, but are not limited to, clear articulation of teaching and learning goals and standards, clarity of explanation at students' level of comprehension and understanding, the learning material and content to be pitched at the appropriate level, judging and monitoring academic progress toward goals and standards against some past benchmarks, cooperative and collaborative behaviours and suitably challenging academic environment (Ramsden, 1991; Shavelson et al., 1991). As for lecturers, key factors include: years of academic training in the discipline taught, possession of credentials in the subject taught, measured subject-content knowledge, measured pedagogical and didactic knowledge and translatable subject-content knowledge to students' level (Ramsden, 1991; Shavelson et al., 1991).

The researcher's self-designed ITLMUA begins with individual lecturers 'internalizing' the alternative, innovative dynamic teaching and learning strategies, pertinent subject content designed as thematic learning units and their associated learning outcomes before delivering to the students in class. The ITLMUA does not rely on one performance indicator but on a variety of both qualitative and quantitative data generated from multiple research methods, and encourages lecturers to operate from an "espoused theory of teaching" based on the public scholarship of teaching with integration of theory and practice (Boyer, 1990; Biggs, 2001). The alignment of instructional practices and activities with standards and LOs is paramount for improvement of instruction and student learning (Polikoff, 2013). The varied PIs can be used to determine the quality, effectiveness, efficiency and satisfaction of the instructional activities in higher education by using, among other things, student evaluation of instruction (Feldman, 1978; Marsh, 1987; McKeachie, 1983; Centra, 1980;).

2.3 INSTRUCTIONAL ALIGNMENT IN HIGHER EDUCATION (HE)

In the educational context, the definition of 'alignment' is broadly described as the degree to which the components of an educational system such as standards, curricula, assessments and instruction, work together to achieve desired instructional goals (Webb, 1997b; Resnick et al., 2003). The success of a learning environment is determined by the degree of alignment among the critical factors such as teaching and learning goals and tasks, subject content, LOs, assessment, students' and lecturers' roles and responsibilities (Reeves, 2006). The most common misalignment factor in higher education is assessment. The conception of alignment has become increasingly sophisticated to meet the educational goals for strengthening education systems and to satisfy rigorous requirements for accountability assessments (Reeves, 2006). The process of establishing the relationship between assessment and content standards is required for any assessment to be considered rigorous, high quality and valid (Case et al., 2004).

Educational alignment occurs when lecturers have high quality content and advanced instructional designs, but focus their assessment strategies on what is easy to assess rather than on what is important to assess (Reeves, 2006). Assessment systems at HE seek to improve alignment between a coherent mechanism of instructional expectations and assessment practices, and this could be achieved by instructional alignment which seek to develop deep and lasting changes in students' approach to learning and teaching (Webb, 1997a). Aligning instructional goals and expectation carefully with the assessment system is an important tool for monitoring students learning progress as they proceed through the system, allocating subjects responsibly to lecturers, and verifying when student knowledge of important ideas is attained (Webb, 1997a). Unnecessary repetition in the assessment system in higher education can be trimmed by carefully analyzing expectations and assessment alignment to avoid over-assessing a few LOs at the expense of overlooking others, and to ensure that students are being assessed on what they are expected to know (Webb, 1997a).

2.4 ACADEMIC INSTRUCTIONAL MODELS

Tregidgo and Ratcliffe (2000) described a model as the outcome of representing an object, phenomenon or idea with a more familiar one, and the model can only relate to some properties of the target (Ornek, 2008). The effectiveness and efficiency of the educational system is fraught with challenges that cause it to fail to provide equitable and effective quality education to meet achievement gaps of students (Brooks-Gunn & Duncan, 1997; De Civita et al., 2004; Stavroula et al., 2011). The interventional effectiveness of ITLMUA was determined by the degree to which it accomplishes its aims, purpose and objectives, with its efficiency measured by the research techniques used in an attempt to produce valid and reliable results (Ball & Halwachi, 1987). Currently available instructional models demonstrate profound differences in values, ideologies and degrees of relatedness. They are mutually supportive of each other, but fall short in regard to taking into account student diversity and facilitation of a differentiated system of education that is responsive of students' needs (Tomlinson et al., 1998; Buckler, 1996).

The ITLMUA takes into consideration the varied personalities of both students and lecturers, including their general approaches to learning and teaching, and contextual factors such as the social climate of institutions of HE, and the impact on the effectiveness, efficiency and quality of learning and instructional practices (Oxford, 2003). This model also takes into consideration psychological and educational theories utilized in the provision of HE, and assessment strategies used which may affect students' achievement and performance. The ITLMUA advocates for utilization of alternative instructional strategies in order to address these limiting factors, which may, inadvertently, impact on the effectiveness and quality of teaching and student learning.

The use of instructional models results in greater subject content delivery as a result of resources provision, structural system support, academic learning time, quality instruction and a positive influence on students' and lecturers' attitudes and motivation (Oliva, 2009; Mehlenbacher, 2005). The ITLMUA seeks to stimulate students to improve their learning strategies, which is defined as specific actions, behaviours, techniques that students used to enhance their quality learning (Scarcella & Oxford, 1992). Learning styles and strategies can work in concord or in discord, and this has an impact on performance, with good performance involving a feeling of confidence and low apprehension, and poor performance involving a feeling of self-doubt, thereby leading to a deterioration of lecturer-student interaction (Oxford (2003).

The definition of an instructional model is that it is a theoretical reference framework that is a representation of instructional activities with varied concepts, principles, ideas and patterns that guide academic activities that are systematic, interactive and integrative in order to leverage quality learning and teaching (Lunenburg, 2001). Current instructional models focus on single constructs of TLA, and incorporate computer-based cognitive tools, but lack integration of educational and psychological theories and pedagogical principles. They are intended to increase assessment scores so that low throughput rates are reversed and government subsidies are increased (Holland, 2001; Voorhees, 2001; Nichols, 2003; Yi & Davis, 2003; Alonso et al., 2005; Moallem, 2007; Doering & Veletsianos, 2008; Kong, 2008; Hadjerrouit, 2008; Chatti et al., 2010; Jansen, 2011).

2.4.1 Review of Instructional Models in Relation to ITLMUA

Buckler (1996) cautioned that for any HE institution to survive and be successful in today's rapidly changing environment, it has to make sure the rate of learning surpasses the rate of change imposed on it. Models should help lecturers to describe their teaching sequences and teaching strategies within a theoretical reference framework, including their underpinning educational and psychological theories (Leclercq & Poumay, 2005). The qualitative resolve, relevancy and appropriateness of any instructional model depends, among other factors, on its power to reduce complexity without being too simplistic (Leclercq & Poumay, 2005). An instructional model should be responsive to the diversity of student experience, and underline the values of student-centeredness and equitable distribution of power relationships between lecturers and students (Griffiths, 2005; Leclercq & Poumay, 2005). Husband (1999) noted that instructional models need a shift from hierarchy to wirearchy, defined as a dynamic two-way flow of power and authority based on information, knowledge, trust and credibility enabled by interconnected people and technology.

Buckler (1996) cautioned that we should not copy initiatives which have worked elsewhere only to realize that they do not work in our case, but it would be more sensible and useful to use a discovery learning process to assist in evaluating successful initiatives, experimenting with other ideas of interest, and always reflecting on our thought processes. The aim of implementing ITLMUA was to evaluate the efficacy of the utilization of blended learning theories and pedagogical principles using formative assessment to refine ITLMUA and promote and support equitable quality instructional activities for enhanced teaching and student learning and teaching. In addition, ITLMUA gives attention to teaching and learning strategies and styles described generally as patterns, actions, behaviour, techniques that direct teaching and learning behaviour (Dunn & Griggs, 1988; Scarcella & Oxford, 1992; Oxford, 2003).

2.4.2. Learning Models

The conventional principle of learning emphasized transmitting a great deal of information and factual knowledge and failed to model the learning process and product as envisaged in the ITLMUA. The lecturers present the subject material in an organized and error-free form that overlooks the natural steps of making mistakes, feeling overwhelmed, overcoming frustration, deconstructing what went wrong, and starting over again with hope and enthusiasm (Kort & Reilly, undated). These factors would naturally impact on student learning undesirably. The needs of students should be considered when planning educational activities, and they learn better when they are in control and directs their learning, using prior experiences, determine LOs, and aspire to achieve their goals and achievement of LOs (Knowles et al., 2005; Dunlap et al, 2012).

McIlrath and Huitt (1995), in their discussion of the various models, described instructional models as being a visual aid or picture which stresses the ideas and variables in a process or a system. The model by Carrol (1963) indicated **time** as an important variable for school learning, where the students are allocated time by the lecturers to learn, and the ITLMUA concur with Carrol's time variable, but belief that studying should happen at all times as students are encouraged to do self-study out of school time as half-life of knowledge is decreasing (Siemens, 2006). The half-life of knowledge is defined as the time period from when information and knowledge is attained to the time it becomes outdated (Siemens, 2006).

The Proctor's model (1984), according to McIlrath and Huitt (1995), focused on social climate and interaction in HE institutions, and these variables are influenced by students' charateristics such as race/ethnic, sex/gender, socioeconomic status, and past academic performance. These students' characteristics may influence lecturers' attitudes and efficacy, and students' self-image and behaviour are affected by the lecturers' efficacy (Woolfolk & Hoy, 1990). The students' achievement level is a culmination of positive outcomes of variables and factors related to enhancement of effective and quality learning such as engagement, interaction and participation (McIlrath & Huitt, 1995). The ITLMUA indicate that knowledge and understanding of students' characteristic, traits and behaviour, including learning styles, is vital in directing students' learning behaviour by setting appropriate and authentic learning and modifying teaching style to accommodate diverse students' learning styles to enhance their learning (Dunn & Griggs, 1988; Scarcella & Oxford, 1992; Oxford, 2003).

The model by Cruickshank (1995) classified variables as **product** which is learning on the part of student with observable and measurable change in behaviour or behaviour potential. **Process** involves interaction between student and the lecturer where the expectations of learning are high, which may improve intermediate outcomes of student learning and student self-expectation, and the opposite will spiral down student self-esteem and student achievement. Lastly, **presage** is the lecturers' intelligence, level of experience and relevant qualification to provide quality instruction. The ITLMUA encouraged lecturers to have an academic qualification in addition to professional qualification, and the right attitude and efficacy to be able to offer high quality instructional input and corrective feedback so that the product is enhanced as a result of the teaching-learning process (McIlrath & Huitt, 1995).

The model of the instructional processes developed by Gage and Berliner (19920 focused on **objectives** and **evaluation** that are connected by instruction based on the lecturer's knowledge of the students' characteristics and how best to motivate them (McIlrath & Huitt, 1995). If the evaluation process does not indicate that the expected results have been achieved, the lecturer re-teaches the content and starts the process all over again, the notion that the ITLMUA embrace by encouraging lecturers to teach-assess-reteach-reassess, but this must happen only once. The Huitt's model (1995), focused on variables that are related to school achievement and based on school social climate and contextual influences, with redefinition of Academic Learning Time as engagement in academic learning at a high success rate (McIlrath & Huitt, 1995). Brady et al., (1977), added another quality component of content overlap in which content covered in class overlaps to content tested. Squires et al., (1983), defined content overlap as the amount of time students are successfully engaged on content that will be tested.

The Learning Process Model (LPM) by Buckler (1996) aimed at innovation and continuous based on knowledge and understanding to fundamentally review instructional processes and have the opportunity to design into the new process the capability of continuous ongoing improvement. The focus of the LPM is to help develop an understanding of how learning can be stimulated by examining various relevant theories, concepts and techniques of learning, and examine how this knowledge can be applied to the design of teaching and learning processes, so that learning, and thereby continuous improvement and innovation is maximized (Buckler, 1996). The taught and discovery model are based on behaviourism and gestalt theories with focus on learning as something which is done to students, and something which students do for themselves, respectively. The ITLMUA focus on the product and process with an inclination that students must be taught and encouraged to engage in self-study as the researcher believes that this approach allows to relate the relative benefits of lecturer- and student-centered focus (Buckler, 1996). Lecturers can use ITLMUA to fundamentally review their instructional practices in order to significantly improve their programme delivery systems and processes. The knowledge gained from the implementation of ITLMUA can be applied to maximize continuous improvement and innovation, thereby stimulating students' learning (Buckler, 1996).

The Competency-Based Learning Model (CBLM) by Voorhees (2001) is designed and developed to meet industry demands based on the students' ability to demonstrate that specific competencies have been achieved, no matter where and how they have been mastered. The ITLMUA supports the achievement of knowledge, skills and abilities as determined by the competencies demonstrated by students to perform a specific task. Competency is defined as "a combination of skills, abilities and knowledge needed to perform a specific task" (Jones et al., 2001, p1). The lecturers can increase their ability to teach effectively by researching and incorporating the alternative instructional practices, and explicit description of competencies to be achieved, to enhance the quality of teaching, thereby student quality learning as advocated by ITLMUA. The ITLMUA subscribes to integrative learning experiences where competencies should logically and clearly build on the achievement of the previous competencies (Voorhees, 2001).

The HE education sector has encountered numerous changes in their external and internal environment, and are obligated to respond to emerging challenges such as the persistent and repetitive developments in information and communication technology (ICT), a shift in student goals and expectations, changing demographics of students, rapid development of subject knowledge, decreasing financial support and '#fees must fall' campaign (Ryan et al., 2000; Alexandra 2001). Engelbrecht (2003:38), indicated that "using internet for teaching and learning is becoming a normal extension" and "offers a global open platform for information storage and display in text, graphic, audio and video format as well as communication tools for synchronous and asynchronous interaction" (Keegan, 2000:90). The e-learning models value as investitaged by Engelbrecht (2003) to develop e-learning strategies is welcome by this study's ITLMUA as instruction delivered via all electronic media, but will not be explored as part of this study. Furthermore, this study acknowledges that while the value of e-learning lies in its ability to train anyone, any time, anywhere, implementing and sustaining e-learning programmes require more than merely relocating instructional activities online (Harris, 2002).

Currently, DUT is investing seriously in developing, delivering and administering e-learning programmes, and training lecturers and support staff to become competent in e-learning activities, and have a strategy in place to meet the needs of the students and institutional goals (Engelbrecht, 2003). The undertaking of this research study addresses e-learning in terms of web-enabled teaching and learning, and communication (Govindasamy, 2002). One of the justification for e-learning is that ICT can improve the quality of student learning and teaching, and improve access to education at a reduced cost (Bates, 1997). In the ITLMUA, technology can be used in an integrated manner to support effective, good and quality learning experiences and to promote more interactive and effective learning and teaching (Richardson, 2002; Engelbrecht, 2003;). Effective, good quality learning experience is where students are taught how to intelligently engage and master new knowledge and skills, critically examine and evaluate assumptions and beliefs, and engage in a stimulating, collaborative pursuit for wisdom and personal and professional development and growth (Jonassen et al., 1995).

The Observational Learning Model (OLM) developed and validated by Yi and Davis (2003) to determine the underlying observational learning processes by which modeling-based training interventions influence computer task performance. This study will consider using this model in the future to use internet for TLA strategies as envisaged in the ITLMUA to enable lecturers and support staff to store information and for display as indicated by Engelbrecht (2003) above. Bolt et al., (2001) and Johnson and Marakas (2000) found that behaviour modeling brings about better training outcomes than other methods such as lecture-based instruction. Most of the subjects in the Clinical Technology programme utilized practicals which are performance-based activity with the retention enhancement as the observational learning process which significantly improved task performance through its specific effects on the retention processes dimension of obserbvational learning (Yi & Davis, 2003). Retention is where students cognitively register actions as a symbolic representation in memory in order to regulate future behaviours (Bandura, 1986). In any learning activity which involves modeling-based training, students watch/observe a professional in action performing a target behaviour/skill, and then attempt to reenact it (Yi & Davis, 2003).

In the Faculty of Health Sciences where this study was conducted, the subjects have integrated practical assessments with performance-based learning (PBL). The students are expected to demonstrate proficiency of clinical procedures such as measurement of lung functions and capacities. This clinical activity can only be performed by students after observing an expert demonstrating how the procedure is performed, and this clinical procedure can be learnt through behaviour modeling. Modeling-based learning was limited at the time that it appeared by a lack of existing knowledge about the psychological basis of modeling behaviour despite social cognitive theory being the underlying theory for behaviour modeling (Yi & Davis, 2003; Bandura, 1986). In this study, the students' achievement and performance were measured pre- and post-intervention, and there was no expectation on students to have reached the highest level of achievement and performance given the limited period of research, but the possibilities are that this would be the case if the ITLMUA is implemented over a longer period of time.

The Learning Events Model (LEM) by Leclercq and Poumay (2005), developed a theoretical model that hope to assist lecturers and trainers to conceive and/or describe teaching sequences and training strategies. Their model has three components: (1) a series of Learning Events (LE), seeking to describe and conceive the multiplicity of learning/teaching experiences and their underpinning psychological theories, (2) a series of principles helping in designing and evaluating learning environments, and their underpinning educational theories, and (3) a series of more specific descriptors or metadata, that provide detailed information about LE, enabling to judge their intrinsic qualities, their underpinning theories and their degree of appropriateness to specific students and situations (Leclercq & Poumay, 2005). A learning event refers to both intentional and non-intentional learning situations, and the purpose of LEM as a descriptive aid is used to analyse existing teaching/training strategies and sequences, and as a prescriptive aid, the model provides the framework for the creation of a new teaching/training strategy and sequence or for enhancing an existing one (Leclercq & Poumay, 2005). The students are encouraged to demonstrate initiative, diversity of experiences, familiarity with the whole range of learning approaches and styles, and ethical autonomy and responsibility (Leclercq & Poumay, 2005).

The ITLMUA emphasises the need to acknowledge the varied students' needs, aspirations and goals, and to be cognizant of the educational and socio-cultural and economic status of individual students, and encourage them to modify their learning approaches and styles so that their quality learning can be enhanced effectively by quality teaching and authentic assessment and qualitatuive feedback. Ausburn and Brown (2006) aligned with Leclercq and Poumay (2005) in saying that learning situations are significant and influential in promoting desired student learning. The significance of this model is the extent to which students are given the freedom to initiate learning activities, for example, inspecting learning modes and choosing the content they want to explore (Leclercq & Poumay, 2005). Furthermore, the model encouraged diverse experiences of students to reinforce and maximize learning, and made students aware of the whole range of learning approaches, with a focus on student autonomy and responsibility.

The current traditional pedagogical practices at HE institutions, particularly in the Faculty of Health Sciences (FoHS) at the Durban University of Technology (DUT), are dominated by the behaviourist theory which is based on stimulus-response that reinforces desired responses rather than active engagement, interaction and participation (Hammond et al., 2001). The theoretical assumption of the ITLMUA is information and knowledge acquisition, interpretation, construction, sharing and behaviour modeling influence by learning theories of cognitive, constructivist, socially situated and constructive development (Bandura, 1986; Anderson et al., 2005; McCauley et al., 2006; Merriam et al., 2007; Hadjerouit, 2008). The subject content delivery in the ITLMUA is sequential and integrated in order to maximize and enhance student quality learning and teaching, utilizing AL strategies as the instructional mode of delivery.

The 3P Learning Model (3PLM) by Chatti et al., (2010) is a vision of learning characterized by the convergence of lifelong, informal and personalized learning within a social context as an alignment with the shifts and challenges of the ever changing knowledge landscape. The core elements of the 3PLM is personalization which recognize that effective and efficient learning need to be individualized, personalized and student-centered; participation, with emphasis on overarching structures where learning is supposed to take place such as in groups and communities, and lastly, knowledge-pull based on providing students the access to a plethora of tacit/explicit knowledge without knowledge overload (Chatti et al., 2010). The ITLMUA acknowledges the importance of individualism, hence the promotion of lecturers' modifications of their teaching styles and diversification of their teaching strategies and methods that are responsive to the students' socio-cultural and educational diversities. Furthermore, the utilization of AL teaching strategies where students are encouraged to work collaboratively and cooperatively in order to enhance the effectiveness, efficiency and the quality of their useful and meaningful learning experience. The explicit LOs for each learning unit and accompanying assessment criteria for each learning tasks ensures that students are assisted to provide high quality academic work and standards,

The subject content in the 3PLM is primarily compiled by the lecturers with content delivery being sequential and linear, with topics following a static and structured framework (Chatti et al., 2010) Furthermore, the 3PLM has a low Perceived Ease of Use (PEOU) and Perceived Usefulness (PU), where PEOU is the extent to which the user believes that a system is free of effort, and PU is the degree to which a system can enhance performance (Davis, 1989).The ITLMUA is a systematic model that uses integrated components that are dynamic and flexible as a direct response to the dynamics of the students' complex and multifaceted knowledge. The subject content is created in consultation with students and industry representatives in order for it to be responsive to the demands of industry and students' diverse needs. The integrative nature of the ITLMUA is such that its components exercise a wide range of interacting and related elements that may produce unpredictable outcomes, despite having pre-determined outcomes. The ITLMUA aligns both students learning goals and lecturers teaching goals in order to have common outcomes to enhance students' useful and meaningful learning experience.

The Personal Coaching (PC) as an effective learning model by Griffiths (2005) demonstrates the learning value inherent within the coaching framerwork and as a model for active, collaborative, authentic and engaging learning that courageously challenges and moves beyond more conventional transmission models of learning. There is a recognition that learning is "at the heart of coaching", a "holistic multifaceted approach to learning and change", and "a vehicle and platform for learning" (Zeus & Skiffington, 2002:20; Skiffington & Zeus, 2003:30). The key distinction of coaching is the coaching expectation of the achievement of specific goals and a solid commitment to planned action, with an equal partnership between the coach (lecturer) and student (Grant, 2001a; Zeus & Skiffington, 2002). The most common approaches used by coaches are goal-directed coaching and facilitation and process oriented coaching (Bono et al., 2004). The ITLMUA fosters lecturers to develop teaching and learning goals and to facilitate student efforts towards goal-directed learning and oriented to what is happening in the learning processes in order to know how learning targets were achieved, with the intention to improve weaknesses and strengthen their achievement.

The peer coaching used in PC is similar to the team-teaching advocated in ITLMUA were there is reciprocity between lecturers and students with regard to sharing of responsibilities and accountability in the delivery of effective, efficient and quality education and training, including observational learning, informative and helpful feedback, and continuous support. The cyclic coaching process in PC is tantamount to iterative and cyclic teaching and learning process inherent in the ITLMUA components (Hurd, 2002). The coach teaches the students how to learn, thereby shifting from teaching to facilitation, and creating an environment where students become aware of their responsibility and accountability (Griffiths, 2005). The outcomes of coaching include improved goal-setting and goal attainment, better communication and problem-solving skills, better reception and use of feedback, better understanding of consequences of actions, practical application of theory and effective thinking strategies (International Coach Federation, 1998; Campbell & Gardner, 2003). The coaching model uses cognitive coaching in order for lecturers to reflect on their instructional practices with the intention to enhance student learning (Garmston, 1993; Costa, 2000).

The distance education learning (DEL) systems model is designed to encompass lifelong learning and can be used to design, implement and evaluate distance learning programmes (Frantz & King, 2000). The DEL systems model is similar to ITLMUA as it can be used to evaluate the quality of learning and teaching, with subsequent improvement of curriculum and instructional activities in higher education. Kort and Reilly (undated) suggested the 'novel model' which pays attention to the construction of knowledge and the extraction of meaningful insights, and when this knowledge is coupled with a personal or cultural value system, wisdom emerges. The ITLMUA by virtue of using cognitive, constructive, situated, constructive development and socio-cultural learning theories in teaching and assessment activities, is cognizant of the importance of knowledge construction, extraction of relevant information from a variety of sources, and integrates new and old knowledge influenced by social-cultural values and ethical moralities to develop new knowledge and understanding.

2.4.3. Teaching Models

Lecturers at HE institutions (HEIs) have the autonomy to choose their preferential teaching strategies without providing any contextual grounding, and this may lead to a negative impact on student learning. There are numerous concerns with lecturers in HE such as their lack of educational practice qualification and adequate and relevant workplace experience which may affect the effectiveness in classroom management, teaching and use of teaching theories and models. The new challenges faced by teaching is engagement in lifelong learning and adoption of alternative instructional models that are responsive to new goals and perspectives of learning (Enkenberg, 2001). Designing instructional models and environments should make allowances for psychological, affective, technological, sociocultural and pragmatic perspetives (Hannafin & Land, 1997).

The behaviourism dominates the current conception of learning which fall short in explaining the working of the mind when students are faced with real-life problem-solving situations, and authentic environments. The relevant learning theoretical perspectives of cognitivism, constructivism and socially-situated learning theories are more applicable and responsive to the working mind of the 21st century students, and these theories are used in the ITLMUA in this research study (Enkenberg, 2001; Yuan & McKelvey, 2004; Russel et al., 2007;). Paradigmatic emphasis in instruction has moved in two ways: (1) from acquisition of knowledge, which is individualized, to facilitation of practices and discourses, and (2) collaborative aspects in education are slowly replacing the mind-oriented approach (Enkenberg, 2001).

Poblete Sr (1999) Reflective Teaching Model (RTM) used reflection (inquiry or critical thinking) as a useful teaching strategy to teach students to think critically. Poblete Sr (1999) noted that the role of HE is to develop students' power to think and to do, and not mere reflectors of the other men's thoughts, and students are directed to the source of truth. The reflective teaching goes through five steps of suggestions, intellectualization of direct experience, establishment of leading ideas, mental elaboration, and hypothesis testing (Dewey, 1993). The ITLMUA's idea is to be involved in a cyclic, iterative and sequential reflective practice of TLA activities in order to ascertain whether the goals and objective of educational intervention has been achieved or not. Reflection process goes through six process of knowledge of students needs, setting of instructional tasks, determining of instructional strategies and methods, utilization of learning theories, development of assessment tasks, and review and reflection with refinement of the components of the ITLMUA. These two models supports the plan of action in order to ensure that provision of quality education is systematized and directed towards a useful changed behaviour.

The inquiry-oriented paradigm of teaching education used in RTM view students as active participants in the construction of curricular content (reflexive), with the needs and concern of students given greater weight and the curriculum is viewed as socially constructed (Zeichner, 1983). In addition, this paradigm develops students' capacities for reflective action and to help them examine the moral, ethical and political issues embedded in their everyday thinking and practice (Zeichner, 1983). The ITLMUA insist that lecturers should be committed to high quality teaching undergirded by theory, research, and a set of personal and professional values, beliefs and ethics, including the elaborate understanding of the various aspects of the subject content (Poblete Sr, 1999).

Enkenberg (2001) grouped all the models that subscribed to two prominent metaphors of knowledge acquisition and participation that guide how we think about learning and relevant instruction into Collaborative Teaching Models (CTMs). The demand of the working environment calls for expertise, which is a more thorough command of specific knowledge and skills, and life-long learning, which demand that employees should be more flexible, mobile and ready to learn and develop themselves continuously (Enkenberg, 2001). Th ITLMUA intention is to educate and train students in an authentic real-life environment in order for them to be work-ready and to understand the importance of continued professional development (CPD), as a response to the growing demands of updated knowledge as a result of the ever-evolving educational and professional landscape. The mind-oriented strategies to learning are being overtaken by collaborative perspective demonstrable in AL utilised in the ITLMUA, as this study supports the rhetorical expression of acquisition, active partipation and engagement.

The CTMs and ITLMUA are student-centered and concede that the basic starting point is to determine instructional goals and standards, and students' participation in the teaching and learning process that create and sustain the relationship of mutual accountability and collaborative and cooperative learning such as AL (Sfard, 1998; Wenger, 1998). The mutual interaction between students and the lecturers promote effective, efficient high quality learning and teaching, and students' ability to learn fairly complex skills provided the social context and incentives are supportive of quality learning (Brown & Duduid, 1993). Central to instructional planning is the targets of teaching, the character of the learning tasks, the supporting activities and systems, the role and responsibilities of the lecturer and student, the connection between conceptual knowledge and its context, and the assessment strategies and methods to determine knowledge, understanding and application (Enkenberg, 2001).

The models subscribe to the authentic, contextualized content that is supported by the social context that offers opportunities for placing of new knowledge in the context of problem solving which is favourable to the application of what has been learned, referred to as 'just-in-time learning (Adams et al., 1988; Enkenberg, 2001). Social interactions occurring during team-based problem-solving activity can enhance metacognitive skills through reflective dialogue, and such reflective activity is fundamental to development of expert performance (Schon, 1987; Karpov & Haywood, 1998). The AL emphasizes students' active engagement in the learning process and active meaningful learning activities, and continuously reflecting on what is happening in classroom time, with the utilization of collaborative and cooperative learning (Faust & Paulson, 1998; Prince, 2004).

Clarke's (2007) Reflective Teaching Model (RTM) is an inquiry approach which instills reflective practices of instructional activities to enhance classroom management and pedagogy. Schon's (1987) reflective practice focuses on the ways people think about their experiences and how to devise responses as the experiences are happening. In the case of the ITLMUA, reflection and review is encouraged in the whole process of TLA, with the students and the lecturers expected to think about their TLA goals, strategies, methods and their effects on the effectiveness, efficiency and quality of student learning and teaching.

The challenge of learning and teaching is engagement with reflective thinking so as to evaluate whether learning and teaching goals have been met, as well as defining the areas in which challenges emerged (Artzt & Armour-Thomas, 2002). Self-assessment, as a reflective activity, help identify what was not addressed and the unexpected challenges of the lesson. Failure to acknowledge these challenges could inhibit lecturers' self-enhancement and students' achievement and performance (Clarke, 2007). Reflective teaching holds values that provide opportunities for lecturers to inquire into other instructional strategies, further their learning, and use intuition, insight and artistry (Hinnet, 2002). The ITLMUA support reflective thinking skills in both students and their lecturers in their learning and teaching activity with the aim of promoting and enhancing critical thinking skills of analysis and the ability to make judgments about their experiences, and refinement of instructional activities and the model. Research has supported the notion that the use of learning strategies is positively related to student achievement and proficiency (Pressley & Associates, 1990). This relationship and remarkable association between learning strategy use and positive learning outcomes manifests in high levels of self-efficacy, that is, a perception of being effective as students (Zimmerman & Pons, 1986).

Ostad and Soleymanpour (2014) investigated the impact of the Concept Attainment Teaching Model (CATM) and Mastery Teaching Method (MTM) on students' academic achievement and metacognitive skills. Concept attainment is when students search and list features that can be used to identify standards from non-standard lessons, and these concepts have characteristics such as attribute, value, classification and definitions (Ostad & Soleymanpour, 2014). Students are, therefore, engaged in the same subject activities in an attempt to provide an agreed upon solution to the topic or issue using active teaching strategies based on active model of problem oriented (Ostad & Soleymanpour, 2014). Active teaching strategies use variations of engaging students such as questions and answer sessions, discussions, brainstorming, problem-solving, critical thinking and creativity (Ostad & Soleymanpour (2014). The CATM and MTM objective is to reinforce creativity, learning stability, make hypotheses and increase tolerance of ambiguity in students. In addition, to use of information processing by emphasizing on strengthening internal tendencies of the human to understand the world through the collection and organization of primary information, explore issues and presnt solutions (Ostad & Soleymanpour, 2014).

Similarly to CATM and MTM, the ITLMUA uses academic achievement as one of the indicators for the effective intervention of the instructional model using AL variations such as think-pair-share, think-aloud pair problem solving, clarification pauses, rotational questions and answers and team-based learning to reinforce collaboration and cooperation learning (Silberman, 1996; Meyers & Jones, 1993; Bonwell & Eison, 1991). These models teach the students to extract the relevant information from the text and the lecturers then support, guide and facilitate students' in order for students to achieve the concepts (Ostad & Soleymanpour, 2014). The CATM enables students to develop advanced conceptualizing, inductive reasoning, tolerance of ambiguity and sensitivity to logical reasoning in communication (Ostad & Soleymanpour, 2014). The ITLMUA facilitates students to meaningfully interpret knowledge, engage in analytical reasoning and social practices, and construct own knowledge based on prior knowledge (Yuan & McKelvey, 2004; Merriam et al., 2007; Hadjerrouit, 2008).

These models provide students the amount of time and required opportunities to learn. This is referred as talent, since the ability to master academic tasks depend on these factors. Also, the teaching and learning goals are explicit and well-aligned to maximize effective and high-quality student learning (Ostad & Soleymanpour, 2014). Lecturers should be guided by teaching models that are underpinned by relevant theoretical perspectives such as cognitivism, constructivism and socially-situated learning theories rather than behaviourism approach that seem to permeate the HE sector (Enkenberg, 2001).

Caird et al., (2015) Higher Education Teaching Models (HETMs) indicated that the distance-based HE models (distance, online and ICT-enhanced teaching models) reduced energy consumption by 88% and achieved significant carbon reduction of 83% when compared with campus-based HE models (face-to-face [F2F] and ICT-enhanced teaching models). Caird et al., (2015), identified two factors that are central to the carbon-based environmental which impacts were energy consumption and carbon emissions. They recognized the main sources of carbon emission as travel, residential energy consumption and campus site operation. A study by Roy et al., (2008) found that distance learning-based education systems consumed less energy and produced fewer CO_2 emissions than campus-based systems.

This study recognizes the importance of the reduction of energy consumption and carbon reduction programmes by transforming from lecture-based instruction to blended or hybrid learning of e-learning methodologies (Johnson et al., 2012). The Durban University of Technology (DUT) is a campus-based F2F institution, and according to Caird et al.'s (2015) study, the distanced-based system consumes less energy and produces fewer carbon emissions than the campus-based system. This was achieved through reducing the need for students to stay in residences, travel and utilize campus facilities (Caird et al., 2015). The DUT is not a distance education institution. Therefore it can only utilize, at best, instructional models such as ITLMUA which adopt ICT-enhanced F2F and online teaching models to reduce energy consumption and carbon emissions, thereby reducing materials and transport impacts (Caird et al., 2015). The teaching strategies employed at DUT utilize ICT to supplement and enhance rather than replace classroom-based F2F teaching (Caird et al., 2015). There is also utilization of a Blackboard as an online resource to post lecture notes, tutorials and communication notes to students instead of using paper and print materials. This reduces energy consumption and carbon emission as a result of dematerialization of education (Caird et al., 2015). The future prospects of radical online learning designs, with minimum F2F learning could be realized for the betterment of greener HE system and long-term reduction in global warming.

2.4.4. Assessment Models

Assessment in HE is a complex phenomenon, and it is suggested that an instructional model be design to comprehend and clarify the range of issues that need to be addressed in seeking to improve the quality of assessment practices (Joughin & Macdonald, 2003). It is from this backdrop that ITLMUA assessment component has been developed to address quality issues in the HE sector. Assessment of LOs is one of the most challenging and complex issues facing teaching in HE and there is a need for alternative assessment models that support and measure learning more authentically (Resnick & Resnick, 1992; Entwistle & Entwistle, 1992; Moallem, 2007). Havnes (2002) asserts that improving student learning requires improving assessment systems since students orient themselves in relation to what will be assessed and worth learning, and not necessarily what is being taught. This view basically means that assessment drives learning and 'overrules' teaching as has been advocated by educational researchers (Elton & Laurilard, 1979; Crooks, 1988; Biggs, 1996).

Hybrid learning and synergistic team-teaching is using technology to offer subjects anywhere, anytime and employing team-teaching approach to reduce workload and over-assessing (Holland, 2001; Garrison & Kanuka, 2004). The researcher-designed ITLMUA supports information dissemination about learning targets and effective assessment strategies to ensure consistent quality of effort and experience, and provision of assessment criteria for all assessment activities in order to enhance the quality of students' achievement and performance (Holland, 2001; Woytek, 2005).

Assessment models should impact on the quality of student learning, and it is this viewpoint that motivated the researcher not to deal with discrete instructional models, but rather to develop an integrated and interrelated instructional model which advocates for formative assessment primarily, and takes into consideration its relation to other aspects of education (Havnes, 2002). Moallem (2007) proposed a student-centered project-based assessment system as an alternative way of assessing complex learning tasks, arguing that online learning is a better learning environment for assessing complex LOs and for implementing alternative and performance-based assessment systems. The ITLMUA uses dynamic formative assessments, but not to the exclusion of alternative assessment methods such as case-based learning and problem-based learning among others (Seok-Hoon et al., 2005).

Baker's (1998) Model-Based Performance Assessment (MBPA) raised the concern about the type and level of knowledge acquired in educational systems, despite efforts to restructure what student are taught and the manner in which their learning is accurately assessed. Furthermore, students' ability to demonstrate competency over challenging subject matter was a particular focal point for the development of standards (Baker, 1998). The young graduates are not well-prepared by the HE instutions to enter the workforce being work-ready (U.S. Department of Labor, 1991; South African Department of Higher Education & Training (SADHET), 2013). The rationale for the design and development of ITLMUA was to provide an instructional model that will be able to offer both the lecturers and students a theoretical framework that will ensure that students are well prepared and competent enough to enter the real-life working environment. The practicals that students perform in most of the subject of Clinical Technology are performance-based as advocated by MBPA, with a focus on attainment of teaching and learning goals, content and standards, and assessment of the learning process as evident in students’ engagement and participation in instructional activities of the programme (Baker & O’Neil, 1994).

Performance assessments assist lecturers to enhance the effectiveness, efficiency and quality of student learning and teaching by focusing on academic tasks that demand high-order thinking skills, in-depth understanding of subject content and open-ended responses, rather than multiple-choice questions (MCQs), which assess memorized factual knowledge (Baker, 1998). The integrative nature of ITLMUA in terms of TLA within and across subjects, offer students the time and opportunities to acquire skills such as problem-solving, textual analysis and useful communication skills, thereby encouraging interdisciplinary learning experience. The blended learning theories of constructive development and socio-cultural learning theories for assessment, encourage students to learn maximally when asked to solve authentic real-life problems (Voorhees, 2001).

Assessment strategies should be aligned to the characteristics of performance assessments in such way that students are be able to effectively acquire skills and understanding as intended in the standards and LOs of the subjects. Stecher et al., (1996) indicate that it is difficult and expensive to develop performance assessments as they require trained and skilled assessors, and there is reluctance of lecturers to teach the way performance assessments indicate. These doubts about performance assessments could be addressed with instructional models such as ITLMUA, which specify explicitly the intention of each component of the model so that their implementation is facilitated. Furthermore, lecturers have the flexibility and the opportunity to modify and refine the ITLMUA in order to enhance the effectiveness and quality of student learning and teaching, particularly when the intention is to assess the quality of students' understanding of integrated scientific knowledge (Baker, 1998).

The ITLMUA supports teaching for application and transfer where students are competent to apply and transfer their knowledge in the same and new situations, and most importantly, alignment on teaching strategies and methods with assessment strategies (Mayer & Wittrock (1996; Baker, 1998). The ITLMUA supports the generic development of graded assessment rubrics to assess students' understanding of subject content, and could ease the criticism directed at performance assessments by specifying items to be developed and a strategy to translate standards into assessment (Baker, 1998). Specifications give direction about important attributes of instruction and generic marking rubrics that may reduce lecturers' academic load and marking costs since general rubrics could be used in multiple academic tasks.

Joughin & Macdonald (2003) proposed a model of assessment in HE (MAHE) that is helpful to make sense of the assessment situation in HE and useful in identifying critical points for intervention, and make us aware why attempts to improve the quality of assessment are successful or are failing. The design and development of ITLMUA is to enhance not only the quality of assessment practices in HE institutions, but the whole instructional practices of TLA, and in doing so, identify gaps and limitations in the whole system of the education sector, with the aim of continuously improving the evolutionary education system. Both the models intend to help to make sense of, or clarify instructional debatable issues, and on the other hand, it may add further complexity or ambiguity to what was already a incomprehensible situation (Joughin & Macdonald, 2003).

The ITLMUA needs students and lecturers to experience alternative assessment practices that are effective, efficient and of high quality. This can only be realized when institutional management have the will and are committed to making resources available, re-skilling of staff through academic development programmes, and implementation of e-learning (Bull, 1999). Assessment methods and tasks should be aligned with subject LOs and learning activities, balancing of the purposes of assessment such as for learning, measurement of accomplishment and maintainance of standards (Joughin & Macdonald, 2003). The MAHE and the ITLMUA share similar sentiments of good assessment practices that are valuable, useful and meaningful in terms of useful and helpful feedback. They both support the notion that students experience an integrated system approach to assessment, where lecturers are encouraged to be innovative and creative in order to enhance the effectiveness and the quality of student learning (Joughin & Macdonald, 2003).

These instructional models encourage academics and support staff to access information not only on assessment, but also on teaching and learning. In addition, these instructional models provide the opportunities to academics to reflect on current practices and share their wealth of pedagogical experience with their colleagues, and conduct regular peer review of TLA (Joughin & Macdonald, 2003). The heterogeneous nature of the ITLMUA would respond adaptively to any changes in the education system given its flexibility and openness to be refined and modified as the need arises. This includes being responsive to external factors such as government policy reform initiatives with regard to curriculum renewal, funding and access just to name a few. The ITLMUA should be seen as enabling instructional model which is adaptable to changes in institutional policies, principles and practices in order to respond positively to issues of strategic enhancement. The ITLMUA advocates for the greater use of continuous assessment (CA) rather than timed, unseen final examinations, and supports participation and involvement in assessment practices in the HE sector, such as self and peer assessment. Assessments should be used to improve learning through feedforward rather than just feedback to reflect on what has been done in the past (Joughin & Macdonald, 2003).

Rennert-Ariev (2005) Theoretical Model for the Authentic Assessment (AA) of Teaching (TMAAT) uses a powerful and nuanced assessment strategies to target the complexities of knowledge that students bring to bear in their learning (Wolf, 1991; Shulman, 1987). The nuances of innovative and creative teaching and assessment practices should be able to transcend the restrictions of traditional teaching and assessment practices as envisaged in the ITLMUA instructional methods (Rennert-Ariev, 2005). The AA criteria is to sample the actual knowledge, skills and disposition of students in the teaching and learning context, that is, assessments need to reflect the intellectual work of practicing professionals, and require the integration of numerous types of knowledge and skills, that is, the need to be characterized by active engagement, exploration, and inquiry on the part of the student (Darling-Hammond, 2000; Wiggins, 1989).

The intention of the ITLMUA is not for lecturers to hold on to 'authentic' assessments while still being underpinned by their assumptions of traditional methods of assessment as evident in the subtleties of the lecturers' decision-making processes (Rennert-Ariev, 2005). This study is rooted in a theoretical position that utilizes both the traditional and authentic assessment strategies in order to impact positively on the effectiveness and quality of student learning and teaching through formative assessments. The models expect students to have the ability to be thoughtful judgemental and reflective to assess an idea and intention of its fitness of purpose in the overall LOs, and valuing of teaching and assessment practices (Rennert-Ariev, 2005).

Seok-Hoon et al.’s (2005) Effective Dynamic Model of Assessment and Learning (EDMAL) utilizes an interactive approach to conducting assessment focusing on the ability of the student to respond to his/her learning. The two types of assessments are psychological and achievement tests which are given to determine the eligibility of students for a variety of learning settings and to determine student LOs, respectively (Seok-Hoon et al., (2005). Dynamic models of assessment and learning intends to play a key role as an integral part of a range of deliberate effots to help students learn how to assemble and use knowledge, and enable lecturers to identify and develop the cognitive processes that students need in order to achieve high academic standards (Jensen, 2000).

The ITLMUA intends to teach students how to learn by analyzing textual information, extract relevant and meaningful information, and apply that knowledge. Both these models utilize an interactive approach to conduct assessment in order for students to respond to intervention with the intention to modify the individual students' cognitive functioning (Seok-Hoon et al, 2005; Tzuriel, 2003). Furthermore, the two models subscribe to dynamic assessment (DA) which refers to an assessment strategy that facilitates the assessment of perception, learning, thinking and problem solving by an active teaching process and active learning (Tzuriel, 2003).

The theory of Mediated Learning Experience (MLE) and structural cognitive modifiability were used to develop EDMAL, and further noted that people have a distinctive capacity to modify their cognitive functioning and adapt to changing demands of the environment (Feuerstein et al., 1980). Cognitive modifiability is defined as the individual's propensity to learn from new experiences and learning opportunities and to change his or her own cognitive structures (Seok-Hoon et al., 2005). The quality of interaction between an individual and the environment, coupled with the intentions of the individual to learn, play an important role in the cognitive development of the individual (Seok-Hoon et al, 2005).

The formative assessment strategies employed in the ITLMUA uses information from the intervention to promote student learning and teaching, and to refine and modify the ITLMUA. Similarly to DMLA, the ITLMUA uses assessment information to determine the impact of the intervention in student learning and teaching, so as to determine students' cognitive modifiability (Seok-Hoon et al., 2005). The ITLMUA advocates for reteaching and reassessment, and redraft of assignments where students demonstrate low achieving, with a minimum of fifty-percent percentage mark to be attained for supplementary attempts. The ITLMUA is viewed as complementary to the currently used traditional methods and is not a replacement for existing interventions.

The ITLMUA intends to change how individual students perform in academic activities and purposefully look out for indicators of prospective changes that may be expected if suitable and appropriate quality teaching is delivered (Feuerstein et al., 1980). The similarity in both the EDMAL and ITLMUA is that the lecturers assume the role as the facilitators of learning with the intention to use assessment information to enhance the quality of student learning, and thereby, improve students' achievement and performance through interactive instructional strategies such as AL. Traditional assessment approaches focus on the end product, that is, student results, without looking at the process of learning and teaching and the impact on student assessment as the consequence of the interventions employed. Finally, results in the ITLMUA and DMAL are interpreted based on the both the quantitative and qualitative aspects of the student achievement and performance, through analysis and interpretation of deficient cognitive functions and on the remedial efforts required to modify them (Feuerstein et al., 1980).

Seok-Hoon et al. (2005) developed the Mindladder Dynamic Assessment Model (MDAM) which prioritizes thinking and learning skills enhancement through collaboration among educators, parents and administrators. The MDAM uses academic information to identify students' learning needs, modify their instructional strategies and intervention, and assess both teaching and learning progress. The ITLMUA ranks the effectiveness and quality of teaching and learning high on the priority list, with a focus on the enhancement of TLA in order to improve student learning and teaching. The ITLMUA identifies students learning needs at the beginning, including teaching and learning goals that must be aligned to maximize the academic outcomes, rather than focusing on curricular goals and standards as evident in MDAM (Seok-Hoon et al., 2005). The philosophy of both the MDAM and ITLMUA is aimed at constructing knowledge, skills and abilities in the mind of students rather than merely transmitting them as is evident in traditional instructional practices (Jensen, 2000).

The Hierarchy Model of Assessment (HMA) developed by Zhang et al. (2006) aims to improve the quality of educational services. The ITLMUA concurrs with HMA in noting that teaching and learning is a dual-process that calls for interaction between students and lecturers (Zhang et al., 2006). The ITLMUA’s intention is to stimulate and inspire lecturers and students to be the change agents of curriculum, subject content, and student learning material aimed at improving the quality of instructional activities through e-learning initiatives which are currently the focus of the institution. There is commonality between their model and ITLMUA in the setting of measurable teaching and LOs for the learning units and assessment tasks, but the ITLMUA recommends that assessment criteria must accompany each and every assessment task to enable the students to understand the assessment expectations. The monitoring of assessment tasks and their associated LOs achievement is through qualitative feedback by lecturers, departments and the faculty, and 'at risk' students are given 'warning letters' by departments and faculty. Monitoring of teaching and learning activity is done through peer review of teaching and learning, and is utilized routinely and whenever monitoring and assessment feedback indicates a need for action. The lecturers are responsible and accountable for continuous monitoring of students' performances and achievements, as well as effecting the adaptive changes and adjustments at all levels of operations as the need arises according to national and institutional policies, rules and regulations.

Dureva and Tuparov (2006) discusses two models: Conceptual Model of Assessment Unit (CMAU) in e-learning environments and the Physical Model of Assessment Unit (PMAU), and these models give a clear description of LOs which describe the level of knowledge, skills, and competences that students should achieve in the learning process. The object of assessment in the educational process is not only knowledge, but enlarge toward the skills and competences, and competence is a mastering of knowledge and skills at the level that is sufficient for their application for doing real-life professional work (Harvey, 2004). The ITLMUA encourage the lecturers to clearly describe LOs for each learning unit so that there is no confusion on what student should achieve in terms of knowledge, skills, abilities and competences in order to apply what has been learnt in authentic real-life situations. The characteristic of measurability of LOs is central in an educational context, and must be described in terms of the knowledge domain and the cognitive domain as described in terms of Bloom's Cognitive Taxonomy (Dureva & Tuparov, 2006). The criteria for success is based on expert evaluation of the minimum level of mastering each LO in percentages (Dureva & Tuparov, 2006).

The Conceptual Model of Assessment Unit (CMAU) supports assessment methods that include appropriate and relevant assessment activities that are aligned with LOs, and the input data for the CMAU are LOs, criteria for success, and learning styles (Dureva & Tuparoc, 2006). The assessment criteria accompanying the assessment tasks in ITLMUA, explicit LOs and student learning styles and approaches to learning, are some of the input indicators that ensure successful implementation of assessment tasks in this study, with monitoring of the teaching and learning process. The involvement of students in assessment practices in HE, as advocated in this study, is to ensure that there is a common understanding of the expectations of the assessment tasks between students and the lecturer.

Moallem (2007) proposed the student-centered, Project-Based Assessment System (PBAS) as an alternate way of assessing complex learning tasks, as this has been identified as a matter of concern facing HE. It has been reported that newer assessment models measure student learning more authentically and provided alternatives to the conventional assessment models (Resnick & Resnick, 1992). The researcher's self-designed model, the ITLMUA, intends to assess student learning more authentically by utilizing case-based and project-based assessment through individual and collaborative assignments. The ITLMUA has been provided not as an alternative to, but complementary to, currently used conventional methods of assessment. The researcher envisages that over time, the ITLMUA might be an alternative to conventional models after satisfactory implementation, refinement and modification by lecturers and students.

The ITLMUA embraces alternative assessment strategies and methods that demonstrate the potential of inspiring students to engage and interact with authentic learning that offers diverse learning opportunities in order for students to demonstrate critical thinking skills and in-depth knowledge that relates learning to the real life environment (Muirhead, 2002). Alternative assessment models support both assessment for learning and assessment of learning as we are expected to provide percentage marks to employers and funding agencies (Black & William, 1998).

This study is focused on an instructional model that can pedagogically transform TLA methods and strategies, and for lecturers to reflect on their educational philosophies in order to challenge the status quo in HE, and to call for radical reformulation of the basic assumptions of education and the role of assessment (Moallem, 2007). One of the necessary radical transformations in HE is to respond to the claim that distance education is equally as effective, if not better, than face-to-face (F2F) learning, and there is no significant difference in the LOs that occur in a distance education and F2F environment (McDonald, 2002; Shachar & Neumann, 2003). The ITLMUA also subscribes to ongoing transformation of instructional practices in HE through adoption and integration of newer and alternative instructional methods and strategies, and continuous reflection on the quality of learning accomplished and learning deferred (Moallem, 2007).

The taxonomy for the development of Assessment Model of Learners (AML) in a hybrid learning environment was developed as a result of the rapid pace of technological developments and innovations, particularly in the education sector where student learning is the core element that is taken into consideration (de la Vega, 2008). These technological innovations necessitate educational transformation in order to realize the benefits promised by technology (Garrison & Kanuka, 2004). The benefits of technology are not only for use inside the classroom, but lecturers are able to run the whole programme away from classroom environment in order to offer anyone access to HE, anywhere and anytime (de la Vega, 2008). This research study embraces hybrid learning, which is called blended learning, which is a blend of both classroom or F2F learning and online learning (Garrison & Kanuka, 2004). Admittedly, the DUT is still unfolding the implementation of e-learning, and staff are currently engaged with workshops to understand utilization of technology in relation to assessment of students.

The researcher is of the opinion that synchronous F2F and asynchronous online learning could be used to combine the positive features of both in order to provide both the institution and students with competitive and learning advantages (Garrison & Kanuka, 2004). The accrued benefits of blended learning are enhanced enrollment rates at universities, provision of access to education, engagement and social contact, improved student retention, and the presentation of material is integrated (Singh, 2003; Picciano, 2006). The ITLMUA encourages reiterative and cyclic refinement and modification in order to ensure compliance with the advancements and innovations in technology, particularly in hybrid learning assessment integrating technological and non-technological means of assessment. Pelligrino et al., (1999) defined assessment as a means used in academic institutions to measure the scholastic ability of students, and Cronbach (1957) emphasized that it is critical to link cognition and learning with the practice of assessment. Furthermore, Cronbach (1957) explained that students are ready to be taught in varied types of teaching, and lecturers should brace themselves to develop or incorporate new and alternative methods of teaching that would be appropriate and relevant to different types of student readiness. The integrative nature of the ITLMUA supports alignment of learning and teaching with assessment practices that are both conventional and innovative to enhance academic achievement and performance. The role of assessment is to indicate the level of students' understanding and learning, and the fitness of purpose between students' readiness and the teaching methods used (Cronbach, 1957).

Other instructional models do not include students in assessment practices in HE by way of students assessing themselves and their classmates using self and peer assessment, thereby promoting students' understanding of how assessment is carried out in higher education, and to learn from each other to improve their learning. The neutrality of the models with regard to the type of knowledge, skills and abilities that hey are trying to assess is attended to in the ITLMUA by outlining LOs of each learning unit, and using varied instructional strategies to attain LOs (Frantz & King, 2000). The task of designing pedagogical models is one of ensuring that there are absolutely no inconsistencies between the curriculum taught, the teaching methods used, the learning environments chosen, and the assessment procedures adopted (Biggs, 1999). The quality of any model depends, among other factors, on its ability to decrease the complexity of the learning context without being too simplistic, and keeping within the limits of human cognitive capacities (Leclercq & Poumay, 2005).

Several researchers have developed models of the teaching and learning process to address the need to increase test scores, yet the public is also concerned about students' character, self-esteem, and social development (Gallup, 1980; Squires et al., 1983; Proctor, 1984). The ITLMUA advocates for criterion-referenced assessment strategies that are underpinned by a blend of learning and developmental theories in order to make assessment to be an instrument of measurement and a means of promoting and supporting useful and meaningful learning (Fook & Sidhu, 2010; Scott & Fortune, 2011). The ITLMUA supports the notion of measuring learning more authentically and providing alternatives to the conventional assessment methods in order to capture the complexities of teaching and learning as they develop over time and across different contexts, and for both lecturers and students to have the opportunity of transforming their teaching, learning and assessment philosophies and strategies, including curriculum transformation (Rennert-Ariev, 2005; Moallem, 2007). The ITLMUA encourages assessment of cognition that is consistent with the cognitive demands in the environment for which we are preparing the student by means of techniques such as case-based assessment, and performance-based assessment used to assess problem-solving skills, synchronized with problem-based or project-based teaching approaches (Segers et al., 2001).

2.5. TEACHING AND LEARNING STYLES, STRATEGIES AND APPROACHES

The amount of student learning is directed and regulated by the student's instinctive ability, prior preparation and the compatibility of student's characteristic approach to learning, and lecturer's characteristic approach to teaching (Felder & Henriques, 1995). Human beings can be changed, and therefore, to some extent, both learning and teaching styles and personal characteristics can be modified to accommodate new approaches (Fischer & Fischer, 1979). Learning and students are central to teaching/learning interaction, meaning that what the student does is more important for student learning than what the lecturer does, and this assumption has led to the redefinition of teaching as facilitation of students' effective, efficient and quality learning (Lublin, 2003).

2.5.2. Learning Strategies, Styles and Approaches

The basic task of a student is to learn which can compel students to utilize a variety of abilities, tactics, strategies and styles of learning (Entwistle, 1981). Learning strategies are defined as behaviours and thoughts that students use to select, organize and integrate new knowledge or to facilitate learning more efficiently and effectively (Dansereau, 1978). Learning style refers to the characteristic ways in which an individual acquires, retains and retrieves information (Felder & Henriques, 1995). Approaches to learning vary, with students having a propensity towards either deep or surface approaches to learning. Good teaching and teaching prowess, or lack thereof, can influence and encourage students to adopt either deep or surface approach to learning (Biggs, 1999).

The pervasive quality in each individual student's behaviour is quite distinct from other students and is consistent through time and context. (Fischer & Fischer, 1979; Cano-Garcia & Justicia-Justicia, 1994). The planning and preparation of instructional activities should be adaptive and accommodative to individual student styles and strategies, and can be facilitated by lecturers carrying out students' needs and profile analysis (McLoughlin, 1999). Increase in class size and academic workload, and dwindling resources is likely to make lecturers unenthusiastic to conduct students' needs and profiling analysis. This may result in poor and inefficient quality teaching, and one-size-fits-all teaching styles and strategies. Students will therefore adopt a surface approach to learning which may be limiting to their awareness of their cognitive capabilities (Dansereau, 1978; Lublin, 2003). Students should adopt learning strategies compatible with their cognitive capabilities making a greater effort to follow their interest which will increase their motivation to learn (Dansereau, 1978; Fischer & Fischer, 1979).

The ITLMUA can change students' behaviour by linking teaching and learning activities in order for students to integrate new and prior knowledge to facilitate effective and quality learning of the subjet content, thereby improving student achievement and performance of LOs (Vermunt, 1996; Garavalia & Gredler, 2002; Hofer & Yu, 2003). Furthermore, ITLMUA provides the opportunity to lecturers to conduct needs and profile analysis of students in order to have an understanding of their prior knowledge, their experiences, motives, interests, socio-cultural backgrounds and attitudes in order to adapt their teaching styles and strategies to enhance the effectiveness, efficiency and quality of learning. Felder and Henriques (1995) caution that major disparities between teaching and learning strategies and styles can have regrettable consequences such as student boredom with academic activities, lack of concentration in their studies and the course, reduction in academic performance and achievement (Smith & Renzulli, 1984; Oxford et al., 1991).

Students' learning style determines the learning strategies they adopt instinctively, for example, visual students remember best what they see, like pictures and diagrams, and use various learning strategies to maximize the effectiveness and success of learning (Felder & Henriques, 1995). Effective learning is based on integration of prior knowledge and new information that enable students to engage in analytical reasoning, critical thinking and information transformation into stored information and knowledge. The manner in which students organize knowledge determines how they use it (Clement, 1982; Bruner, 1990; Gagne et al., 1993; NRC, 2000; Hadjerruoit, 2008).

Students' organization of their learning activity is not an inherent characteristic, but is their response to a learning task which may change and is dynamic (Rowe & Harris, 2000; Ramsden, 1987). There are three sources of variation in students' approach to learning which are amenable to modification, and they are, (1) individual student characteristics, (2) understanding of the context of learning, and (3) the requirements of the programme being studied (Rowe, undated).

According to Marton and Säljö (1976a) fundamental speculation involves the acceptance of the "essential uniqueness of each student's attempt at learning under controlled conditions", and some students operate on understanding the subject content and others focus on memorization. Marton and Säljö (1976a) define surface learning as the process where students direct their attention towards learning the text or at least the recall of it, which is a reproductive conception of learning and is generally associated with a rote-learning strategy. In a deep approach to learning, students are directed towards the intentional content of the learning material and towards comprehension.

2.5.3. Teaching Strategies, Styles and Approaches

Brown and Atkins (1988) describe teaching as the provision of opportunities for students to learn in an interactive process with intentional activities such as factual and procedural knowledge, skills, ideas and values. The teaching goal of lecturers is for students to attain competencies, deepen their understanding and develop problem solving skills, with goal of students passing their examination. Lecturers should spend time articulating their teaching goals to students and establish whether these goals are achievable through formative reciprocal questioning. (Brown & Atkins, 1988). The varied teaching methods adopted by lecturers are either strictly controlled or would allow students' interactive participation through active learning strategies to bring about effective teaching that is goal-oriented and contextualized. Teaching transformation has been under the influence of social changes which require the institutions of higher learning to respond to the requirements of the dynamic and complex reality by reorganizing the learning process so as to be able to train students to participate and function competently in professional practice within that reality (Mocinic, 2012). Prince (2004) states that active learning can be achieved by any method of teaching which actively involves students in the process of authentic learning, which involves constant intellectual participation in the learning process (Mocinic, 2012). This study supports and promotes students' involvement in some teaching activities, as in active learning, as it fosters student development in procedural knowledge and its integration with declarative and metacognitive knowledge.

Lecturers are encouraged to explore current research on student diversity, interaction and student success as it relates to lecturer behaviours and student learning (Mocinic, 2012). When lecturers are aware of the heterogeneity of modes of access to knowledge, they are more likely to get through to and motivate a wider spectrum of students (Leclercq & Poumay, 2005). It has been reported that matching teaching styles to learning styles can significantly enhance academic achievement, student attitudes and student behavior (Brown, 1978; Griggs & Dunn, 1984; Smith & Renzulli, 1984; Charkins et al., 1985). The ITLMUA advocates for lecturers to teach what they are going to assess in order to avert non-alignment and mismatch in the instructional activities and assessment activities, and use assessment to have a positive impact on student learning (Fook & Sidhu, 2010; Scott & Fortune, 2011). This can be realized by using formative assessment strategies to improve the pedagogical practices of lecturers and to provide specific instructional support to students, particularly lower performing students (Seok-Hoon et al., 2005; Fook & Sidhu, 2010).

Assessment information is needed to make informed decisions regarding students' abilities, their placement in appropriate levels, and their achievement (Fook & Sidhu, 2010). Alternative, dynamic, innovative and authentic assessment practices emphasize the practical application of tasks in real-world settings to measure acquired knowledge and skills, and prepares students for lifetime of learning (Mueller, 2005; Boud & Falchikov, 2005). Dynamic assessment refers to assessment of perception, learning, thinking, and problem solving by an active teaching process aimed at modifying the individual's cognitive functioning (Seok-Hoon et al., 2005). Dynamic assessment is an active process in which students and lecturers participate to provide a model for new assessment techniques (Fook & Sidhu, 2010). The nature of the assessment strategies may contribute to constructive and transformative learning. Moallem (2007) notes that alternative and authentic assessment models promote authentic learning and provide a diversity of learning opportunities for students to display critical thinking skills and greater depth of knowledge.

2.6. EDUCATIONAL THEORIES OF TEACHING, LEARNING AND ASSESSMENT

The HE system is unwittingly built on the dominant and varying types of behaviourism which values the external behavior of students and not necessarily their cognitive and social skills

(Graham, 2010; Batson, 2011). Behaviourism is embedded in behavioural and emotional change as a results of change in the environment, and if applied in an educational setting, this perspective conceives of teaching as a form of ‘conditioning’ and of being lecturer-centered (Graham, 2010). The theoretical framework is based on inferences from behavior where students are conceived as objects to be conditioned, where all students are the same, and are passive recipients of information from the active lecturers. The implications of our current *de facto* learning theory makes teaching challenging and may encourage lecturers to be more willing to change (Batson, 2011). The current research study intended to make lecturers to be more open and enthusiastic to adopt and implement alternative blended learning theories as advocated in the ITLMUA, which to emphasize student learning rather than on teaching. The HE system is stuck in an increasingly archaic teaching model with its powerful deterrent to any fundamental change despite the eagerness of lecturers’ to change to a new epistemology of teaching and learning with an emphasis on student-student and student-lecturer partnerships (Batson, 2011).

Cognitive theories are based on an assumption that learning and development, as distinctive processes occurring in social and classroom environment, are the essential part of learning. Humanistic theories stress the active nature of the student (Harrison et al., 2002). Humanistic learning theories emphasized the urges and drives of personality, migration towards increased autonomy and competence, compulsive tendencies towards growth and development, involvement in active search for meaning, achievement of individually set goals supported by conducive environment to learning and development (Harrison et al., 2002). The researcher recognized the need for innovativeness and creativity considering the changing times when the educational system is faced with a web of entrenched processes which emphasize superficial approaches to learning instead of innovation (Batson, 2011). This study is focused on active, valuable and integrative student learning which should continue long after graduation and involve lifelong learning.

The cognitivist, constructivist and socially-situated learning theories used in this study are considered theories fit-for-purpose due to their explanatory and predictive power. These theories, collectively, keep the value in HE by allowing the researcher to redesign the ITLMUA that placed student experience at the heart of learning designs. The theories suggest a new epistemology based on the constantly changing, socially and culturally-embedded knowledge-building process (Batson, 2011). The researcher could also draw out shared principles across theories such as the value of reflection, tolerance of ambiguity, and understanding how inferred knowledge is organized individually and collectively (Bleakley, 2006). Educational principles are theories that oversee good quality educational practice and curriculum design. (Alonso et al., 2005). The ITLMUA is supported by a blended and eclectic view of educational and psychological theories, with a shift from transactional to transformational pedagogical practice where both students and lecturers are engaged in integration, construction and meaning-making (Alonso et al., 2005; Tigelaar,, 2004).

Educational theories assist in the organization of information into conceptual frameworks to facilitate structured knowledge, greater transfer and active interaction with instructional content via lecturers and peers (Donovan et al., 1999). Educational theories assist in the systematic development of instructional specifications to ensure the quality and effectiveness of instruction, particularly in the design of instructional models that meet learning needs and goals (Moallem, 2007). The ITLMUA has been designed to provide an integrating link between educational learning theories and educational practice, in order to help lecturers and instructional designers incorporate fundamental elements of the instructional design process and principles (Moallem, 2007).

Theories of learning that emphasize the need for students to construct their own understanding have challenged the theoretical underpinnings of traditional lecturers' transmission of knowledge approach. Theories of learning provide empirically-based accounts of the variables which influence the learning process, and provide explanations of the ways in which that influence occurs (Mayes & de Freitas, 2004). The ITLMUA utilizes distinct and complementary educational theories, derived from different perspectives regarding the nature of teaching, learning and assessment, in the third (C), fourth (D) and fifth (E) steps of the ITLMUA model (Figure 1) (Mayes & de Freitas, 2004). The main focus of the ITLMUA is to link learning theories and principles with practice and demonstrate dynamic systems interactions and success in transforming pedagogical practices in the curriculum for the Clinical Technology programme (McCauley et al., 2006).

2.7. ACTIVE LEARNING (AL) INSTRUCTIONAL STRATEGIES

Passive learning pervades HE and will continue to be influential in future, notwithstanding the plethora of alternative and active teaching strategies available. However, 21st century students require more than just transfer of knowledge and passive recipients of 'readymade' knowledge (Michel et al., 2009). The competitive world of work demands that the HE sector produce competent students who are be able to compete with the best in the world, and it is for this rationale that effective, efficient quality and excellent teaching and learning must be fundamental in the mission statement of HEIs (McKeachie et al., 1986; Michel et al., 2009). The AL instructional strategies provide students with time and opportunities to ask meaningful questions, interact with relevant readings to solicit appropriate answers, reflect on the content of the subject matter, and in so doing, they are actively engaged with subject material and actively participating in learning (Meyers & Jones, 1993). This study integrates the conventional and active learning teaching strategies to, hopefully, enhance the effectiveness, efficiency and high-quality learning and teaching, and provide the lecturers with the opportunity to guide and facilitate learning in order for students to be knowledgeable, skillful and competent.

Active learning can be used to develop student learning activities that best reflect lecturers' teaching styles and the type of learning material provided to the students. Active learning such as collborative and cooperative learning involve students in doing a variety of academic activities and thinking about the activities while they are doing them (; Kolb, 1984 in Michel et al., 2009; Johnson, et al.1991; Bonwell & Eison, 1991; Eison, 2010; Batson, 2011). McGourty et al., (1998) noted that cooperative learning techniques promote skills development such as self-learning, interdependence amongst students, encourage interaction, and require information sharing, and utilize team-based assignments as a keystone of the learning process. Active learning is generally accepted and used to describe any activity where students are actively occupied in doing and engaging in meaningful activities, high-order thinking, reflecting about what they are doing, and receiving immediate helpful feedback about the instructional activities (Bonwell & Eison, 1991; Prince, 2004).

In the implementation of ITLMUA, student are involve in the preparation of a thematic learning unit and class oral presentation that encourage active engagement and interactive student participation through questions and answers during peer teaching, and elaboration on what is being presented using prior knowledge and experience. The systematic approaches in AL include creating an open and laissez-faire atmosphere for learning in the classroom environment, class preparation in which lecturers think, plan, and create how lessons will be delivered, and continuous improvement where the leturers use students' and peer feedback on their teaching strategies (Auster & Wylie, 2006). This study uses *clarification pauses* to promote greater student engagement, to foster active listening, and to consolidate their notes (Eison, 2010; Felder & Brent, 2009; Faust & Paulson, 1998), and *rotational questions and answers* to stimulate and determine students' degree of their understanding of the delivered subject matter (Faust & Paulson, 1998; Prince, 2004; Russel et al., 2007; Michel et al., 2009). This approach averts the same active students answering questions at all times, and academic loafing from those students who rarely answer questions in class (Faust & Paulson, 1998; Michel et al., 2009). The *team-based learning* includes permanent and purposeful heterogeneous team work where the majority of work is individualized and consolidated into unitized work in subsequent meetings, and the final written work is agreed upon by all members of the team to foster cooperative learning (Faust & Paulson, 1998; Prince, 2004; Eison, 2010).

Employers frequently cited lack of basic science knowledge and team skills in our students who are entering work-integrated learning, therefore, team-based learning can address these limitations. Students who are involved in team-based learning activities with a common goal such as cooperative learning, are learning about interdependence and individual accountability in heterogeneous groupings, with overwhelmingly positive results such as increased academic achievement and enhanced social and psychological benefits to students (Stahl, 1994; Cooper & Mueck, 1990; Faust & Paulson, 1998). Cooperation is more effective than competition in producing consistent positive learning outcomes with good internal validity, large effect size, promotion of interpersonal relationships, social skills and effective teamwork, and improvement in social support and fostering self-esteem (Prince, 2004). The ITLMUA promotes communication and social skills related to group work while at the same time, supporting and endorsing individualism through providing an opportunity for students to meaningfully and actively participate in the teaching-learning process.

Students who adopt deep approaches to learning are able to understand and extract meaning from subject content by relating new ideas to previously learned knowledge, looking at relationship of concepts and principles, authenticating information and examining arguments and deliberations (Birenbaum, 1997). In surface approaches to learning, students tend to cope with course requirements through memorizing and reproducing factual knowledge (Marton and Säljö, 1997). Lecturers in HE continue to utilize conventional teaching strategies despite the strong evidence that the quality of learning is better achieved by alternative methods of instruction such as AL (Marzano et al., 2001). Lombardi (2007) reports that students said that they are motivated by solving real-world problems and prefer 'doing' rather than 'listening, and most lecturers consider learning-by-doing to be the most effective way to learn. In AL students are expected to actively engage in reading, writing, dialogic discussion and engage in authentic problem-solving, with a focus on the three learning domains of knowledge, skills, and attitudes. In particular, students are expected to engage in such higher-order thinking tasks as analysis, synthesis, and evaluation (Renkl et al., 2002). Active learning is an educational approach that places the student at the center of the teaching and learning process and recognizes the variance between different styles, and focuses the responsibility of learning on students (Doppelt, 2003).

Active learning strategies helps students to explore a diversity of perspectives, increase their intellectual agility, increase their respect for students' voices and experiences, develop habits of collaborative learning, and develop skills of synthesis and integration (Brookfield 2005). In addition, by having the teacher actively engage with students enables teachers to come to class better prepared because they are aware of what is taking place in the classroom. Teamwork participation is useful in situations where students can identify and relate what they know to their peers and be involved in discussions. Silberman (1998, p. 1) emphasized the need for active learning by the following statements: "What I hear I forget. What I hear and see, I remember a little. What I hear, see, discuss and do, I understand. What I teach to another, I master." This study intends to encourage students to exert themselves towards a common, well-defined goal with positive interdependence and individual accountability when they are exposed to AL strategies that lecturers will be using during subject content delivery to advance student effective and high-quality learning (Cooper & Mueck, 1990).

Lecturers participating in this study were not that eager to embrace AL citing extra preparation work and waste of class time that may affect syllabus completion, but were reassured that guidance and facilitation will be provided in the execution and implementation of AL strategies. Felder and Brent (2009:2) proposed that lecturers must not “throw out lecturing and make every class you teach a total active learning extravaganza”, and suggested that lecturers spend time teaching what they know by explaining, clarifying, demonstrating and modeling. Hopefully, students and lecturers could appreciate their newly-found opportunity to explore new ways of acquiring knowledge, discover new ideas, and develop the ability to integrate subject content knowledge from an array of subjects offered in Clinical Technology.

2.8. LEARNING OUTCOMES (LO) AND ASSESSMENT CRITERIA (AC)

Lecturers should be taught how to write LOs and AC, as well as their associated assessment strategies. Lecturers could approach this exercise by focusing on what the student is expected to know, do, and understand by the end of the thematic learning unit (Bingham, 2002; Gosling & Moon, 2002). The AC guide shows how LOs can be achieved using aligned assessment strategies which have been preceded by appropriate and relevant teaching strategies to comply with achievements of constructive alignment (Biggs, 1999; Gosling & Moon, 2002). The lecturers participating in this research study were made aware of the significance of writing LOs for each thematic learning unit so that students could be informed of the LOs expected to be achieved using the Revised Bloom’s Taxonomy of Cognitive Dimension in order to enhance the quality of instructional activities (Mueller, 2005).

2.8.2. Learning Outcomes (LOs)

The LOs are statements/descriptions of what the student is expected to learn and achieve during a learning session, and are expressed in terms of what the student is expected to know, understand and be able to do (Bingham, 2002; Gosling & Moon, 2002). The ITLMUA promotes utilization of TLA strategies that are best suited to assist students to achieve the desired and expected LOs that are linked to the threshold of AC. The LOs consist of three parts: a measurable verb, a condition under which the performance is to take place, and the criterion of acceptable performance.

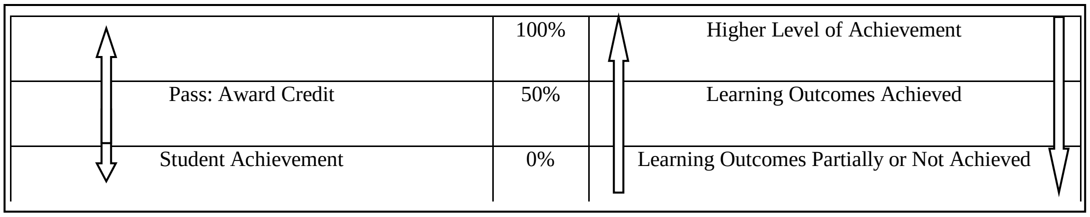

Figure 2: Learning Outcomes and the Qualities of Higher Education Learning
Source: Adapted from Gosling and Moon (2002)

Figure 2 presents a notional view of student achievement from 0% to 100%. A learning outcome drawn at a pass/fail point of 50% can be interpreted as a 'tie down' description, the lowest 50% of achievement. It tells the student what s/he must do in order to pass the subject. In this way it forms a sort of learning contract between the lecturer and student. The students must be aware of what they should do to pass the subject. The ITLMUA advocates for LOs that are developed with reference to the learning expected at one identified level descriptor, which must be translated into subject descriptors. The benefits of specifying LOs are many, and include informing students of what is expected, a means to ensure TLA methods are appropriate and match the LOs, and a way to facilitate formative feedback to students and lecturers. The LOs must have the following characteristics: achievable, general, unambiguous, significant, assessable and essential (Gosling & Moon, 2002). There is observable development in individual students learning as outcomes of their learning display increasing structural complexity in the details of their responses (quantitative), and details became integrated into a more complex pattern (qualitative) (Mayes & Freitas, 2004). Programme designers, curriculum developers and lecturers are encouraged to use verbs from Revised Bloom's Taxonomy Table to define the desired LO's of the programme, subject and learning period (Mayes & Freitas, 2004).

2.8.3. Assessment Criteria (AC)

The key features of assessment criteria are that they should closely relate to LOs, indicate what is required at a pass level, help students know what they need to do and expect at differing levels of achievement, be understandable to all stakeholders, be manageable in terms of number, be distinct from each other, and be seen as an indication of achievement (Bingham, 2002). In HE students' academic performance can be assessed either according to norm-referencing where students work is judged on the basis of their performance in relation to each other, or criterion referencing, where students work is judged on the basis of their performance in relation to clearly stated criteria (Bingham, 2002). The ITLMUA embraces the utilization of criterion-referenced assessment as a means of ensuring consistent standards between examiners and moderators, and across the programme subjects, and norm-referenced assessment where students' performance is compared and contrasted among themselves in order to monitor individual progress with the aim of intervening to improve achievement and performance (Rust et al., 2003). It is suggested that a common comprehensive criteria assessment grid be developed plotting marks in a matrix format, with detailed definitions of acceptable performance for each criterion which enables consistency in assessment and easier moderation (Rust et al., 2003). Furthermore, this common comprehensive assessment criteria grid must be made available to students to provide a more explicit guide to students, resulting in improved students' performance and achievement and making it easier to give effective feedback to students (Rust et al., 2003).

2.9. ASSESSMENT PRACTICES IN HIGHER EDUCATION

Assessment is defined as any method used to better understand the current knowledge and understanding that a student possesses. Good assessment information provides accurate diagnostic and prescriptive estimations of student achievement and performance and enables lecturers to monitor students' progress and make appropriate decisions in terms of motivating them (Dietel et al., 1991). Educational reforms and restructuring in HE focuses attention primarily on assessment as it believed that assessment drives student learning, and the trends in HE assessment are adoption of alternative, authentic, meaningful and dynamic assessment methods (Dietel et al., 1991). The ITLMUA uses an integrated, authentic and formative assessment method based on short, relevant and meaningful answers that demonstrate high-level thinking in an effort to enhance the quality of teaching, learning and assessment, and provides an active, constructive knowledge environment (Dietel et al, 2006). In addition, ITLMUA involves students in assessment practices through self and peer assessment and assignments are assessed based on assessment criteria for each learning unit to ensure that students are aware of the standards and expectation of assessment.

It is commonly accepted that students are influenced by assessment and not teaching, a concept supported by Rowntree (1987:1) who states that "if we wish to discover the truth about an educational system, we must first look to its assessment procedures". Lester (1998) notes that assessment exerts a powerful influence on what and how students learn, to the extent that the assessment tail frequently wags the learning dog. The challenge with assessment in HE is that people are modest to question the assumptions on which lecturers' assessment strategies are based as long as students are passing to satisfy the funders. The ITLMUA was developed to facilitate the understanding of the assumptions embedded in assessment strategies lecturers are using in assessing students' learning in order for transparency so that they can be scrutinized and challenged, including the purpose and reasons for selecting a particular assessment strategy. Assessment strategies and practices should be designed around a paradigm, for example, the humanistic approach tends to focus on academic discipline with the intention of building knowledge incrementally through research or discourse, and the technocratic approach which focuses on producing solutions to problems using professional discipline, knowledge base and theory of practice (Lester, 1998).

Assessment should set up an expectation of what is acceptable in terms of students' responses against which students' achievements and performances can be judged, using AC agreed upon by both students and lecturers. The assessment strategies should be designed and operate in such a way that they are not only responsive to clear-cut answers but also to divergent issues, value-conflicts and dilemmas of perspective which do not yield to unidisciplinary knowledge or to technical-rational solutions (Lester, 1998). Traditional assessment strategies test students' ability to replicate accurately what was disseminated by the lecturers in class and perform procedures unthinkingly, that is, recall factual knowledge as is (Meldrum, 2002). The lecturers' assessment practices and decisions are most often based on their knowledge and beliefs about learning when in essence, they should also be based on learning and assessment theories, and pedagogical philosophies as indicated in the ITLMUA (Allen & Readman, 2008). Assessment cannot advance in practice unless lecturers view teaching as a multidimensional activity where they are constantly involved in research in their teaching practice in the process of striving to enhance the quality of teaching, learning and assessment, particularly assessment that informs and is integral to instructional activities (Dietel et al., 2006).

The expectation is that the teaching, learning and assessment of both students and lecturers should be aligned as is advocated in the ITLMUA, but the reality is a different picture – one of misalignment because of the lack of knowledge of students' needs, traits, characteristics, behaviours and attitudes (Allen & Readman, 2008). Furthermore, the assessment practices and strategies selected by the lecturers requently inhibit student engagement resulting in students performing at lower than expected learning levels, and the probable sources of misalignment are the lecturers' expectations of student learning and assessment, and students' engagement within that context (Allen & Readman, 2008). The role of assessment is to raise the standards of teaching and learning in order to inform the teaching and learning process. The ITLMUA focuses on assessment of learning in conjunction with formative and summative assessment practices, using these to enhance instructional activities (Harlen, 2004). Assessment of achievement and performance is a suitable way to inform both student and the institution of how well expected knowledge, skills and competence have been mastered, and to establish whether individual students' targets have been achieved (Tillema et al., 2000). The ITLMUA promotes assessment methods as a tool for both diagnostic and adaptive purposes that can inform the direction of learning most suitable for different learning goals (Tillema et al., 2000). , The ITLMUA focuses on fundamental science knowledge basic health principles and concepts as well as competencies for the professional work environment which students will encounter post-graduation when they will be working in multidisciplinary teams (McGourty et al., 1998).

2.10. FEEDBACK

Student feedback is an important part of the student learning experience although students and lecturers often express dissatisfaction and disappointment with the negative or unsupportive manner in which feedback process occurs, which is sometimes demoralizing since it does not give guidance on how to improve subsequent performance (Spiller, 2009). Empathetic, clear and goal-oriented feedback to students should encourage a dialogue in which both students and lecturers examine and articulate the differences and similarities in their thoughts, feelings, values and behaviour (Tsui, 2005; Hanna, 2000; Tsien & Tsui, 2007).

The utility and meaningfulness of student feedback drives student learning and encourages student engagement with academic tasks to improve their own learning. The ITLMUA focuses on internal and external feedback so that the whole process and activities are reviewed and refined to ensure that instructional activities are responsive to the diversity of student population with regard to satisfying their learning and teaching goals as determined by the LOs of the subjects. Unhelpful feedback is unwelcome by students, particularly comments that are unfocused, for example, “you will only get good marks if you put time and effort in your work”, dismissive and sarcastic comments such as “did you do enough literature review for this task?”, comments that pass the buck, for example, “we will refer you to the academic development consultant”, and mixed messages comments such as “I don’t hear your voice, only what you copied verbatim from the internet and literature” (Chamberlain et al., 1998). The students would be happy if timely feedback is actually telling them what is it that they did not do in their assessment tasks and they would also appreciate if they are given exemples of how to improve their academic responses in addition to clear, concise and simple assessment criteria as supported by ITLMUA. Most importantly, balance the positive and negative feedback, and start with positive feedback followed by negative feedback that has comments on how to better the responses for improvement.

The misunderstanding and confusion about feedback emanates from students not knowing the role of the lecturers therefore, it is critical that student know that lecturers are facilitators of their learning by informing, questioning and answering, guiding, supporting and assessing and providing feedback to students with the sole purpose of achieving the LOs. The ITLMUA encourages lecturers to allow students to redraft/rewrite and resubmit the academic task that they did not do well, and students would be allocated a supplementary fifty-percent mark irrespective of their previously obtained mark, but those who are unsuccessful the second time around, would be allocated the mark obtained. The ITLMUA encourages students to be involved in assessment practices in HE in self and peer assessment, thereby getting feedback from oneself, peers and the lecturers. The cooperative learning component of active learning allows students to provide each other with meaningful and useful feedback regarding the technical and interpersonal performance (McGourty et al., 1998). When feedback is formalized, it sends a clear message to students that performance should be improved, and encourages students to appraise their own achievement and performance by establishing their own improvement (McGourty et al., 1998).

CHAPTER 3: RESEARCH METHODOLOGY, DESIGN AND METHODS

3.1. INTRODUCTION

This chapter deals with the research methodology, research design and research methods, based on a design-based research (DBR) approach because of its systematic and flexible methodology characterized by empirical educational research, theory-driven, contextually-sensitive design principles and theories of the learning environments (Design Based Research Collective (DBRC), 2003; Wang & Hannafin, 2005;). This research study adopted a qualitative dialectic case study approach to discover concepts, relationships, theories, and gradually build up general theories that emerge from the data (Denscombe, 2007). The philosophical research principles of interpretivism, with symbolic interactionism as the theoretical position, were used to study the subjective perceptions, meanings and responses of participants (Flick, 1998). *Research methodology* refers to the philosophical and theoretical aspects of the approaches employed to develop knowledge, *research design* refers to the strategy used to integrate the different components of the research thesis in a cohesive and coherent way, and *research methods* encompass the variety of techniques that people use when studying a given phenomenon (Hall, 1991; Hammel, 2002). The research methodology and methods in any research reflect particular historical, ontological and epistemological assumptions concerning how claims to knowledge might be justified (Evans, 2000). This research study adopted humanistically grounded methodologies and interpretive approaches (DeCorte et al., 1996).

The ITLMUA was implemented in a way that assisted the researcher to obtain results and information which helped to make sense of the aims and assumptions of the research, and that could be associated with the real situations under study (Burns & Grove, 2001). The evaluation of ITLMUA was conducted in a real educational setting and the research methods and methodologies assisted in the determination of the ITLMUA's effectiveness, usability and satisfaction as the main criteria for the study (Eseryel, 2002; Osman et al., 2013). The effectiveness of ITLMUA refers to the positive impact of the instructional model on participants, as articulated by the qualitative responses of the participants themselves (Bayram & Nous, 2004; Rogers et al., 2007; Noordin et al., 2011). Evidential information from students is highly reliable when is received against prescribed criteria (Muijs, 2008). The efficacy of ITLMUA was explored and evaluated formatively to determine the impact on the enhancement of teaching and the quality of student learning in the selected academic subjects in the Clinical Technology programme.

3.2. RESEARCH METHODOLOGY

This study is underpinned by empiricism, which holds that all knowledge is acquired through human senses to provide insight into instructional activities, with DBR providing a philosophical, theoretical and methodological foundation (Joseph, 2004; Alghamdi & Li, 2013). The DBR facilitated the development and refinement of the ITLMUA in order to address particular educational challenges, for example, alignment of learning goals with learning outcomes and to ensure validation of participants' perceptions (Sidani & Sechrest, 1996; Krauss, 2005). The multimethod approach was used to gather, analyze and interpret data to explain the impact of the instructional model intervention on the quality of student learning and teaching in the natural context in which it is occurring (Greene, 1994; Denzin & Lincoln, 1998). The study was conducted at the DUT in the Faculty of Health Sciences (FoHS), Department of Biomedical and Clinical Technology (DoBCT), with registered students and lecturers in the 2nd year of study of Clinical Technology who granted their consent to participate in the study. The independent variable in this study was the method of instruction, a variable with two categories: individual learning and collaborative learning, and the dependent variables are the post-test results and partipants qualitative responses.

The thematic learning units were jointly developed with the lecturers of the respective subjects, and delivered in an interactive AL teaching strategy to facilitate knowledge and understanding of the subject content. Alphabetical tags were used to conceal the identification of the volunteered participants, for example, Student M and Lecturer B. The lecturers were lecturers who are normally teaching the two subjects, namely, Biomedical Apparatus & Procedure 2 and Organ & System Pathophysiology 2.

3.2.1. Design-Based Research (DBR)

The underlying principle of DBR is the continuous development and elaboration of newly generated theories and principles as determined by the educational context and participants' perceptions to facilitate in-depth understanding of the phenomena under study (Barab et al., 2007; Wang & Hannafin, 2005; Barab & Squire, 2004; Collins et al., 2004; Fishman et al., 2004). The DBR, with its utility and adaptability, integrates theory-driven design with empirical analysis of an educational phenomenon to provide scientific and educational value and impact on the outcomes of student learning and teaching through an iterative mechanism of design, discovery, exploration, and evaluation using formative assessment (Hoadley, 2002; DBRC, 2003; Kelly, 2003; Bell, 2004; Bowler & Large, 2008; Kong, 2008). The DBR facilitated different kinds of knowledge and theoretical understanding of TLA in order to advance the ITLMUA (Edelson, 2002; DBRC, 2003).

The DBR is a problem-solving methodology for instructional activities in HE when evaluating an instructional model's impact of instructional practices with the opportunity to review and reflect on the outcome of the intervention in order to improve pedagogical practices, thereby enhancing the effectiness and quality of educational practices and processes (Schon, 1983; Dorst & Dijkhuis, 1995; Penner et al., 1998; Fortus et al., 2004; Kennedy-Clark, 2013). The DBR assisted in theoretically understanding the instructional phenomena addressed by ITLMUA intervention, and to build new theory of the TLA, thus facilitating development of effective learning environments and improvement of instructional practices (DBRC, 2003; Shavelson et al., 2003; Hoadley, 2004; Sandoval & Bell, 2004;). The advantage of the DBR is development of evidence-based claims derived from naturalistic investigations that result in meaningful and usable knowledge, and understanding about how lecturers teach and students learn (DBRC, 2003; Barab & Squire, 2004). Such useful and functional theory assists in bridging the gap between theory and practice and organizes social knowledge (Pring, 2004; Neuman, 2007; Alghamdi & Li, 2013; Trna & Trnova, 2014).

This research study focuses on research for education which aims to bridge the gap between the theoretical and the practical aspects by comparing and evaluating alternative strategies for instructional activities by using varied research methodologies that govern research (Marczyk et al., 2005; Henn et al., 2006; Juuti & Lavonen, 2006; Sari & Lin, 2012). The theory and information from this study can assist in further design and refinement of the components of the ITLMUA with academic benefits for students and the lecturers in the HE sector (DBRC, 2003; Joseph, 2004; Dede, 2005; Wang & Hannafin, 2005).

Real-world practice, with its associated evolution of knowledge, necessitates the continuous modification and refinement of the ITLMUA in order for it to be responsive to the developments in practice and technology which impact on instructional practices (Barab & Squire, 2004; Hadjerrouit, 2008). The DBR advances theory development which should be informed by practice in action rather than merely testing hypotheses, to be able to transfer findings from a particular context of intervention to similar or different contexts, referred by Stake (1995) as *petite generalization*. The formative nature of DBR allowed the cyclic and iterative implementation and evaluation of the efficacy of the ITLMUA to advance theory as a consequence of the interactions between design interventions and personal experience (Barab & Squire, 2004; Hoadley, 2004).

Furthermore, the exploratory approach of the DBR attempts to evaluate and explore the interventionist nature of the ITLMUA with the aim of identifying new theoretical insights, knowledge, understanding and meanings, and providing a theoretical explanation of the factors related to the research topic (Brink & Wood, 1998). This research is exploratory in nature, and the research findings are not necessarily generalizable, however, the study provide a better understanding of the sample population being examined in order to arrive at an appropriate description of reality of the existing situation (Burns & Grove 1999). The descriptive design allows for the development of theory, identifying problems and justifying current practice, and providing perceptions and views of the respondents regarding the phenomenon beig studied (Waltz & Bausell, 1981; Burns & Grove 1993; Lechner, 2001). Therefore, design-based research could be regarded as a theoretical paradigm which is used to identify the underlying basis of a problem and is then used to construct a scientific intervention or a collection of logically held together assumptions, concepts and propositions that orientates thinking and research (Bogdan & Bilkan, 1982).

3.2.2. Qualitative Dialectic Case Study Research

Qualitative dialectic case study research utilizes a variety of research methods to gather data which may show the same pattern and becomes credible through triangulation and member validation (Seale, 1999; Bloor, 1997; Gay, 1987). Triangulation involves the practice of viewing things from different perspective by using different research methods and different sources of data to enable the researcher to obtain a better understanding of the constructs that are being investigated (Denscombe, 2007). The researcher is the primary instrument, with the aim of exploring human experiences in order to answer humanistic research questions from the perspective of the participants in their social context (Strauss & Corbin, 1990; Cassell & Symon, 1994; Denzin & Lincoln, 1998; Merriam, 1998). The goal of QR is to generate new hypotheses and theories rather than testing hypotheses, which resonates well with the DBR approach to theory generation based on *a priori* theoretical ideas in order to provide rich and in-depth description of phenomena using a credible theoretical framework (Oka & Shaw, 2000; Merriam, 1998; Kelle, 2001). Qualitative research focuses on studying individuals' subjective meanings attributable to their environment, with the philosophical view that humans cannot perfectly understand reality, but with meticulous data collection and analysis, researchers can approach the truth about the phenomena under study (Flick, 1999; Oka & Shaw, 2000).

Case study was used as transparadigmatic and transdisciplinary heuristic approach involving careful description of the phenomena, with a focus on learning through knowledge acquisition and construction, and problem-solving to enhance the effectiveness and quality of instructional practices (; Merriam, 1998; Eckstein, 2002; Anderson et al., 2005; Van Wynsberghe & Khan, 2007). Creswell's (2002) definition of case study is that it is a method of develoing an in-depth understanding of the phenomena under study in a bounded system involving the process and procedures of an event. The case study approach is used in this study to interpret in-depth accounts of educational processes, relationships and experiences occurring in a classroom environment in order to enhance the quality of pedagogical practices in HE using small-scale research to determine the efficacy of ITLMUA (Denscombe, 2007; Wilson & Chadda, 2010). A case study approach provides the researcher with the opportunity to delve holistically into pedagogical practices in the Clinical Technology subjects selected in great detail to discover relationships and processes within the educational setting.

The research tools such as survey questionnaires, interviews, observations, evaluation forms, test results, and programme documentations were used for collecting quantitative and qualitative data from participants. Collected data was analyzed using content analysis and the constant comparative method to develop salient categories and patterns, and triangulated across data sources in order to confirm and refute research evidence. Lin & Hsieh (2001) conducted a study on the computer as a learning partner in the curriculum report on four generic and cornerstone principles of the scaffold knowledge framework that they observed: (1) making science accessible, (2) making thinking visible, (3) helping students learn from others, and (4) promoting autonomy and lifelong learning. Edelson et al. (1999) conducted research on technology-supported inquiry learning featuring scientific visualization technologies in the geosciences, and generated two content-specific principles: (1) the design of investigation tools can address the challenges of motivation, accessibility, and practical constraints, and (2) knowledge resources and record-keeping tools are a necessary process support for inquiry-based learning. The DBR guides theory development, improves instructional design, extends the application of results, and identifies new design possibilities (Edelson, 2002; Cobb et al., 2003).

3.3. RESEARCH DESIGN AND METHODS

3.3.1. Research Design

The purpose of the research design was to integrate and sequence the different instructional activity components in a cohesive and coherent way, with the objective of analyzing the current pedagogical practices in the two selected subjects in the Clinical Technology programme, and to provide a new theoretical framework for instructional activities (Leclercq & Poumay, 2005). This study was characterized by the integration of qualitative and quantitative methods to facilitate the triangulation of the gathered data in an attempt to achieve greater validity (Caracelli & Greene, 1997). The qualitative research designs and methods could be repetitively refined, adjusted, expanded, adapted or limited while the researcher was coducting iterative research using the DBR paradigm (Goetz & LeCompte, 1984).

Research methods are instruments that operate within sets of philosophical and theoretical assumptions, and claims about the nature of participants and interaction as a result of the instructional intervention (Roberts, 2002). An exploratory descriptive research design has the following characteristics: flexible research design that provides an opportunity to examine all aspects of the problem being studied and to strive to develop new theoretical insights and knowledge to answer research questions, and in-depth description of participants lived experiences (Uys & Basson, 1991).

3.3.2. Research Methods

A variety of research methods were used such as survey questionnaires, interviews, class observation, assessment questions and results, programme and subject objectives, with qualitative data supplemented by quantitative data in order to consolidate inductive analysis and interpretation of the research findings (Johnson & Onwuegbuzie, 2004; Kraus, 2005). The 'yes' and 'no' responses were counted to yield numerical data, including assessment results, and were used to measure the effectiveness of the achievement outcomes (Allan et al., 2009).

3.3.3. Sampling Design and Sample Size in Qualitative Research

The study used the purposive sampling technique to select information-rich participants in order to answer the research questions, elicit appropriate, relevant and sufficient information, explore their meanings, develop and maximally describe the phenomena being studied (Fossey et al., 2002). Purposive sampling strategy was employed to improve the suitability of sampling, significance and satisfactoriness of information collected, and to take advantage of the representation of a variety of perceptions on the effectiveness, usability and satisfaction of the instructional model (Hoepfl, 1997; Fossey et al., 2002; Hammel, 2002). The 'logic and power' of the various kinds of purposive sampling used in qualitative research lie primarily in the quality of information obtained per sampling unit, as opposed to their number per se, but inadequate sample sizes could undermine the credibility of research findings (Sandelowski, 1995).

The study adopted a sample design of 'within-case analysis' which enabled analysis, interpretation and legitimizing data that helped in explaining the efficacy of the ITLMUA in an educational context (Miles & Huberman, 1994; Onwuegbuzie & Leech, 2004). The cross-cases analysis was used for textual responses and thematic analysis across participants (Creswell, 2007; Schwandt, 2001). Student participants were selected based on the adequacy of time and experiences of the programme as they were in their second year of study, and would be able to provide authentic and subjective accounts of their perceptions of the subject offerings (Onwuegbuzie & Leech, 2004). Unquestionably, the researcher acknowledges that the sampling strategy may seem statistically unrepresentative in the eyes of the positivists, but it is informationally representative as data was obtained from participants who are representative of other persons with similar characteristics (Sandelowski, 1995; Onwuegbuzie & Leech, 2004).

Samples for qualitative investigations are typically small but are sufficient to adequately answer the research question (Marshall, 1996). According to Sandelowski (1995:179), "a common misconception about sampling in qualitative research is that numbers are unimportant in ensuring the adequacy of a sampling strategy". Too large sample size makes extraction of thick, rich data difficult and prone to biases, and too small sample size makes it difficult to achieve data saturation, theoretical saturation and informational redundancy (Lincoln & Guba, 1985; ; Flick, 1998; Strauss & Corbin, 1990; Sandelowski, 1995; Morse, 1994; Onwuegbuzie & Leech, 2004). This sampling strategy was employed to fully elaborate and authenticate theoretically derived variations discerned in the data and makes it possible to generalize analysis of the underlying context of the research findings (Sandelowski, 1995; Onwuegbuzie, 2003).

The researcher ensured that subjective experiences were adequately captured and used the gathered textual and numerical data authentically, ensuring that the data was adequately legitimized with regard to validity, generalizability and reliability (Onwuegbuzie & Leech, 2004; Denzin & Lincoln, 2005). The researcher ensured that the general design guidelines and principles derived from reviewed literature were applied to the research design.

Table 1: Sample Population Biological Demographic Characteristics for the Main Study

Africans		**Whites**		**Asians**		**Coloureds**		**Total**
15		1		14		-		30
Students' Participants								
Male	Female	Male	Female	Male	Female	Male	Female	**Total**
7	8	-	1	6	8	-	-	30
African		**Whites**		**Asians**		**Coloured**		**Total**
1		-		1		-		2
Lecturers' Participants								
Male	Female	Male	Female	Male	Female	Male	Female	**Total**
1	-	-	-	-	1	-	-	2

Table 1 is representative of the regional demographics, and not necessarily of the country, particularly when it comes to Asians and Coloureds, and includes age, race and gender. The exclusion criteria comprises those students who did not consent to participate in the research study, but were expected to attend lectures as they were part of their normal programme activities, as a result they were not exempted from being involved in the implementation of the ITLMUA since it was covered in the normal subject content and assessment practices. According to Sandelowski (1995) qualitative researchers seek informationally representative participants in terms of age, sex and race because they are considered good sources of in-depth knowledge and information that will advance the analytical aim of the research. Qualitative and quantitative data collection research methods or techniques were used to gather textual and numerical data which complemented each other in order to strengthen the analysis and the interpretation of the research findings. Quantitative data was derived from Likert Scale statements and questions, and students' assessment results using various assessment methods. The qualitative data derived from questions and Likert Scale opinions provided a descriptive base for the study. The various teaching, learning and assessment philosophies, goals, and strategies; typology of learning materials presented; definition of effective teaching; means of assessing student performance; lecturers' orientation towards students; and, type and extent of learning tasks and other requirements from students were documented (Donald, 1990; Theall, 1993). A matrix was designed to ensure that every variable and indicator was addressed and refined and that each instrument content could be connected back to the goals and research questions of the research (Holland, 2001).

3.4. INTEGRATED TEACHING AND LEARNING MODEL USING ASSESSMENT (ITLMUA)

The variables used to determine the efficacy of the ITLMUA were *effectiveness*, *usability* and *satisfaction* of the participants during implementation and evaluation of ITLMUA's impact on the quality of student learning and teaching. The shift to quality enhancement to improve the quality of learning opportunities, require lecturers to know and understand the students' needs, aspirations and attributes so as to be responsive to their diverse needs and learning goals (Chua, 2004; Zafiropoulos & Vrana, 2008). The effectiveness of ITLMUA is determined by students' perceptions about the effectiveness and quality of the teaching practices and acquisition of students' quality learning (Fenstermacher & Richardson, 2005). The usability variable of ITLMUA is ascertained by participants' responses to the utility of ITLMUA of its impact on the effectiveness, efficiency and quality of instructional practices' impact on the progressive improvement on the quality of learning and teaching as evident in the qualitative responses to assessment questions and assessment results (Zafiropoulos & Vrana, 2008).

The educational quality in this study, refers to the conformity of educational output of the teaching and learning goals, achievement of educational outcomes, and the application to the real-life environment, and alignment with the expectation of the professionals (Parasuraman et al., 1998; Sahney et al., 2004). Quality teaching, as determined by elements of service quality, involves excellent teaching strategies, lecturers’ availability for consultations, excellent infrastructural and academic support, manageable class sizes, subject content and workloads (Adee, 1977; Oldfield & Baron, 2000). Central to the ITLMUA is a quality framework to guide lecturers in maintaining and enhancing quality instructional practices throughout the teaching-learning process (Baig et al., 2006).

Kapoor et al. (2001) pointed out that accurately identifying students' cognitive-emotive state is a critical observation that can enable lecturers to provide students with an efficient and pleasurable learning experience so that they are able to evaluate their characteristics and behaviours in relation to their effect on learning (Tsien & Tsui, 2007). The ITLMUA is student-centered as it fouses on the students' learning goals and aspiration. It supports consulation of students in the development of learning tasks and assessment criteria involves students in the assessment practices in HE, expects students to be competent and perform to the requisite expectations, standards and satisfaction, with lecturers playing a facilitator role for the students. The ITLMUA utilizes alternative instructional strategies, underpinned by learning theories and pedagogical practices to ensure that students achieve the learning goals as set in the learning task, thus enhancement of their learning as a result of quality teaching by use of ICT in the teaching of subjects in the Clinical Technology programme (Frantz & King, 2000; Hadjerrouit, 2008; Alonso et al., 2005; Engelbrecht, 2003;).

The behavioural socialization aspect of ICT can be influential in the socialization process of the students in terms of facilitation of conversation, communication and feedback between lecturers and students and among students. Transformation is an integral part of the teaching-learning process of the ITLMUA that enables active interaction and synergistic interrelationships so as to impact on students' effective and quality learning and teaching, supported by a community of reflective practitioners throughout the intervention (Clarke, 2007). The ITLMUA is also reactive and responsive to the internal factors such as professional lecturers without academic qualification and adequate workplace professional experience. The ineffective and misdirected staff skills and development programmes directed to improve staff performance and lack of management support for self-advancement and incentives for high achievers. The external factors such as dwindling fiscals support from central government, political will-power to advance education, lack of accessibility to previsouly disadvantages communities and underprepared of students from high school education system, are some of the transformational impediments.

The student population reflects the characteristics and behavioural diversity of our nation with a medley of student interests, needs, learning styles and socio-cultural backgrounds. Lack of knowledge of students' characteristics makes it difficult for lecturers to make an informed judgment related to students' academic issues and makes it more difficult to develop and assess knowledge, skills, abilities and competences (Darling-Hammond & Snyder, 2000). Lecturers need to be explicit regarding their expectation of students' achievement and performance as stated in the LOs and assessment criteria, including cognitive, analytical and behavioural concepts students must comprehend and use to acquire and create knowledge (CEA Global

Education, 2011). Students use learning strategies and styles to navigate through their studies in order to enhance the quality of their learning, and these strategies and styles are useful toolkit for active, conscious and purposeful self-regulation of learning (Scarcella & Oxford, 1992).

It has been reported that learning styles and strategies can work together with, or in conflict with a given instructional strategy or/and style, and there is a need to align and modify either in order to improve student achievement and performance by increasing their confidence and lower personal anxieties in students (Oxford, 2003). If there are clashes, the students often perform poorly, feel unconfident, and experience significant anxiety, and such clashes sometimes lead to breakdown in lecturer-student interaction (Oxford, 2003). Learning strategies empower students to develop and advance their analytical synthesis of the information, utilize their learning styles to gather and monitor their mistakes and evaluate tasks success, ability and skills to integrate information in and orderly manner, and ask questions for clarification (Oxford, 2003; Boud, 2001). The teaching strategies used in this study were practical and work-based such as show and tell, case studies, flowchart techniques, open-ended quizzes and brainstorming. Students were given the opportunity to do oral class presentation, thereby enhancing their learning as they were able to integrate theory and practices, and understanding of the requirements to achieve high performance through active participation in the educational processes in the HE (Courter et al., 1996).

3.4.1. The Development of the Integrated Teaching and Learning Model Using Assessment (ITLMUA)

The design and development of the ITLMUA emanated from a needs and context analysis of the pedagogical practices in the FoHS at DUT in order to establish whether any instructional model existed that guides pedagogical practices there. This was followed by a review of the extant literature on the currently used instructional models, including articles focussing on teaching, learning and assessment, which equipped the researcher with the intellectual and procedural knowledge to develop the conceptual and theoretical framework for this study. The prototype of the ITLMUA was developed through numerous cyclic iterations, with a focus on fine-tuning components of the instructional model. The researcher was pleased to observe that the lecturers used some of the teaching strategies of AL anyway, not being consciously aware that this was a particular approach with broader implications. This facilitated an effortless application of the AL teaching strategies introduced to them as part of this study.

The ITLMUA was designed by the researcher as a theoretical framework model for the delivery of lectures, and for exploration and implementation by them in their lectures in their respective subjects in the Clinical Technology programme. The student-centric ITLMUA focuses on user-centric design and was verified by colleagues, students and collegial friends in the academic sector (Osman et al., 2013). The methodological approach is not necessarily that different from other research approaches, but there are some differences between the philosophical frameworks and goals of the DBR when compared with traditional approaches (Cotton et al., 2009; van den Akker, 1999). Some of the differences include interaction between participants and the researcher, the way knowledge is gained in the form of design principles, linking theory and practice, and in DBR, there is continual interaction between the participants and the researcher throughout the entire research process (DBRC, 2003; Cotton et al., 2009; Lai et al., 2009).

The underlying theory of DBR is "the dedication to providing direct benefits to all stakeholders within the context of the educational research", and its iterative, continual approach rather than the linear approach of traditional predictive empirical research (PER) (Reeves, 2000:10) as summarized in Figure 3.

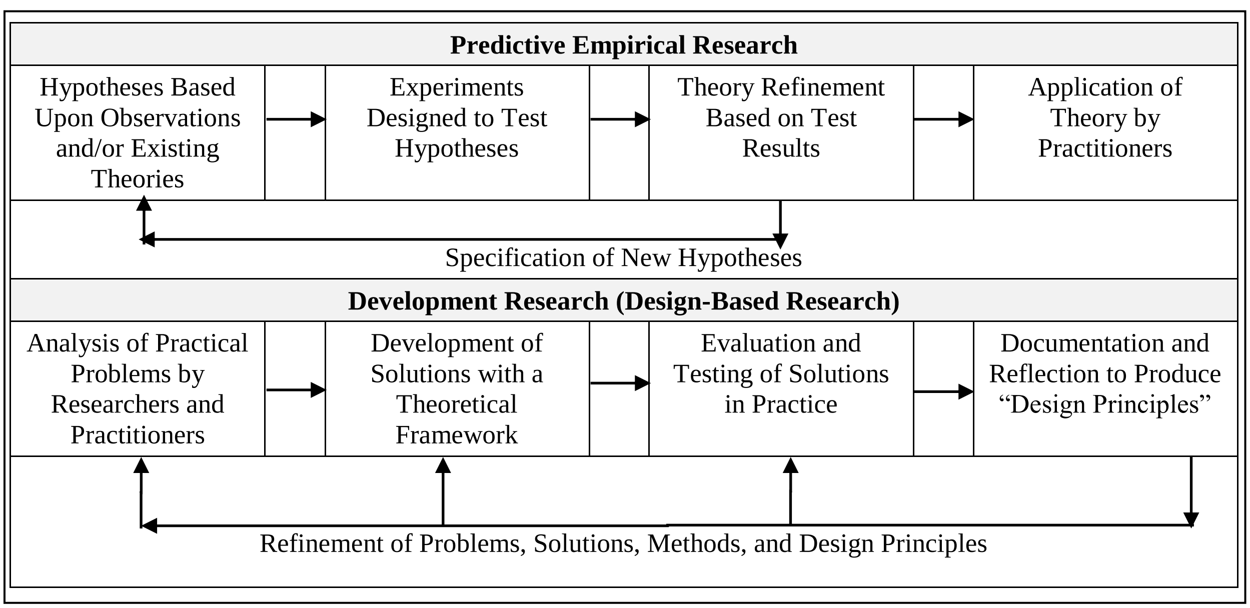

Figure 3: Differences between the Predictive Empirical Research and the Development Research
Source: Adapted from Reeves (2000)

Figure 3 illustrates the differences between the types of PER studies that have dominated technology research for decades and the DBR as an emerging framework that can guide better educational research (Cobb et al., 2003; Amiel & Reeves, 2008; DBRC, 2003).

The DBR goal is to build a stronger connection between educational research and real-world educational challenges utilizing the iterative cyclic research process, and formatively evaluating and developing the instructional model, and producing design principles to improve future research endeavors (Amiel & Reeves, 2008). The traditional PER is undertaken in a controlled environment whereas DBR undertakes its research in a flexible and uncontrollable educational environment (Amiel & Reeves, 2008). Peterson and Herrington (2005) reported that the DBR approach is itself very much in the process of development, with its characteristics of introducing and refining of theoretical concepts, the theoretical breadth of the approach, its scientific underpinnings and the drive for socially responsible research. The researcher intended to enhance the quality of education from two perspectives: (1) the theoretical area of learning transfer from the participants' point of view, and (2) the quality of subject content delivery and authentic assessment systems (Lobato, 2003; Peterson & Herrington, 2005).

The process of implementing and refining the instructional model includes a summary of four phases of the design-based research as illustrated in Figure 4.

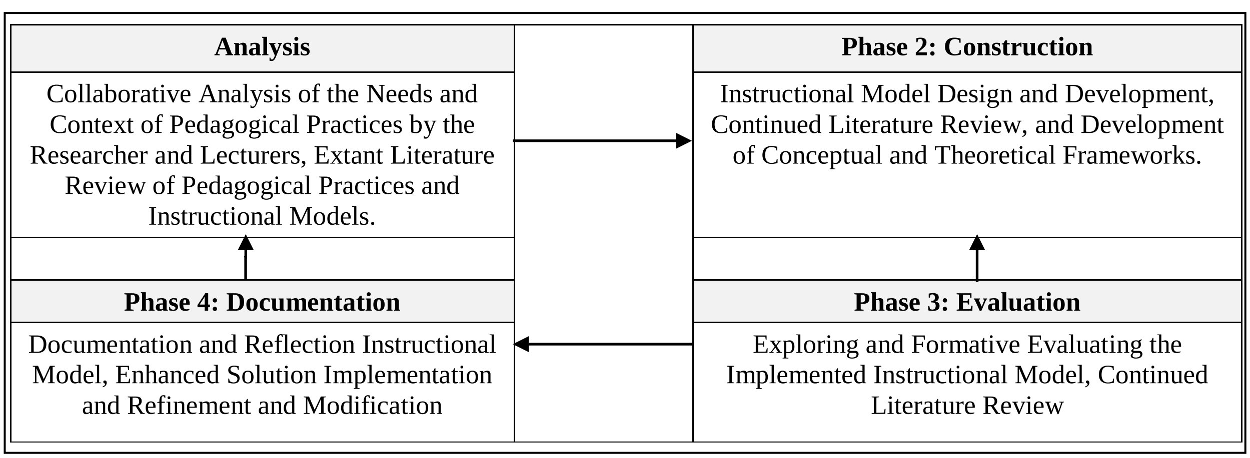

Figure 4: Design-Based Research Methodology Phases for the Instructional Model
Source: Adapted from Amiel and Reeves (2008)

Phase 1: Analysis. This involves analysis of current pedagogical practices and the context in which they occur, and to establish the extent and nature of the utilization of instructional models and their associated pedagogical principles and learning and teaching theories (Hoadley, 2002; Alonso et al., 2005). A review of extant literature was conducted on instructional models, pedagogical practices, learning theories and curriculum. A collaborative partnership between the researcher and lecturers determined the challenges facing the educational activities in their subjects as taught by them at DUT. This analysis led to the creation and design of the prototype instructional model that comprised varied and integrated components. The participants' profiles were drawn up to establish, among other things, their teaching and learning styles, levels of experience and behaviours.

Phase 2: Construction. The designed and developed prototype version of the instructional model underwent a number of cyclic iterative processes with each cyclic iteration being a micro cycle of the research (Kennedy-Clark, 2013; Osman et al., 2013). Extensive and comprehensive review of literature continued which aided in the development of the conceptual and theoretical framework. The components of the proposed instructional model consisted of three main components: (1) students' and lecturers' characteristics and behaviours, (2) teaching and learning, and (3) reflection upon, review of and refinement of the model.

Phase 3: Evaluation. This involved the exploration and formative evaluation of the implemented prototyped instructional model through iterative cycles, as well as continuing the needs analysis and refining the design principles and model components. Reflection assisted the lecturers and students to monitor the progress of the intervention and its impact on both pedagogical practices and student learning, and to be flexible and adaptive in changing and modifying teaching and learning strategies to the current situation (Clarke, 2007.

Phase 4: Documentation. This involved the documentation of the research process to ensure that the outcome being investigated met the predetermined aims, purpose and rationale of the research, and most importantly that the research problem and questions had been answered. The mixed-methods approach to data collection was used and contributed to the refinement and modification of the model, and in theory generation.

3.4.2. The Implementation of Integrated Teaching and Learning Model Using Assessment (ITLMUA)

The design underwent a series of prototype refinements as part of the design process of the instructional model until a satisfactory instructional model was accomplished (Osman et al., 2013). Figure 5 shows the conceptual stages in the iterative cycle of setting of teaching, learning and assessment goals, designing instructional activities, gathering and analyzing both qualitative and quantitative data, using data and assessment results to evaluate, redesign, and refine the instructional model.

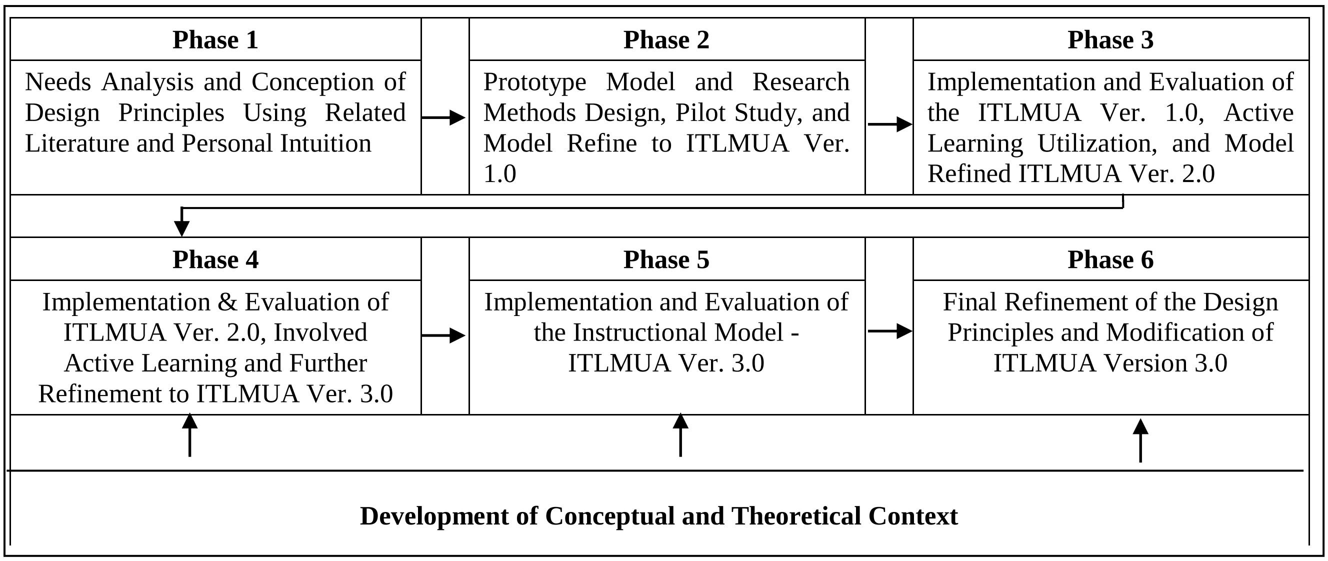

Figure 5: Conceptual Phases of the Instructional Model and Theory Development

Hereunder is the detailed descriptions of the six stages shown in Figure 5, which are the conceptual phases of the development of the instructional model and theory:

Phase 1: Involved an initial needs and contextual analysis to identify whether the lecturer participants utilized instructional models in their pedagogical practices, and what educational and psychological theories underpinned their instructional models. At this stage, the theoretical design of the instructional framework model was conceived, which was influenced by the lack of an existing instructional theoretical framework model in the Clinical Technology programme and in the reviewed literature on instructional models. The motivation was the desire to have a structural theoretical framework that would guarantee the quality of TLA in health science education, particularly in the Clinical Technology programme. The optimism and expectation was that the theoretical framework model could possibly integrate and sequence the educational activities to enhance the efficacy and quality of teaching, learning and assessment.

Phase 2: Following extensive review of related literature on instructional models and learning and teaching theories, the prototype instructional framework model was conceived and designed, and consisted of the integrated educational activities of teaching, learning and assessment. The preliminary observation, questionnaires and interview research methods were developed. The prototype instructional model was piloted with duly consented lecturers and students from the Biomedical Technology programme, and the survey questionnaires were administered to authenticate their relevance and appropriateness and revised accordingly. The questions and statements which were ambiguous were either rephrased or eliminated to constrain response bias and increase response objectivity, and additional statements and questions were added in compliance with issues raised from the responses and continued literature review. The prototype instructional model was modified as informed by the participants' responses, literature reviewed, and professional inputs from peers, supervisors, the researcher's intuition and pedagogical experience. In this way the Integrated Teaching and Learning Model Using Assessment Version 1.0 was developed.

The Head of DBCT gave permission to enroll 2nd year Clinical Technology students, and written ethical approval was received from the Institutional Research Committee (IREC) and individual lecturers and students. The pre-intervention questionnaires Appendix C - Lecturers' Pre-Intervention Survey Questionnaire (LPREISQ) and Appendix G - Students' Pre-Intervention Survey Questionnaire (SPREISQ) were administered to the consented lecturers and 2nd year students registered for the Clinical Technology programme to elicit their descriptive account of their experiences and perceptions on the previous and currently used 'conventional' instructional practices and learning activities prior to the exploration and implementation of the ITLMUA Version 1.0 prototype.

The qualitative responses of the pre-intervention questionnaires were analysed by sensitization and familiarization which provided a general sense of the objectivity and quality of the lecturers' and students' responses, and some of the questionaires and statements were rephrased to avoid ambiguity and eliminated to avoid repetition for the next cycle. The responses to the closed questions were considered quantitative since the frequencies of responses were counted and weighted with a numerical value. The students and lecturers were surveyed to rank their perceptions and expectations in relation to quality with closed five-point Likert scale responses and open questions and statements. The aim was to measure the effectiveness, usability, quality, and satisfaction of the ITLMUA.

Behavioural class observations was conducted using Appendix K - Observation Checklist for Lecturers' Performance Outcomes Assessment (OCLPOA) during routine 'conventional' lecture-based instruction sessions for individual lecturers in their respective subject periods at different times and space. The lecturers were allowed to use their familiar instructional practices in the delivery of their subjects in order for the researcher to determine similarities and differences, and compare and contrast with the implementation and evaluation of the ITLMUA in the next cycle. The class observation allowed the researcher to record verbal and non-verbal behaviours of the participants as it normally occurs in a classroom environment, and to determine reciprocal interaction and relationship between participants, and to fully account for the interpretation of the observations by immediately recording the events as they unfolded to ensure accurate manifestation of the proceedings were portrayed.

Conversational semi-structured interviews were conducted using Appendix D - Lecturers' Pre-Intervention Interview Schedule (LPREIIS) with the two lecturers later after receipt of the completed pre-intervention questionaires, and selected eighteen students based on their general academic performance from low, middle and high percentage mark range, using Appendix H - Students' Pre-Intervention Interview Schedule (SPREIIS). Participants' interview responses were compared to the the written questionnaire responses to validate the trustworthiness and authenticity of the responses, and any naturally occurring shifts in thematic content, termed thematic transition were described (Ryan & Bernard, 2000). The students previewed the interview questions and associated sentences so that they could better prepare and build their confidence when engaging in the conversational interviews, and they recommended that interviews be held in the researcher’s office as it provided a more relaxed, aesthetic and supportive environment.

The preferred and agreed method for recording during the interviews was pen-and-paper with responses being noted verbatim, followed by summary paraphrasing and elaboration immediately after the interviews, followed by coding and interpretation. Audio/video recordings were not used out of concern for participants' possible response bias, that is, the tendency to answer according to perceived social desirability of the response alternatives, and the presence of technical and technological gadgets may distort the natural academic setting and may induce the Hawthorne effect, meaning that the impact of participants knowing that they are part of a research undertaking (Tiainen & Koivunen, 2006).

Potential response bias was neutralized by interpreting parts of narration using the researcher's experience, professional knowledge and expertise, and intuition to select the interesting parts of narration and rewriting them. The interviews were used as supplementary and complementary to the questionnaires to gain more insight into interested and unexpected qualitative and quantitative findings, and to consolidate and concretize the students' responses from the questionnaires and to assist in triangulation during analysis and interpretation of verbal and numerical data. Furthermore, interviews shed more light on the fairness and appropriateness, or lack thereof, of the students' responses of the questionnaires.

Phase 3: The ITLMUA Version 1.0 was implemented and evaluated using the 2^{nd} year Clinical Technology students and respective lecturers for the two selected subjects. The lecturers were inducted individually to understand the methodological approach of the research process in the implementation plan of the ITLMUA Version 1.0, and their concerns were addressed satisfactorily by the researcher and reassured that there would be a continual interaction between the participants and the researcher throughout the entire research process (Cotton et al., 2009). To ensure reliability, the same OCLPOA was used for recording as indicated in Phase 1. Further needs analyses were conducted to identify what issues and concerns lecturers and students faced with regard to the implementation of the ITLMUA Version 1.0, and the active teaching and learning strategies, so that they could be addressed for the next cycle of the instructional model implementation. Any observable behavioural changes between the lecturers and students were discussed and interventional strategies were suggested to maximize the active learning and teaching strategies and elicit optimal authentic responses from both the lecturers and students.

The lecturers used the lecture-based instruction method in combination with active learning strategies to deliver the researcher developed thematic learning units over a period of time before assessments were conducted. It was in this phase that the second behavioural class observation was conducted to note if there were any changes in the interaction and relationship between research participants relative to the initial class observation as indicated in Phase 1 above. Data collected included field and lecture notes, and learning material given to students these were analyzed using sequential data analysis by employing *in vivo* coding and open coding, content analysis and descriptive analysis. The analyzed data was then used to inform the refinement and modification of the design components and principles of ITLMUA Version 2.0, including the researcher's expert evaluation, acquired information from ongoing reviewed literature, and input from participants.

Phase 4: The responses for the same questions and statements were grouped together from the LPREISQ and SPREISQ with the objective of qualitatively analyzing varied perspectives by inductive category coding. The data from these questionnaires, field notes, learning material, continual literature review information, and the researcher's expert knowledge was used to refine and modify ITLMUA Version 2.0 to produce ITLMUA Version 3.0.

Phase 5: The ITLMUA Version 3.0 was implemented and evaluated after the lecturers introduced more strategies of active learning and the students presented orally some selected sections of the thematic learning units, followed by interactive dialogue between students and the lecturer. The post-intervention questionnaires Appendix E - Lecturers' Post-Intervention Survey Questionnaire (LPOSTISQ) and Appendix I - Students' Post-Intervention Survey Questionnaire (SPOSTISQ) were administered to elicit the descriptive accounts of their experiences and perceptions on active learning in the two selected subjects following the exploration and implementation of the ITLMUA Version 3.0.

Phase 6: The researcher conducted interviews using Appendix F - Lecturers' Post-Intervention Interview Schedule (LPOSTIIS) and Appendix J - Students' Post-Intervention Interview Schedule (SPOSTIIS) to determine participants opinions of success to provide consistency for the analysis of responses, and to compare participants' interview responses with written post-intervention questionnaires and followed the same procedures as indicated in Phase 2 above. The ITLMUA Version 3.0 was further refined and developed as informed by the textual information from post-intervention questionnaires and interviews in Phase 4 and the current phase. The design of the ITLMUA was concurrently done with determination of students' traits, characteristics and behaviours which included general approaches the students use to acquire knowledge, and the overall patterns that give general direction to learning behaviour (Oxford, 2003). The purpose of the implementation of the ITLMUA was to compare any improvement in the teaching and learning practices in the Clinical Technology programme between conventional teaching and learning practices and alternative and innovative instructional practices, namely, active learning, collaborative learning and cooperative learning.

3.5. INTEGRATING AND USING ACTIVE LEARNING IN A CLASSROOM DURING THE IMPLEMENTATION OF ITLMUA

Felder & Brent (2009) noted that AL is a straightforward and useful teaching strategy based on solid research and rationality where lecturers ask students to do rather than passively listen to the 'broadcasting' and information transmission. The researcher acknowledges the reluctance of lecturers to accept new teaching strategies as they are generally comfortable and satisfied to do business as usual, adhering to conventional instructional strategies, along the lines of the metaphor of 'you can't teach an old dog new tricks'. The study used AL strategies which required minimum time and effort both in preparation and in practice, and cooperative and collaboration learning strategies, which involved a minuscule commitment of time and energy as students were already used to some of the AL strategies indicated by Faust and Paulson (1998:4) as involving the "greatest commitment and time".

Hereunder, the researcher outlines and describes the active strategies used in this research study and indicates some obstacles for the implementation of active methodologies in class, and the suggested strategies to overcome these.

(1) **Clarification Pauses**: The lecturer explains the learning goal and define concepts, and then stops for a moment to let the information to be processed, and thereafter ask individual students whether they have understood and clarify issues for anyone who may asked for it. The lecturer can ask those understanding students to clarify the issues raised, thereby reinforcing learning through repetition, and active participation and engagement. This strategy augurs well for the introverts and provide time and opportunity to foster active listening and learning, and the

clarification pauses allows for avoidance of information from passing from the lecturer to students without passing through the mind of either one, which may lead to superficial learning on the part of students (Johnson et al., 1991).

(2) **Rotational Questions and Answers**: The lecturer asks questions to a particular student after waiting for a short time during the course of a lecture to establish comprehension of the taught material, and if student is unable to articulate the answer, another student is asked until the question is correctly answered (Schaible & Rhodes, 1992). The students who were unable to answer the question, will be requested to rephrase or summarize the answer, thereby fostering active listening, engagement, participation and learning through elaborative rehearsal. All students would have the opportunity to answer questions during lecturing sessions, and by so doing, the lecturer sidesteps the "serious drawback" of favouring only a small percentage of students who can answer practically any question thrown to them (Faust & Paulson, 1998). The interventional strategy prevents students who have already answered the question from not continueing to pay attention as they can be asked to corroborate by giving an alternative opinion on the same question, and the lecturer summarizes all the responses. The strategy also allowed the students an opportunity to ask questions during and at the end of the lecture to facilitate recap of information covered during the lecture sessions.

(3) **Team-Based Work**: The researcher preferred to use randomly selected groups as the team members feel greater camaraderie among themselves compared to self-selected teams. Random selection generally ensures that members of each team possess a range of abilities which then complement and support each other for the benefit of the team. Moreover, team members were also requested to come up with a jointly agreed team name, and names such as 'The Intellects', 'The Dynamites', 'The Powerpuffs' and so forth showed that there was a sense of ownership and belonging. The team-based work occurred in conjunction with variations of share/pair or think-pair-share, where students are put in pairs to discuss and debate issues on what has been presented either by the lecturers or peers (Felder & Brent, 2009). The team-based work is a cooperative and collaboration strategies targeting more complex projects, where, according to Faust and Paulson (1998:13) referred to as "many heads often are better than one or two". In team-based work, students are geared to work together to accomplish a common goal, and are also involved in assessment practices through engaging in self and peer assessment. Self

and peer assessment is meant to level the participatory and contributory fields among the members, with members of the group being the arbiters and moderators of self and peer assessment marks. The lecturer is responsible for facilitation, supervision, monitoring, troubleshooting, and intervening when necessary (Faust & Paulson, 1998).

3.6. SCIENTIFIC QUALITY AND RIGOR IN QUALITATIVE DESIGNS

LeCompte and Goetz (1982) pointed out that the value of scientific research is partially dependent on the ability of individual researchers to demonstrate the credibility of their findings, that is, striving for authentic results. Achievement of objectivity, neutrality and lack of bias in the procedures and the interpretation of results is challenging in DBR since the researcher needs to immerse him or herself in the context in which the research is taking place, and interact with participants in an ongoing way in the research study (DBRC, 2003; Akilli, 2008; Alghamdi & Li, 2013). The researcher can employ triangulation by using multiple sources and kinds of data that maintain and increase the objectivity in the findings of DBR (Wang & Hannafin, 2005; Akilli, 2008).

External reliability addresses the issue of whether independent researchers would discover the same phenomenon or generate the same constructs in a similar setting, and internal reliability refers to the degree to which other researchers, given a set of previously generated constructs, would match them with the data in the same way as did the original researcher. Further, internal validity is the extent to which scientific observations and measurements are authentic representations of some reality, and external validity addresses the degree to which such representations may be compared legitimately across groups (LeCompte & Goetz, 1982). Reliability is concerned with the replicability of scientific findings, and determines whether the researcher would obtain the same results when using the same methods as a prior research study, and validity is concerned with the trustworthiness of research findings (LeCompte & Goetz, 1982). Hansen (1979) indicated that validity is established to the extent that conclusions effectively represent empirical reality and constructs developed by the researcher do indeed represent or measure the categories of human experience that occur.

Shenton (2004:63) asserts that "the trustworthiness of qualitative research generally is often questioned by positivists, perhaps because their concepts of validity and reliability cannot be addressed in the same way in naturalistic work". Validity and reliability are constructs that are used to evaluate the quality of quantitative research, whereas the rigor of qualitative research uses Guba's (1994) construct, *trustworthiness* and four other concepts: *credibility*, *transferability*, *confirmability* and *dependability*, as defined by Lincoln and Guba (1985) to evaluate the scientific integrity of a qualitative study. Guba's constructs correspond to the criteria employed by positivist investigators: (a) credibility in preference to internal validity, (b) transferability in preference to external validity/generalizability, (c) dependability in preference to reliability, and (d) confirmability in preference to objectivity. *Trustworthiness* is a general term that refers to the overall reliability and validity of qualitative research, and the other four concepts are construed as dimensions of trustworthiness. *Credibility* refers to the appropriateness and accuracy of data sources and interpretations through multiple interviews and member checking, *transferability* is related to representativeness and concerns itself with the contextual boundaries of the findings, *confirmability* is similar to replicability through transparency and an audit trail, and *dependability* refers to the consistency of the multiple coding procedures used by keeping an audit trail (Meyers & Sylvester, 2006).

This research study used various mechanisms to ensure the rigor and trustworthiness in the analysis of gathered data, as recommended by Shenton (2004):

- The participants were given the opportunity to *refuse to participate* in the research project so as to ensure data collection was honest, faithful and genuine, and *prolonged the engagement* between the researcher and participants.
- *Triangulation* uses different research methods in concert to exploit their respective benefits, and *consistency* and *stakeholder checks* by having multiple coders taking the category descriptions and finding the text which belongs in those categories, and the participants to comment on categories or the interpretations made, respectively (Erlandson, Harris, Skipper, & Allen, 1993).

- *Iterative questioning* was employed in the questionnaires and interviews to thwart response bias, including the non-audio and video recording of observation and interview sessions to avoid the Hawthorne effect.
- *Frequent debriefing sessions* with supervisors and the participant lecturers for their input and advice, and *peer scrutiny* of the research project by colleagues and peers for positive and helpful feedback.
- *Compare the research study finding* with previous research on instructional models, and the usefulness of the research findings in influencing policy and practice for another credibility check.

3.7. RESEARCH METHODS USED IN THE COLLECTION OF DATA

Over the past years, the HE sector has undergone a comprehensive transformation that included among other things, the streamlining of the previously fragmented educational system based on racial divides, responsive curricular reform, the use of the internet and ICT, and more emphasis on the integration of industry into the undergraduate education process. At an institutional level, there is a system that encourages a continuously improving evaluation process through reflection practices of the subjects and the lecturers using Subject Evaluation Questionnaire (SEQ) and Lecturer Evaluation Questionnaire (LEQ) in order to enhance pedagogical practices and quality student learning. The SEQ covered is the usefulness of the study guide, the precision of learning outcomes, academic workload, learning material, link between theory and practicals, adequacy of infrastructural support, explicit assessment strategies, the utility of timely feedback, and access to internet and information technology. The LEQ covered lecturers' organization and planning of academic activities, teaching, learning and assessment, interaction and relationship, and provision of resources. These are varied research methods or tools that were used for qualitative and quantitative data collection and yielded valuable information for the ultimate analysis of data using primarily interpretive content and thematic analysis, constant comparative method for qualitative categorization and coding, descriptive and inferential statistics, and hypothesis testing.

The five-point range Likert Scale from 1-Strongly Disagree and 5-Strongly Agree, 1-Very Useful to 5-Very Useless and 'Yes' and 'No' answers were used to provide an overview of the major areas of satisfaction and/or dissatisfaction among participants. The questionnaires covered learning, teaching, assessment and miscellaneous areas of pedagogical practices, and explored the perception and opinions of the participants on the nature and extent of usability, effectiveness and satisfaction of the efficacy of the ITLMUA on the quality of student learning and pedagogical practices. Review and rephrasing of the questionnaires and interview questions and statements, feedback from the pilot study and the researcher's own intuitive and further literature reviews led to the refinement and redesign of the prototype ITLMUA to create ITLMUA Version 1.0.

Qualitative and quantitative data for the needs analysis were gathered from institutional, programme and the academic subjects' documentation, survey questionnaires, interviews, class observation field notes and personal and professional experience, which was used to create a series of design principles to guide subsequent stages. The variables which were determined and evaluated included, but were not limited to: alignment, sequencing, and integration; learning outcomes, tasks and activities; goals and standards, teaching and learning philosophies, methods, style and strategies; and learning materials and handouts.

3.7.1. Behavioural Participants Class Observation Case Study

The OCLPOA was used to systematically record the lecturers' planning, preparation and content organization of lectures; manage instructional activities and control management of students' behaviour, including opportunities to learn; interact and maintain professional responsibility during instructional delivery (Huitt, 1995). The main focus of participants' observation was to determine the degree of *active interaction and participation* between the lecturers and students during lectures. Admittedly, it was humanly impossible to observe and record everything during observation, but an *a priori* determination was made evident in the OCLPOA form and guided by the aims and research questions. Additional observation information was noted in the 'comments' section for each domain of OCLPOA form in an attempt to maximize observed behaviours of the participants.

The qualitative data collected, i.e. the written field notes, were analyzed immediately after the observation had been carried out, noting patterns of behaviours, events and phenomena to investigate in further observations (Lofland & Lofland, 1984). Analysis techniques employed were categorization, coding and thematic analysis and interpretation in order to account objectively, and to some extent, subjectively, the events and activities occurring in the classroom environment. The researcher interacted continually with the participants after observation, including with periodic interviews, in order to probe and verify observed non-verbal behaviours and verbal expression, cues and prompts that were aroused, which enabled the researcher to develop taxonomies of behaviours. There are theoretical variables are at the core of such observation, and the researcher may wish to explore those underlying variables (Pohlmann, 2004).

The lecturers' performances were broadly considered on three evaluation dimensions: planning, development and results, and based on the criteria of adequacy, satisfaction, efficiency and predisposition to pedagogical innovations and alternatives. (Cano-Hurtado et al., 2011). These dimensions and criteria were to establish and guarantee lecturers' professional skills and pedagogical competencies (Cano-Hurtado et al., 2011). Variables that were examined included, but were not limited to, the content validity of the instructional activities and supporting learning material, consequential validity of assessment questions and the use of the revised Bloom's Taxonomy in the development of the questions, assessment strategies and adherence to the time allocated for teaching and delivery methodologies.

The broader consequences of a given assessment activity beyond those which are immediately evident, for example, certification, is to develop assessment procedures of high consequential validity which encourage students to adopt deep study approaches, learning what is most desirable for them to learn (McGourty et al., 2000). Consequential validity refers to the effect of a test or other form of assessment on learning and other educational matters (Messick, 1989; Linn et al., 1991). Consequential validity is high when there is a positive backwash effect on learning and low when it encourages ways of learning which are counter to what is desired. There is nothing sinister to know students learning practices and their preferred methods of teaching and assessing so that one is able to intervene in helpful ways and modify ones teaching and learning practices to fundamentally foster quality student learning (McGourty et al., 2000).

Encouraging deep learning approaches is one aspect of consequential validity. Another aspect is the impact of assessment on the capacities and skills students have in assessing themselves and their peers as indicated in self and peer assessments, respectively.

Students' involvement in assessment practices in higher education can assist not only in the development of assessment skills, but also in establishing the assessment criteria which distinguish acceptable from unacceptable performance. Students need to be able to have reliable judgments about what they do and do not know, and what they can and cannot do. Well-designed assessment practices should be oriented around key concepts and ideas that students should be able to deal with, but most subjects tend neither to develop basic concepts well, nor use assessment tasks which allow lecturers or students to know whether concepts have to be learned (McGourty et al., 2000). The efficacy of the ITLMUA was evaluated on the basis of usability, effectiveness and satisfaction as perceived by the participants input and responses and the researcher's behavioural class observations and interviews, in order to enable the researcher to answer the research problem and research questions.

Educational researchers have been criticized, at times legitimately so, for observing in an educational environment for only very brief periods of time before making sweeping generalizations about participants. The researcher of this study had the benefit of 'living' in the observed educational environment as the lecturer and colleagues of participating students and lecturers, respectively, but consciously avoided to leverage the proceedings of the research unless consulted by the participants. The researcher opted to write extensive field notes during participants' observation rather than audio and/or video recording since not every phenomenon can possibly be recorded without an exceptionally wide-angle lens, and then analysis of the behaviours and language recorded in one hour of video/audio recordings would take many hours. The presence of technologies could induce the Hawthorne effect (Hill et al., 2003).

3.7.2. The Lecturers and Students Survey Questionnaires

The researcher developed LPREISQ, LPOSTISQ, SPREISQ and SPOSTISQ which consisted of 5 dimensional Likert Scale questions and statements, to elicit their opinions, perceptions and experiences with regard to instructional activities in the Clinical Technology programme. Questionnaires are the most efficient and the least expensive way to investigate input, process, output and outcomes variables in classes and institutions, where participants provide their different and similar opinions, perceptions and experiences of the same phenomena under study (D'Haenens et al., 2010). These questionnaires were generated from the researcher's educational experience and the reviewed literature, and were mainly of rating-scale format for rapid processing and ease of comparability across the participants. Some of the questions and statements provided opportunities for freeform responses for participants to raise issues beyond those set in the questionnaire. The pre- and post-intervention students' assessment results were quantitatively analyzed and compared using inferential and descriptive statistics to describe or summarize the data and provide simple summaries about the samples and measures, and to enable comparison across students' performance and achievements. The questionnaires were collected and Likert scale responses quantified by simple counts and their responses and perceptions yielded perceptual data which were analysed by exploratory factor analysis (EFA) to define a set of common latent dimensions or factors, and report the Cronbach's alpha reliability coefficient internal consistency measures (Den Brok et al., 2006; Pope et al., 2000).

3.7.3. Conversational Semi-Structured Interviews

An interview is a research method that an educational researcher uses for the purpose of gathering qualitative empirical data that sheds light on the study's goals and addresses the research questions (Denscombe, 2007). The LPREIIS, LPOSTIIS, SPREIIS and SPOSTIIS were used to conduct interviews with the participants for qualitative empirical data collection through recording of their behaviours and language used in their narratives. The collected data were analyzed using the constant comparative method. The interview technique used was semi-structured iterative interviewing involving an interview schedule coupled with a series of relatively unstructured conversational interviews with all the three participating lecturers and six selected students. The lecturers were interviewed individually in the comfort of their offices, and the individual and paired students opted to be interviewed in the researcher's office to elicit individual and shared responses on the phenomena, with verbatim reporting of respondents' words, termed polyphonic interviewing (Bernard, 1988; Fontana & Frey, 1994). The six students' interviewees were selected to participate in the interviews based on their general academic performance from the high, middle and low mark range.

The interview questions and statements can be broadly expressed as descriptive, contrast questions, opinion and feeling questions, and propositional questions, and were closely aligned with the pre- and post-questionnaires. The interviews were conducted over three months for the purpose of gaining greater insight into interested or unexpected qualitative and quantitative findings. Periodically, the researcher returned to interview participants in more depth to focus on the study's goals and research questions to assist in triangulation with other data and to explore areas that warranted additional information asking the same questions of all eighteen student participants. The interviews were used to consolidate and concretize the students' responses from the questionnaires and to assist in triangulation during analysis and interpretation of both qualitative and quantitative data. Students were allowed to preview the interview questions and statements prior to interviews, so that they could be better prepared and build their confidence when engaging in the conversational interview.

The researcher made sure that he truly listened to participating respondents and recorded what they said, rather than focussin on the researcher's own perceptions or interpretations. In order to maintain the integrity of their responses, the researcher used the participants own words as quotations to illustrate varoious points during discussion of the study findings in Chapter 4. Field notes that contained interpretations of patterns were maintained with the objective of further refinement and investigation on an ongoing basis. The researcher acknowledges the emergence of possible distortion that may have resulted from the researcher's presence, and bias that might have arisen from the researcher, participants or data gathering techniques (Lincoln & Guba, 1985).

3.7.4. Students' Success and Lecturers' Competence

One of the dependent variables in the quality and achievement of effective TLA is effectiveness, which is indicated by student assessment and success. An effective integrated assessment system supports the transformation goals of widening access, improving retention and throughput rates, and producing graduates with appropriate, meaningful and useful knowledge and skills (Council on Higher Education [CHE], 2004). Equally, lecturing staff competence and effectiveness in developing an integrated assessment system approach using units with complementary learning outcomes is critical for programme quality and students' positive assessment and success (Vanderheide & Walkington, 2009).

The study encouraged lecturers to develop an integrated assessment system that could cover learning units from varied subjects domain, for example, a problem solving integrated case study that focused on anatomy and physiology, pathophysiology, pharmacology, biomedical instrumentation systems and clinical care practice of a patient who had had a myocardial infarction, and a marking weight of 25% for each subject domain. This integrated assessment approach deepens student learning, reduces assessment load for both the students and lecturers, results in the development of a single assessment criteria for the subjects' and promotes comprehensive cooperation and collaboration. The students' assessment results are an indicator of teaching and learning effectiveness (CHE, 2004). Assessment in the HE has a critical influence on the quality of teaching and learning and can be used as a powerful point of leverage for change and improvement in the delivery of education (CHE, 2004).

3.7.5. Evaluation of Question Papers and Student Examination Scripts

Participants' responses determine the value and usefulness of a programme and subject characteristics based on the achievement of specified learning outcomes. This is an unobtrusive method for collecting information about human behaviours, but overlaps with other methods, for example, content analysis. The final examination question papers for the two subjects and associated students' examination scripts were scrutinized using the Blooming Health Science Assessment Instrument (BHSAI) adopted from Blooming Biology Tool (BBT) developed by Crowe et al. (2008). The researcher conducted analysis of programme documentation to establish the nature and extent of the utilization of Bloom's Taxonomy Table in the development of LOs, and AC in the design of the selected 2nd year subjects, namely, Organ and System Pathophysiology 2, and Biomedical Apparatus and Procedures 2. The Revised Bloom's Taxonomy of Educational Objectives was used to locate the LOs, instructional activities and assessment in one or more grids. It is also important to specify the LOs by using the 6 categories and 19 cognitive processes and alternative names as the verbs when stating the LOs, instructional activities and assessment (Ferguson, 2002).

Step 1: Clinical Technology programme and subject documentation was analyzed to verify alignment and sequencing of instructional activities, including teaching, learning and assessment strategies. Variables determined and evaluated included level of detail and depth of content coverage arising from examination of instructional activities and learning outcomes according to the Revised Bloom's Taxonomy; students' task and activities, particularly assessment tasks for construct and content validity, pedagogical practices including teaching, learning and assessment philosophies, goals and strategies.

Step 2: Initial OCLPOA was conducted involving the direct observation and systematic recording of verbal and nonverbal behaviours as they occurred normally in the classroom environment to determine reciprocal relationships between the lecturers and students, and interaction between and among students. A full description of the observation was constructed immediately after the event.

Step 3: The pre-intervention questionnaire was administered to participants at the end of the subject delivery and assessments to elicit descriptive accounts of their experiences and perceptions on the past and current pedagogical practices and activities used in the Clinical Technology subjects prior to exploring, implementing and evaluating the ITLMUA.

Step 4: The three lecturers and eighteen students were interviewed. Lecturers and students were requested to give permission to the researcher to take notes during the interviews. The researcher preferred to take verbatim responses and elaborate immediately after the interviews, followed by coding and interpretation. The interview forms (Appendices D and F for lecturers, and appendices H and J for students) were completed two days after the interviews to compare and contrast interview responses with written responses to validate the trustworthiness and authenticity of their responses and any thematic transitions. The researcher was aware of students' response bias, that is, the tendency to answer according to perceived social desirability of the response alternatives, and the Hawthorne effect. These potential biases were neutralized by interpreting interviewees' narrations using professional knowledge and intuition to select the interesting parts of narrations and rewriting them. The data gathered included, but was not limited to field notes from the observation and academic activities, for example, lecture notes, essay topics, question papers, students answer sheets and essays. Sequential data was analysed using *Nvivo* software and open coding, content analysis and descriptive statistics.

Step 5: Lecturers were inducted individually on the implementation of the ITLMUA and subject-specific thematic learning units as developed and guided by ITLMUA. Lecturers delivered their respective subject thematic learning units for 2-4 weeks using ITLMUA instructional strategies. A second classroom observation was conducted. Data gathering included field notes and academic activities, and sequential data analysis using content and thematic analysis, and open coding.

Step 6: The post-intervention questionnaire was administered to participants to elicit their experiences and perceptions about the ITLMUA intervention, followed by second interviews. Sequential data was analysis using open coding, content analysis and descriptive statistics. At this stage, new emerging theory was established and assessment results were compared using theoretical sampling, comparative method, hypothesis testing, and effect size calculation for both pre- and post-intervention data, including all the data from other research tools. Assessment percentage marks were based on a six-point scales from A to F, where F was coded as the lowest and A as the highest. The normal and accepted range of mean scores for this study was between 3.00 and 4.60 to enable comparison across students' performances and achievements using Statistical Package for Social Sciences (SPSS) 20.0.

Step 7: The ITLMUA was refined by using information from qualitative and quantitative research data and ITLMUA was re-implemented, re-evaluated after the lecturers had been advised on the refinement of the ITLMUA, and new thematic units emanating from the new emerging concepts and theory were developed. This step was repeated until the research claims and research questions were satisfactorily answered and the research study reached data and theoretical saturation, resulting in termination of the data collection stage. Ideally, assessment evidence must reflect the levels of complexity and detail of real-life tasks, including locating information, evaluating the credibility of sources, understanding multiple viewpoints, synthesizing information from various sources, creating complex explanations, solutions, or those that capture multifaceted realities, and integrating source material into an original work (Banta et al., 2009)

Step 8: Final data analysis ensued to reveal, hopefully, the emergence of new theoretical and practical insights, with drawing of connections to theoretical assertions and claims that transcend the context in which the research took place (Barab & Squire, 2005). The evaluation criteria that were used to evaluate the model are usability, effectiveness, and satisfaction, and cross checking of the authenticity of the model findings obtained (Osman et al., 2013). The iterative cyclic refinement process was terminated when the intervention model settled into a stable and equilibrium state as signaled by the following primary indicators: **usability** – the ability of lecturers to effectively use the instructional model, **effectiveness** – transformative teaching and learning's contribution to student learning, **satisfaction** – participants' positive responses, and **validation** – participants' use of the fundamental principles of the model (Osman et al., 2013), and the ITLMUA effectively impacting on pedagogical practices and enhancement of students quality learning (Mueller, 2005).

In summary, data reduction begins with memoing, pattern coding, immersion, and familiarization, prolonged engagement in the field, member checks, and audit trails (Hoepfl, 2002). Potential biases were neutralized by interpreting interviewees' narration using my own knowledge to choose the interesting parts of narrations and rewriting them. Furthermore, participants were requested to peruse the manuscripts to verify the authenticity, trustworthiness, and credibility of the narratives.

3.7.6. Blooming Health Sciences Assessment Instrument (BHSAI)

The BHSAI (Table 2) was adapted from the BBT. This was used to classify what was expected or intended for the students to learn and know as a result of instruction, and to determine the quality of examination questions asked in the two subjects selected for this study using the Revised Bloom's Taxonomy of educational objectives (Krathwohl, 2002). The subjects were ranked at the highest possible level of the Revised Bloom's Taxonomy of Cognitive Domains required for its appropriate response to the question (Crowe et al., 2008; Bloom et al., 1956). The Bloom's Taxonomy is a distinct and generally well-received instrument for classifying types of thinking into six different levels: knowledge, comprehension, application, analysis, synthesis and evaluation. The BHSAI uses the six levels of cognitive domain together with their active verbs counterparts: remember, understand, apply, analyze, evaluate and create (Krathwohl, 2002; Anderson et al., 2001). Furthermore, it was essential always to be mindful of considering what students must know and be able to do in order to answer the question on a particular area of the subject content.

Table 2: Blooming Health Sciences Assessment Instrument (BHSAI)

3. Subjects: Biomedical Apparatus and Procedure 1 (BAPO201)						
	1.0 Remember Knowledge	**2.0 Understand Comprehension**	**3.0 Apply Application**	**4.0 Analyze Analysis**	**5.0 Evaluate Evaluation**	**6.0 Create Synthesis**
	LOCS	LOCS	LOCS/HOCS	HOCS	HOCS	HOCS
Key Skills Assessed	Explain, identify, name, list, outline,	Discuss,	Illustrate, classify	Identify		
BAPO201 MAIN	18 (**51%**)	16 (**46%**)	-	1 (**3%**)	-	-
BAPO201 SUPP	8 (**26%**)	13 (**42%**)	5 (**16%**)	5 (**16%**)	-	-

The BHSAI was used as a general guide to assist lecturers in developing and identifying subject-specific related questions representing the different thinking levels of Bloom's Taxonomy, and the expectation is for the BHSAI to evolve through an iterative and cyclic process of refinement as and when informed by feedback from both students and lecturers (Crowe et al., 2008). The BHSAI can also be utilized by students to help them identify the examination questions that present the greatest academic challenge, and they should be assisted to modify their study approaches to be better equipped to tackle any questions.

3.8. DATA ANALYSIS TECHNIQUES AND METHODOLOGY

3.8.1. Coding, Categorization and Analyzing Qualitative Data

The research study used multiple research methods/techniques to gather both textual and numerical data such as document reviews, observations, questionnaires, and interviews in order to systematically analyze data that was guided by the aims, purpose, focus and research questions so as to allow research findings to emerge from themes inherent in the raw data (Nastasi & Schensul, 2005; Thomas, 2003). The researcher transformed gathered data into a standardized form in order to make judgements about the meanings of textual and numerical data, termed coding by Babbie (2000), and created labels from new categories into which text names were assigned. The initial description of meaning of category was developed and the researcher wrote a memo about how these categories are related and their implication to the research process, and also linked them to other categories in various relationships such as hierarchy of categories or commonalities and causal sequencing (Thomas, 2003).

This research study used *open coding* to identify emerging themes from data with similar meaning, followed by *axial coding* where codes from open coding were grouped into meaningful categories and further developed, revised and authenticated using the *constant comparison method* to identify any significant changes in the frequency of a specific comment type, code and ratings. Lastly, the researcher used *selective coding* to explore and link relationships among core categories by the continuous reiterative process of a coding system to revise, modify and refine codes and the instructional model until saturation was reached of a preferable and appropriate number of reduced codes (Glaser & Strauss, 1967).

Table 3: The Qualitative Coding Process in Inductive Analysis

Initial read through text data	Identify the specific segments of information	Label the segments of information to create categories	Reduce overlap and redundancy among the categories	Create a model incorporating most important categories
Many pages of text	Many segments of text	30-40 categories	15-20 categories	3-8 categories

Source: Adapted from Creswell (2002: 266)

Table 3 illustrates the researcher's process of qualitative coding using inductive analysis strategies to read participants' transcripts several times in order to understand the underlying meaning of textual data, identify, develop and group themes and categories from the raw data, what Creswell (2002) termed *data reduction*. Data reduction was terminated when the researcher was not able to identify any further major themes from the data from participants' comments (Marshall, 1999; Elliot & Gillie, 1998).

3.8.2. Teaching and Learning Quality Indicators in Higher Education

This research study focuses on education as the context in which the process of teaching identified as teaching, learning and assessment, with performance indicators recognized as input, process and output (Scheerens, Luyten, & van Ravens, 2011; Chalmers, 2008). The research focused on the implementation and evaluation of ITLMUA in the 2^{nd} year of study of the Clinical Technology programme.

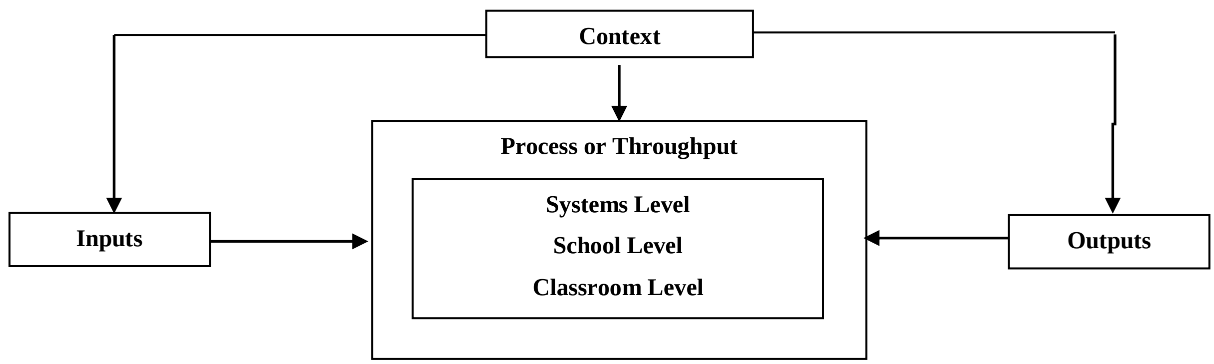

Figure 6: A Basic Systems Model on the Functioning of Education

Source: Shereens et al. (2010)

The model in Figure 6 depicts the basic model the research study used at the classroom level to determine the efficacy of the ITLMUA in determining the effectiveness, suitability and satisfaction of the implemented and evaluated ITLMUA with regard to the quality of instructional activities in the Clinical Technology programme of the selected subjects. The context dimension adds to the flexibility and broadness of applicability of the framework, and it can be seen as generating inputs that determine the desired outcomes, judge educational quality and feedback provision. Furthermore, context dimension pragmatically provides room for situational adaptation to local conditions, and a final analytical distinction qualifies the effect of context between acquiescent conditions that are controlled by participants and environmental constraints. The conditions include students' characteristics such as cognitive aptitude or socio-economic status and classroom size as conditions and variables that are subject to policies, e.g. recruitment, selection and admission policies in order to control student composition. Having clarified the basic 'working' of the input–process–output–context framework, it can be concluded that the framework is quite general and flexible for describing the functioning of education (Shereen et al., 2011).

This research study embraced the assertion that quality education in HE is non-negotiable with demonstration of quality assurance performance by producing evidentiary documentation for systemic effectiveness, efficiency and accountability of performance indicators (PIs) being critical in elevating the standard in HE (Hayford, 2003; Doyle, 2006; Marginson & van der Merwe, 2007;). The study used PIs to monitor students' performance, facilitate TLA, and to improve the quality of HE provision as the PIs are the obligatory component of the collective system of HE and the academic institutional survival is dependent on maximizing not only economy and efficiency, but also quality (Kogan, 2004). The PIs are measures which give information and statistics context that enables comparison over time with laid down standards, and provides information to determine the degree to which the quality of instructional activity objectives have been met within the higher education sector (Romainville, 1999; Burke et al 2002; Rowe & Lievesley, 2002).

The DUT Centre for Promotion and Quality Assurance uses performance indicators to monitor programmes for comparative purpose, to facilitate the evaluation of institutional operations, and as compliance with external accreditation bodies such as CHE for institutional teaching, learning and research quality. Performance indicators are used in this study to determine the process and product of ITLMUA to guide teaching plans for developmental strategies and to monitor progress toward expectations and achievement of standards (Cave et al., 1997; Sanders & Kearney, 2008). The education system throughout the world has been the focus of substantial transformation and restructuring with appropriate justification on the basis of improving the quality of instructional activities in higher education, with emphasis being placed on teaching, learning, assessment and monitoring of student learning outcomes (Rowe & Lievesly, 2002). Performance indicators are critical in ensuring the improvement of quality and effectiveness in the provision of quality education outcomes and achievement, but it must be remembered that PI's must be accurately measured, responsibly analyzed and presented data must have the potential for generating improvements in teaching, student learning and achievement outcomes (Rowe & Lievesly, 2002). The superseding principle of educational indicators is to characterize the nature of pedagogical practices through its components of TLA in terms of their relationship and how they change over time and how the obtained information can be used to form an opinion about the progress toward some goal or standard in relation to some past benchmarks (Shavelson et al., 1991).

3.8.3. Criteria, Standards and Benchmarks for Educational Indicators

Efficiency indicators were developed to ensure good and sustained governance and transformation strategy in HE in South Africa premised on state supervision which permit HE institutions to manage their own academic and administrative affairs within a framework of nationally determined objectives (Galant, 2004; Bunting & Cloete, 2012). Performance indicators cover the instructional activities of TLA and are part of the representation of policies and procedures, and must be easy to interpret and be immune to response errors (Warren, 1989). In this study PIs were used to assess the efficacy of ITLMUA and to identify effective, usable and satisfactory educational practices in an attempt to influence the enhancement of relative quality education provision, and transform the conventional pedagogical practices in the Clinical Technology programme. A fundamental assumption was the expectation that all students must attain the minimum threshold standards in their learning activity, that is, the output from an educational activity should minimize variability (Warren, 1989).

The indicators were used to modify the status of the instructional activities and helped the researcher to understand, to some extent, the conditions under which the instructional activities were being expedited. The researcher provided an explanatory description of the impact of PIs on the facilitation of the improvement of the ITLMUA and its implementation, and the indicators informed the researcher regarding prevailing challenges in the educational system (Vos, 1996; Jaeger, 1978). The indicators were determined on their pragmatic definitional nature. Statistical data were combined or aggregated into an indicator that depicted the notion of quality and served as benchmarks, and the whole of the information provided by a system of indicators was greater than the sum of its parts (Jaeger, 1978). Performance indicators can facilitate improvement in the educational policy of an institution by increasing the standards of the lecturers' qualifications (input) that can indirectly influence the achievement of the thematic learning unit learning outcomes (outputs), as well as the broader development objectives (outcomes), e.g. employing lecturers with PhD qualifications and an educational qualification as a standard to teach at a university (Vos, 1996). Ultimately, indicators must be related to one another so that their relationships and changes in these relationships could be ascertained to suggest possible explanations for observed changes in outcomes. The essential features of useful PIs are embedded in the following criteria for this study, bearing in mind the intention to illuminate evaluation, quality, and performance of both staff and students:

Relevance: The relevance of PIs in this research study is that they provide useful information so that appropriate strategic decisions can be taken in relation to instructional activities, in the short and longterm, in relation to departmental policies and programme objectives, and how these inform planning, practice and reform (Warren, 1989; Rowe & Lievesley, 2002).

Reliability: The reliability of a PI is determined by evaluating the accuracy of the measurement which is critical on the practical and procedural issue for the interpretation and explanation of PI information (Warren, 1989).

Validity: It must be borne in mind that an estimate of a PI's reliability does not necessarily commensurate with its content and criterion-related validity. Simply said, you may have a highly reliable PI that lacks validity, for example, an assessment task, and valid PIs with low reliability which are of little or no value, for example, conclusions about students' achievements are valid only when measured reliably and based on evidence about intended and achieved learning outcomes.

3.8.4. Types of Performance Indicators (PIs)

The types of PIs include Input, Process, Output and Outcomes, and whatever classification is used it is best to think of a chain of indicators that help to link inputs that lead to certain types of activities and responses of beneficiaries to achieve immediate program or project objectives/output, as well as broader development objectives/outcomes (Cave et al., 1991; Borden & Bottrill, 1994). The PIs are broadly categorized as quantitative and qualitative indicators and assist lecturers to promote quality teaching and successful student learning, and to approach their work in ways that are observable and measurable (Cave et al., 1991; Sanders & Kearney, 2008). Quantitative indicators are related to the measurement of amount or quantity, expressed as numerical values, and includes input and output PIs.

3.8.4.1. Quantitative Input Indicators (QIIs)

The QIIs used in this research study measured the efficacy of the ITLMUA with regard to facilitation of the effectiveness and quality of TLA, with the objective of transforming the instructional activities and processes (Scheerens et al., 2010). Test and examination results were also used in this study as indicators of learning outcomes (Hill, 2010). Some of the QII that might be used are tabulated in Table 4:

Table 4: Quantitative Input Indicators for Human, Financial and Physical Resources

Quantitative Input Indicators (Scheerens et al., 2010)		
Lecturers	**Infrastructural Support and Learning Material**	**Students**
Workload, Professional Certification and Licensing Status, Years of Industrial and Lecturing Experience, Knowledge of Pedagogical and Didactic Strategies, Knowledge of Students Characteristics, Learning Styles, Working Hours, Assessment Strategies.	Classroom and Laboratory Infrastructure and Functional Equipment, Availability of Textbook for Major Subjects, Academic Support Service.	Study Hours, Instructional Activities Alignment, Matching of Teaching and Learning Styles, Students' Longitudinal Formative Assessment Results.

The QIIs focused on departmental teaching, learning and assessment, and used numerical measures of instructional activities as tabulated in Table 4. The numerical data information was backed up with narrative analysis and interpretation for better comprehension and understanding of the phenomena under study (Shavelson et al., 1991; Chalmers, 1998; Rowe & Lievesly, 2002). The 'value-added' educational PIs, i.e. a measure of the difference between students' achievement at the beginning of a programme of study and their achievement at the end (learning gain), appears to be an elegant solution, and there is an increasing recognition of the power of such information to motivate and shape improvement efforts Ramsden, 1991; (Rowe & Lievesly, 2002). The 'value-added' PIs indicate the educational 'value' that the Clinical Technology Programme 'adds' to students' achievement outcomes and they could be constructed to indicate different aspects of educational *effectiveness* (Rowe & Lievesly, 2002). Allan et al. (2009), noted that effectiveness is measured through student achievement outcomes which are maximized by establishing the most efficient HEIs and lecture-room processes.

3.8.4.2. Qualitative Process Indicators (QPIs)

Process indicators generally refer to the teaching and learning processes which are used to monitor and improve the effectiveness of teaching and learning, as well as students' achievement (Rowe & Lievesly, 2002). Fundamental to the conception of development and enhancement is the responsibly analyzed, interpreted and presented performance data necessary to identify strengths and weaknesses in the teaching, learning and assessment processes, as well as students' achievement (Rowe & Lievesly, 2002). The LEQ and SEQ are students' evaluation of teaching quality and lecturing skills and effectiveness, and relevance of the subject content and its satisfactory delivery as noted by Ramsden (1991), process indicators are a direct measure of consumer satisfaction with the HE. Administration of lecturer and subject questionnaires are not conducted by the lecturer and remain anonymous to avert fear of intimidation and misuse, thereby increasing fairness and trustworthiness. Performance indicators are not about rating the individual lecturer, but are about the performance of the department in which they work (Ramsden, 1991).

Peer rating of teaching performance was performed by the researcher during class observation, estimating behaviours on three different domains on a rating of 1-3, with 3 rated as consistent behaviour, 2 as usual behaviour, and 1 rated as rare behaviour (Ramsden 1991; Huitt, 1995). Process indicators define at programme level the degree of actual involvement of students and lecturers in various academic activities such as teaching-learning process, extra-curricular and supporting activities (Scheerens et al., 2010). Process indicators included the proportion of professionally qualified lecturers, the amount of time dedicated to teaching and learning, part-time lecturing, servicing departments, efficient use of time, frequency of assessment and alignment, department and staff autonomy, pass rate, academic and infrastructural support, and staff incentive scheme (Scheerens et al., 2010). When indicators are used for programme evaluation purposes, the above-mentioned advantages of disaggregated data are important because they provide firmer ground to answer causal questions about programme effectiveness.

3.8.4.3. Quantitative Output Indicators (QOIs)

The QOIs seek to measure to what extent immediate objectives are achieved, and are the more direct outcomes of schooling and measured by the means of standardized achievement tests.

Furthermore, QOIs are central in productivity and effectiveness of educational quality, including playing an indispensable role in the assessment of equity, efficiency and responsiveness of schooling (Scheerens et al., 2010). There are two sides to efficiency: internal and external efficiencies, but the focus of this study was on internal efficiency which is concerned with the relationship between inputs and immediate goals in education, such as the number of students passing in the 2nd year of study, successful placement at the workplace for work-integrated learning, and the quality of education and the learning capacity of graduates. The QOIs of summative, or examination results were used as numerical measures of summative assessment results in aggregation with subject and lecturer review reports, peer rating, and work-integrated learning placement to account for quality education provision.

3.9. FACTOR ANALYSIS IN EDUCATIONAL RESEARCH

This research study used Exploratory Factor Analysis (EFA) as the researcher wished to explore theoretical variables such as the quality of teaching and learning using assessment information to enhance the quality of subsequent instructional practices. The EFA assisted in reducing a large number of items from the survey questionnaire to a smaller number of components to uncover latent variables underlying the data set, and also to examine which variables had the strongest association with a particular factor (DiStefano et al., 2009). Principal Component Analysis (PCA) is an extraction method which uses the Varimax orthogonal method for data rotation. The Kaiser criterion was used to decide the number of factors to be retained for rotation, that is, all the values with eigenvalues greater than 1.0 (Costello & Osborne, 2005). Any factor with 2 variables was considered reliable when the variables highly correlated with each other with a correlation value higher than 0.70 (Yong & Pearce, 2013). The Scree Plot Test (SPT) was used to examine the graph of the eigenvalues and look for the natural bend or break point in the data where the curve flattens out, and the number of datapoints prior to the break is the number of factors to be retained (Costello & Osborne, 2005). The rotation simplifies and clarifies the data structure using the orthogonal Varimax rotation method to produce factors that are uncorrelated and produces easily interpretable results (Costello & Osborne, 2005). The rotated factor matrix was interpreted after the orthogonal rotation.

The goal for FA is to reduce “variable complexity to greater simplicity” (Kerlinger, 1979:180). The FA is a collection of appropriate statistical methods since the study intended to investigate the implementation, evaluation and refinement of the instructional model through iterative and cyclic experimentation, with the goal of generating theory and facilitating construct formulation (Henson et al., 2004). The FA can be a valuable analytical tool if the researcher needs to make carefully determined subjective decisions and judgments to unravel the factors present in the data, and such decisions and judgments arise from conceptualization of a series of steps to be addressed at each individual stage (Keiffer, 1999). The FA essentially attempts to reproduce the relationships between variables with a fewer number of factors (Henson et al., 2004). The type of matrix of association submitted for analysis was correlation, computed using the SPSS statistical package.

CHAPTER 4: RESEARCH DATA MANAGEMENT, ANALYSIS AND FINDINGS

4.1. INTRODUCTION

This chapter is based on the framework of descriptive and interpretive approaches to analyze, summarize and compare data so that relationships and patterns can be easily interpreted and understood (Yong & Pearce, 2013). In addition, the linear relatedness and correlation of a number of variables to a smaller number of unobservable factors will be investigated, and patterns of interrelationships, data reduction, instrument development, classification and description of data, data transformation, hypothesis testing are examined, using primarily a very powerful and robust factor analysis (FA) in this study (Rummel, 1970; Merriefield, 1974). The qualitative oriented procedures such as content and thematic analysis, and interpretation as summarized text of a collective statements and questions of the survey questionnaires, and not participants' responses to the survey questionaires and interviews. The content analysis involves categorical variables and establishing, through FA, the number of variables of interest are linearly related to a smaller number of unobservable factors (Mayring, 2000). For example, categorical variable 'assessment method' is linearly related and correlated to different factors in rotated component matrix for 'assessment' in the pre-intervention survey questionnaire.

Familiarization with and immersion in the data gave the researcher a preliminary understanding of the meaning of the data and the ability to develop ideas and theories from which the identification and exploration of meaningful categories and coding started, so as to be able to construct meaning from analyzed and interpreted data which is influenced by perspectives, understanding, context, social realities, and worldviews (LeCompte & Goetz, 1982; Lofland & Lofland, 1996; Krauss, 2005). The key to good and sound qualitative research analysis is to stay close to the data, to interpret it from a position of empathic understanding, and to provide a contextually thick description of the phenomena under study (Terre Blanche et al., 2006). The gathered survey questionnaires data were initially analysed using sequential or interim analysis as an ongoing process of data analysis. This was followed by conceptualization of verbal and textual data, grouping of data into relevant categories and employing *in vivo* coding, which involved the naming of categories derived from participants' responses. Thematic and open coding was employed to identify the categories emerging from the data (Strauss & Corbin, 1990; Flick, 1998; Dey, 1993).

Literature review and professional experience assisted the researcher in making sense of the collected data, identification of patterns and relationships, and in building a logical and coherent chain of evidence (Wong, 2008). Theoretical coding was used to analyze data which had been gathered in order develop a grounded theory after a thorough coding, elaboration, interpretation and explanation which were word-based in word repetition/frequency/count and key-words-in-context. Coding was scrutiny-based using constant comparative analysis in order to compare and contrast cases and included linguistic-based checking of word connectors and physical manipulation of text by pawing (Flick, 1998; Ryan & Bernard, 2000).

The qualitative researcher records their own biases and feelings and states them explicitly in the research report, showing that the conclusions were drawn from interpretive and intuitive analysis of the data, and demonstrating a subjective understanding through exchange of ideas with participants (Sidani & Sechrest, 1996; Krauss, 2005; Creswell, 2007). The following are the research questions that the gathered data analysis and interpretation of this research study intended to answer:

- What is the students' perception of the impact of the current pedagogical practices on the quality of their learning, teaching and assessment in the Clinical Technology programme?
- What is the impact of the instructional model on the quality enhancement of student learning and teaching?
- What transformative pedagogical strategies and practices can enhance the quality of students' learning experience, teaching and assessment?

4.2. RESEARCH DATA ANALYSIS TECHNIQUES

Qualitative data analysis is a dynamic, intuitive and creative process of inductive reasoning, thinking and theorizing (Roberts, 2002; Basit, 2003). The researcher used a variety of analysis techniques without purposive manipulation of the study variables and cognizant of the subjectivity of participants' responses, and found theory to explain the data and to improve the comparability and translatability of findings (LeCompte & Goetz, 1982). In summary, qualitative researchers use generative and inductive strategies to develop propositional theory arising from a single site or a number of research sites. Even if they begin with an explicit theory which they are seeking to verify, discrepant data are used first to reject initial explanations, and then to generate and verify more adequate explanations (LeCompte & Goetz, 1982).

The researcher initially interpreted the verbatim textual data in order to understand each participant's responses to the statements and questions; thematic coding and global analyses were used to compare, contrast and edit participants' responses (Flick, 1998; Denzin & Lincoln, 2005). The general inductive approach used in this study has the following purposes which are similar to other qualitative analysis approaches (Thomas, 2003):

- Condensation of extensive and varied raw text data into a succinct, synoptic format.
- Establishment of clear links between the research aims and the summary findings derived from the raw data and ensuring transparency (ability to demonstrate to others) and defensibility (justification given the aims of the research).
- Development of model or theory about the underlying structure of experiences or processes which are evident in the raw text data.

It is good practice to report findings from qualitative inductive analysis by using the summary or top-level categories as main headings in the findings, with specific categories as subheadings, and via the use of suitable quotes in the text to illustrate the meanings of the categories as indicated in Figure 8 (Thomas, 2003).

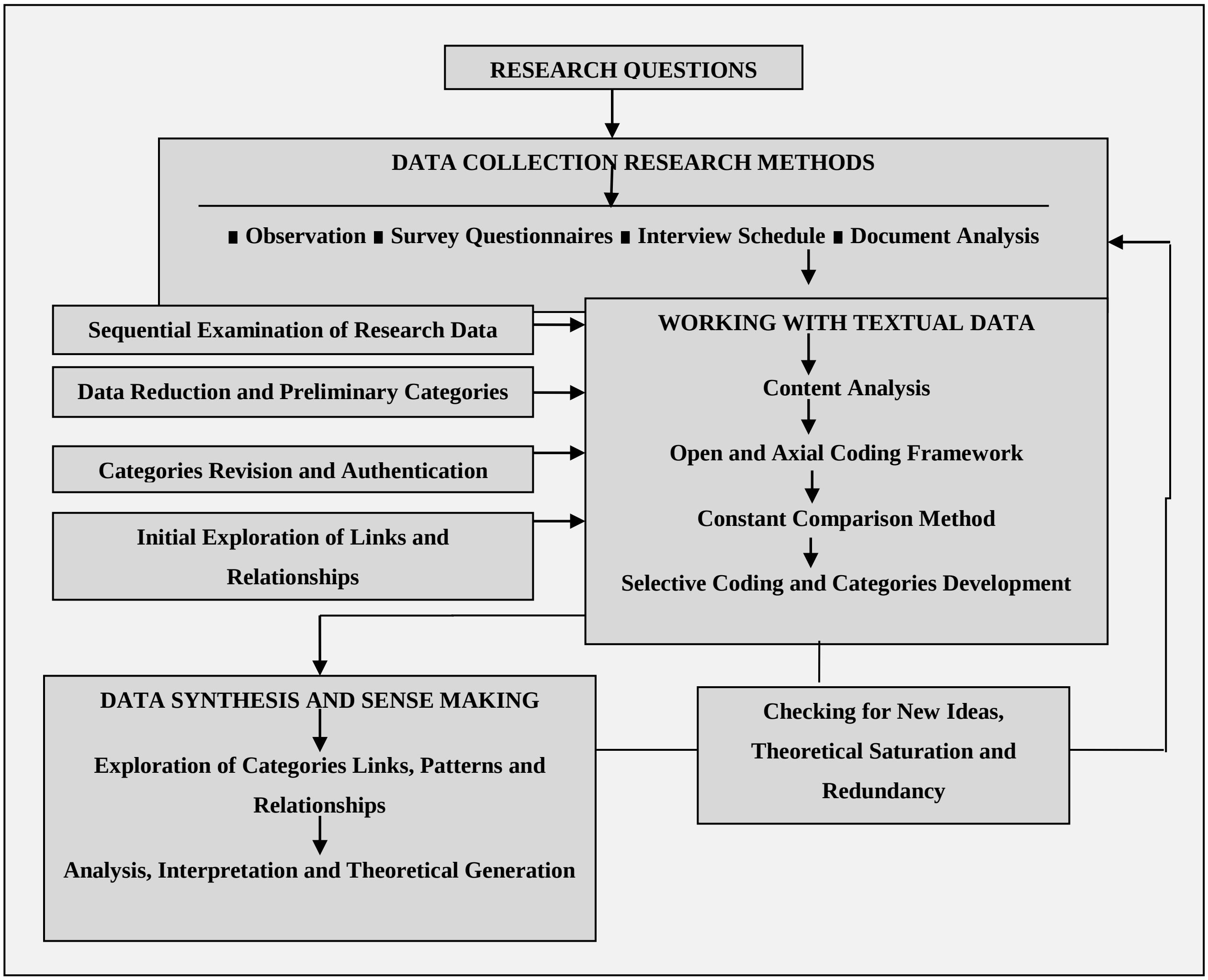

Figure 7: Qualitative Data Analysis Flowchart

Source: Adapted from Wong, (2008)

The main idea of qualitative data analysis flowchart as shown in Figure 7 is to condense raw data into themes and categories based on valid and reliable inferences and interpretations using inductive reasoning. Concepts were generated primarily from theory, reviewed literature and the researcher's intuition at the beginning of data gathering and throughout the analysis and interpretation process. The data came from the participants as as a result of them answering questions, responding to statements and giving their own opinions on teaching, learning, assessment and miscellaneous research topics so that the researcher was able to reveal their perception, behaviours, aspirations and thoughts. All the questions and statements were unitized as a single and/or two words, coded and categorized during the initial analysis phase, and the participants' verbalizations were transcribed literally and in summary form. The categories and codes were derived from the data, reviewed literature and theories, with the coding developed inductively using the constant comparison method to stimulate original insights and make differences between categories apparent (Glaser & Strauss, 1967). The underlying principle of the constant comparison method is to systematically compare each text assigned to a category with each of those already assigned to that category with the intention to completely understand the theoretical properties of the category, and integrate categories and their properties through the development of interpretive memos (Zhang & Wildemuth, undated).

The researcher generated the initial list of coding categories from theory and also adopted some of the coding from previous studies to be able to compare research findings across multiple studies (Miles & Huberman, 1994). The coding system has been applied to all research text and the coding process was checked repeatedly throughout the analysis and interpretation process to prevent what Schilling (2006) termed "drifting into an idiosyncratic sense of what the codes mean". As new themes and concepts emerged, they were added to the coding manual, and consistency of the coding procedure was rechecked for consistency throughout the coding process (Weber, 1990; Miles & Huberman, 1994). The researcher made sense of the developed themes or categories and their properties, and made inferences and presented the reconstructed meaning derived from data. The properties and dimensions of categories were explored, relationships between categories were identified, patterns were uncovered and categories tested against the full range of data (Bradley, 1993). The deep and thick description of results and their analysis are presented in order to answer the research questions and goals, with the intention to strive for a balance between description and interpretation emanating from the researcher's personal and theoretical understanding of teaching, learning and assessment in higher education.

4.2.1. Qualitative Content Analysis

The researcher used the empirical method of qualitative content analysis, including deductive reasoning, to analyze textual data with a focus on giving attention to quantifiable features of the text content such as absolute and relative frequencies of words per text, with the aim of reducing subjective textual data into codes and categories to identify themes, patterns and relationships so that the researcher was able to generate theory from participants' perceptions (Krippendorff, 1980; Titscher et al., 1990; Mayring, 2000; Patton, 2002). The systematic and theory-guided approach of qualitative content analysis gave the researcher the opportunity to thoroughly examine, analyze and interpret textual data of recorded participants' interaction from classroom observation, survey questionnaires, interviews and written documents. The data was transformed by means of coding and categorization in order to produce a unit-by-variable matrix (Kohlbacher, 2006; Babbie, 2000; Gillham, 2000; Mayring, 2000; Ryan & Bernard, 2000; Titscher et al., 2000).

The coding system used in this research study initially developed face-value codes for all statements and questions and thereafter grouped them into content analytic units, and used the constant comparative method to directly and inductively code data into categories assisted by reviewing of literature for strengthening coding of categories, and subsequent summative quantification of the frequency of similar text (Hsieh & Shannon, 2005). The basic proceeding of qualitative content analysis from the initial theory to the final analysis and interpretation is shown in Figure 8.

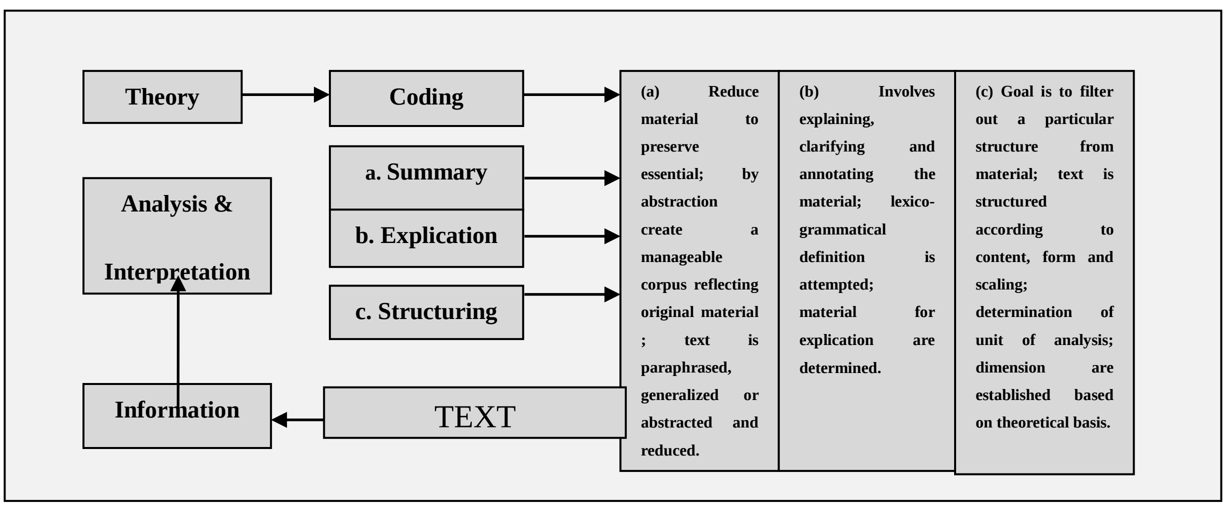

Figure 8: Sequential Model of Qualitative Content Analysis
Source: Glaser and Laudel (1999

The three distinct analytical procedures which could be carried out either independently or in combination depending on the research questions are summary, explication and structural (Glaser & Laudel, 1999), and are shown on Figure 8. Content analysis was used to examine trends, patterns and relationships in programme documentations, and recorded information from matrices (Glaser & Strauss, 1967). Theoretical sensitivity started with sequential/interim analysis using emergent coding by establishing categories, following preliminary examination of data and a priori coding by establishing categories prior to the analysis based upon some theory (Stemler, 2001).

4.2.2. Constant Comparison Method

The constant comparative method was used in this study to analyze data in order to generate theory that explains an educational phenomenon's operational functions in an educational setting. The constant comparative method enabled the grouping of participants' responses to common questions and statements with the intention to qualitatively analyze their varied perceptions by means of inductive category coding, and comparing academic incidences observed (Dye et al., 2000). The following three coding procedures were used, namely, **open coding**: the process of breaking down, examining, comparing, conceptualizing and categorizing data, **axial coding**: putting data back together by establishing links and relationships between subcategories, and **selective coding**: selecting the core category and determining and validating the relationshipsof other categories with it, and filling in categories that need further refinement and development (Strauss & Corbin, 1990). This was followed by the constant comparative method to link relationships with textual data within and across the research instruments to establish a tentative theory, followed by elaboration of theory until theoretical saturation is reached, and the application of grounded theory.

Grounded theory, in short, involves data collection, note-taking, coding and memoing (recording of reflective notes about what you are learning from textual data) all of which occurs simultaneously from the beginning to develop conceptual properties and categories. Sorting occurs when all categories are saturated, and then writing (Strauss & Corbin, 1990). Data analysis for the questionnaires, interviews, and any other verbal data from research methods involved constructing categories of description that were used to characterize verbatim the perception and point of views of students that shared important similarities. The basic aim of the verbal data analysis was not to categorize individual students, but to find categories of description that characterized the qualitatively different ways in which the model and associated educational practices were experienced or conceptualized by the participants

(Marshall, 1999). The procedure for inductive category development is displayed below in Figure 9.

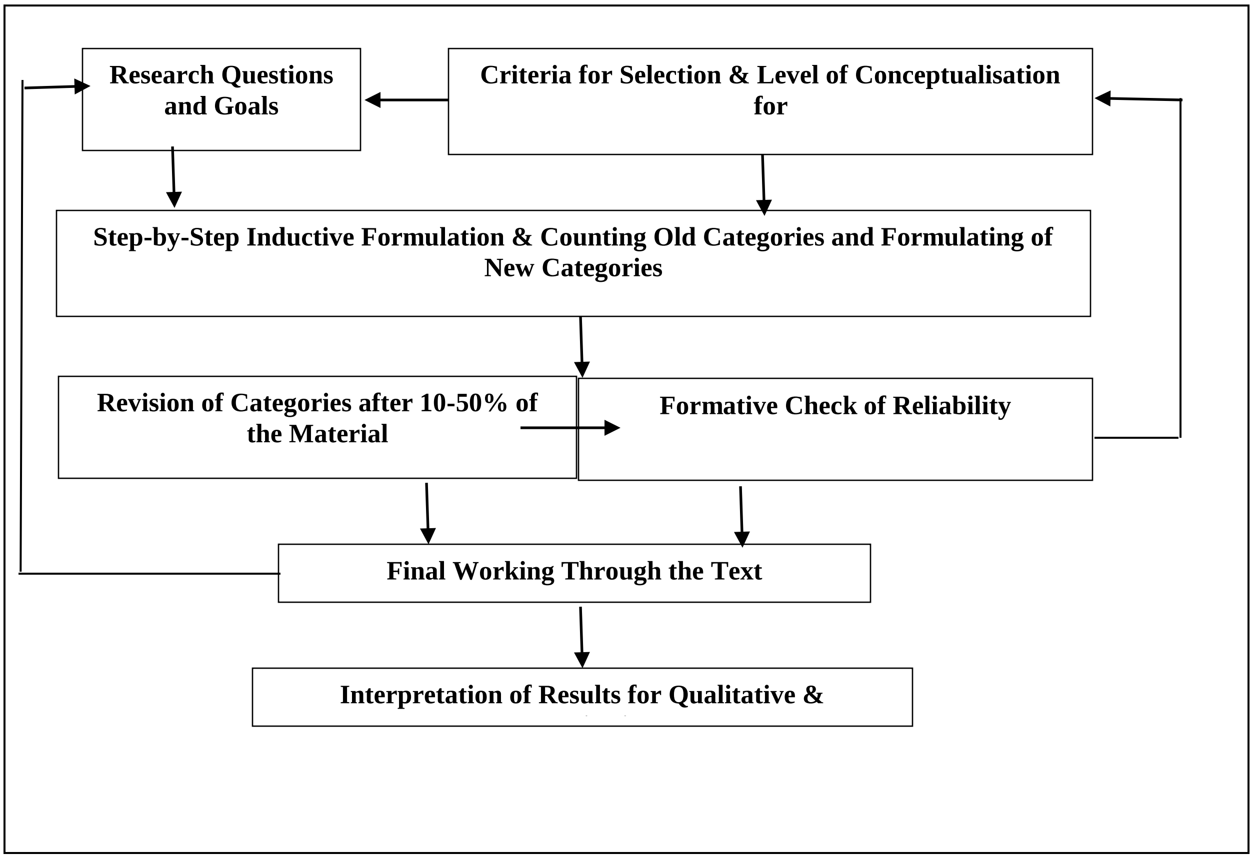

Figure 9: Step Model of Inductive Category Development
Adapted from Mayring (2000)

The most important idea of the procedure is to devise a criterion of definition derived from a theoretical backdrop and the research question, which determines the aspects of the textual material taken into account, and followed by working through material and tentative categories are deduced step-by-step. Through a feedback loop mechanism, categories are revised and eventually reduced into main categories and checked regarding their formative and summative reliability (Mayring, 2000). The quantitative aspects were analyzed to assist in answering the research questions and aims of the research. The process of qualitative content analysis began at the early stages of data gathering which helped the researcher to develop initial concepts of the gathered data and subsequent data gathering towards sources that were more useful for addressing the research questions and aims of the research (Miles & Huberman, 1994). The inductive category development provided a set of systematic and transparent procedures for processing data so that the researcher was able to make some valid and reliable inferences during analysis and discussions of the research findings report.

4.2.3. Factor Analysis (FA) Technique

The basic goal of FA is to describe a set of p random observable and measurable variables in terms of a smaller number ($m<p$) of unobserved construct called components, which were determined by deciphering coefficients in a common factor model called loadings. The common factor model can be described as:

$$X_i = a_{i1}F_1 + a_{i2}F_2 + \dots + a_{im}F_m$$

where X_i is the ith variable, a_{i1} is the jth factor loading for the ith variable, and F_1, F_2 … F_m are the uncorrelated common factors. The square of the factor loading a_{ij} is the proportion of the variance of X_i that is explained by the factor F_j. The variance of ith variable can be split into two components, one corresponding to the variance specifics to that variable (the specific variance or unique variance) and a variance that is common to all variables (the common variance), in the form of the m factors. The estimate of this second component is the communality, the sum of the squared factor loadings across the m factors for the variable in question.

This research study used FA to summarize data so that relationships and patterns could be easily interpreted and understood, and used mathematical procedures for the simplification of interrelated measures to discover patterns in a set of variables (Child, 2006; Yong & Pearce, 2013). Likert-type response formats of the statements and questions, with a five-scale, were used for FA, and the researcher checked and ensured that variables with near identical meanings were excluded for FA, and those with high loadings were checked that they should have distinct conceptualizations (Comrey, 1978). The EFA is the FA technique used to try to uncover complex patterns by exploring the dataset and testing predictions (Child, 2006). The instructional activities such as TLA were central to FA for analysis and interpretation through correlated independent variables extraction and rotation methods in order for the research to generate and test theory about the measured variables, and enabled the researcher to find relative ways of describing and accounting for the relationships between variables (Rummel, 1970; Henson et al., 2004; Pohlman, 2004). The FA is a non-parametric analysis technique that provides a geometrical representation that allowed the researcher to visually portray behavioural relationships and interactions between participants, and to discover the number of factors influencing variables as well as analyze which variables are common to each other (DeCoster, 1998). The relationships yielded latent variables that accounted for a considerable proportion of variance in the matrix of associations, and it represented the way participants in this study perceived the efficacy of the ITLMUA and learning environments in the Clinical Technology programme (Hair et al., 1998; D'Haenens et al., 2010).

This research study utilized EFA to summarize patterns of correlations among observed variables of the instructional activities as gathered during the pre- and post-implementation of ITLMUA, with the main aim of reducing a complex large number of observed variables to a simple smaller number of factors, and to provide a regression equation for instructional activities of TLA (Henson et al., 2004). The research used EFA to explore relationships among variables in an effort to generate theory or facilitate constructs formulation, and the relationships among the variables were factored as tentative assumptions. The findings helped inform research theory and/or construct development (Henson et al., 2004). The EFA was utilized to gain insight into the structure or underlying process of ITLMUA, specifically, *dimensionality*, which is the number of factors that can be derived from the set and *interpretability* which refers to the ability to attribute meaning to the factors. The results help inform theory and/or construct development (Pohlmann, 2004).

Principal component analysis (PCA) was used to extract the factors from the rotated component matrix of association, with the first extracted factor attempting to explain the most variance in the matrix of association, and Varimax with Kaiser Normalization as the rotation method used for data analysis and deciding the number of factors to be retained for rotation and interpretation (Henson et al., 2004; Costello & Osborne, 2005). The researcher derived the correlation matrix by employing a PCA diagonal matrix of association. The proportions of variance in the variables were reproducible by the factors, and used on the diagonal as lower bound estimates of reliability derived through the iterative process of factor extraction and communality estimation (Henson et al., 2004).

4.2.3.1. Determination of the Factor Analysis Model for Factor Extraction

The study utilized EFA because it is correlational in nature and focuses on the matrix of associations to explore the relationships among variables in an effort to generate theory as informed by results or facilitate construct formulation and development (Henson & Roberts, 2006; Henson et al., 2004). Furthermore, EFA accounts for the structure of the items between individuals within the group where the conduct of EFA is on the total dataset without taking into account the hierarchical data structure and intra-class correlation coefficients, which signified the proportion of variance observed within the participants (Henson et al., 2004; D'Haenens et al., 2010). This study extracted a smaller set of factors to maximize the interpretability and explanation of the variances using SPSS 20.0 for PCA, to obtained a correlation or covariance matrix in decreasing order of the variance explained, with the first factor explaining more variance than any other possible factor, the second factor explaining more of the remaining variance than any other, and so on (Henson et al., 2004; Pohlmann, 2004). According to Henson et al., (2004), the first extracted factor endeavors to clarify the most variance in the matrix, leaving a residual matrix behind, with additional factors uncorrelated with the previous factors. These are then extracted to reproduce the variance in each subsequent residual matrix.

The researcher used the PCA as a statistical method of estimating pattern coefficients and to extract factors in an attempt to remove variance common to a set of variables from the original matrix of association (Henson & Roberts, 2006). The PCA uses orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called *principal components* (Henson et al., 2004). This transformation is defined in such a way that the first principal component has the largest possible variance, that is, accounts for as much of the variability in the data as possible, and each succeeding component in turn has the highest variance possible under the constraint that it is orthogonal to the preceding components. The PCA has been utilized because of its suitability to maximize the ability to explain the inconsistency of observed variables, and it involves no assumption about the unique or error variance in the data (Raven, 2009).

4.2.3.2. Factor Retention Rules

The FA enables the researcher to reproduce the relationships between copious variables with fewer numbers of factors, based on criteria and rules to be used in retention of the number of factors which lead to different solutions (Cattel, 1966; Cattel & Vogelman, 1977; Ford, 1986; Henson et al., 2004;). The Kaiser-Guttman rule states that a researcher should attempt to interpret the number of factors that have *eigenvalues* greater than 1 (EV>1); an eigenvalue measures the amount of variance in the variables explained by a factor (Kaiser, 1960; Pohlman, 2004). Tucker et al., (1969) found that the rule or criterion often incorrectly estimated the number of factors. The various rules do not necessarily lead to the same conclusions as regards to the number of factors to retain (Henson et al., 2004). Henson et al., (2004) warns that the number of factors extracted for analysis may not reproduce enough variance to matter or simply may not be interpretable, therefore, only a smaller set of factors are extracted with the intent to maximize the interpretability and variance explained.

4.2.3.3. Rotation (Transformation) of Factors

This research study used Varimax orthogonal with Kaiser Normalization, and the EFA results are rotated to facilitate interpretation of their factors (Henson & Roberts, 2006; Henson et al., 2004). Rotation maximizes high item loadings and minimizes low item loadings, thereby producing a more interpretable and simplified solution. In EFA, a variable contribution to a given factor is indicated by factor pattern coefficients and factor structure coefficients (Henson & Roberts, 2006). Pohlmann (2004) described '*structure*' as the relationships between latent variables and measured variables. Thompson and Daniel (1996) noted that the structure coefficient, or correlations between observed (measured) and latent variables are, by and large, crucial to interpretation. The transformation (rotation) of the factor structures are instituted to enhance interpretability or the ability to recognize which variables define which factors using *varimax criterion* in order to improve the meaningfulness, reliability and reproducibility of factors (Ford et al., 1986; Henson et al., 2004).

The transformation also intends to achieve simple factor structures by utilizing oblique rotation of factors around the origin until each factor is maximally collinear and intercorrelated with a distinct cluster of vectors (Raven, 2009). The level of subjectivity is the cited limitation of EFA stemming from the many methodological decisions a researcher must make to complete a single analysis, with the accuracy of the results largely dependent upon the quality of these decisions (Henson & Roberts, 2006). In FA, the factor structure matrix gives the correlation between all observed variables and all extracted latent factors, and when factors are orthogonally rotated, they remain uncorrelated, and the factor structure matrix will exactly match the factor pattern matrix (Henson & Roberts, 2006).

4.2.3.4. Interpretation of the Factors

The researcher labeled and gave meaning to the results of FA with a loading of .40 or higher on factors considered as guides to interpretation and reduction of subjectivity, with focus on examination of high and low loadings, as well as signs across variables (Ford et al., 1986; Rummel, 1970). The variations of between five observations per variable to a ratio of 10 observations per variable (5:1 to 10:1) is recommended, and the ratios are hard to obtain if the sample size is too small. The FA and DBR share some commonalities of a cyclic and flexible process that is iterative in nature and susceptible to continual refinement and modification until the most meaningful solution and design artifact is reached (DBRC, 2003; Beavers et al., 2013). The sample size suitable for factor analysis to produce a reliable factor analytic solution is at least 10 cases for each item, and the subjects-to-variables ratio should be no lower than 5 (Beavers et al., 2013).

The study used EFA to determine educational effectiveness of the ITLMUA by measuring observed process variables as performance indicators at the class level to explain differences in student learning outcomes based instructional data (D'Haenens et al., 2010). The Q-Technique FA was used to identify types or clusters of students with similar views and examine patterns of relationships among factored entities across replicates with a view toward creating a factor of the factored entities, and compares inter-rater comparison in the evaluation of an educational model efficacy on the quality of teaching and learning in higher education (Thompson, 1998). The Q-Techniques two-mode factor analysis is based on the matrix of associations computed from a two-dimensional raw data matrix, where rows represent scores of students, with the scores organized into columns representing the variables being measured (Thompson, 1998). Process variables involve aspects of the lecturers' behaviours of organizing and planning their lessons and the way they interact with students (D'Haenens et al., 2010). There was a positive correlation reported of several process variables at class level with students' academic achievement, other cognitive performance and psychosocial functioning (Opdenakker & van Damme, 2000; Muijs & Reynolds, 2003; Greene et al., 2004; Johnson & Stevens, 2006;).

4.2.3.5. Evaluation of the Factorability of Matrices

4.2.3.5.1. Kaiser-Meyer-Olkin Measure of Sampling Adequacy

The Kaiser-Meyer-Olkin Test of Measure Sampling Adequacy (KMOMSA) is a measure of the shared variance in the items and an important measure to conclude the worthiness of FA (Beavers et al., 2013). The KMOMSA takes values between 0 and 1 and a value close to 1 indicates that patterns of correlations are relatively compact and therefore, FA is expected to yield distinct and reliable factors. The KMOMSA indicates the amount of variance shared among the items designed to measure a latent variable when compared to that shared with the error.

4.2.3.5.2. Bartlett's Test of Sphericity

The Bartlett's Test of Sphericity (BTS) approach focuses on the shared, that is, common factors that have an impact on factor score. The sum of squared component for the 'error' factors, that is, the unique factors, across the set of variables is minimized, and resulting factors scores are highly correlated to their corresponding factor and not with other factors (Distefano et al., 2009). The BTS relates to the significance of this research study in that it shows the validity and suitability of the participants' responses gathered rearding their evaluation of the efficacy of ITLMUA and its impact on the quality of teaching and student learning; for FA to be recommended the BTS must be less than 0.05

4.2.3.5.3. Cattel's Scree Plot

Generally speaking, the FA summarizes data so that relationships and patterns could be simply interpreted and understood (Yong & Pearce, 2013). Cattel's Scree Plot (Cattel, 1966) involves the visual exploration of a graphical representation of the factors and their corresponding eigenvalues which are presented in descending order, with the first component factor accounting for the greatest amount of variance, that is, it has the highest eigenvalue, and linked with a line, with the *x*-axis representing the factors and the *y*-axis representing the eigenvalues (Ledesma & Valero-Mora, 2007; Beavers et al., 2013). Thereafter, a graphical representation was examined to determine the point at which the last significant drop/break/elbow takes place, that is, where the line levels off to divide the major factors from minor factors (Ledesma & Valero-Mora, 2007). The Scree Plot cut-off is quite subjective, requiring that the number of factors be limited to those occurring before the bend in the elbow (Fabrigar et al., 1999).

4.3. QUALITATIVE AND QUANTITATIVE DATA ANALYSIS AND INTERPRETATION

The researcher's intention was to construct conceptual categories through abstraction of complex data, and classify and compare the critical features of the quality of teaching and learning. As indicated by Dey (1993), abstraction is an influential approach to accomplish better clarity and precision in formulating associations and relationships, exclusive of overlooking their origins and limitations. Both the students' and lecturers' responses from the varied research methods and reviewed literature have resulted in the construction of categories and subcategories. Strauss and Corbin (1990) defined categorization as the process of grouping concepts together that seem to pertain to the same phenomena, and their identification and definition is subjective. The researcher attempted to transform textual data and statistical data to answer the research questions (Durrheim, 2006). There is expectation that the categories may overlap and some of the text may not be allocated to any category, and the category systems may be open to continued revision and refinement as the researcher is informed by contradictory viewpoints and new unfolding insights (Thomas, 2003). The responses were content analyzed and grouped into categories and subcategories, with the percentage of participants and/or responses for each category within each question and statement designated to a specific category heading with illustrative respondents' citations (McDonald & Boud, 2003).

This research study adopted a qualitative and descriptive approach in order to establish qualitative differences regarding the students and lecturers' perceptions of the various aspects of themselves, TLA, and any other phenomena in an educational setting by establishing descriptive categories and subcategories in an attempt to unpack similarities and differences.

4.3.1. Construction of Categories for the Pre-Intervention Survey Questionnaires

The construction of categories where used for EFA as unobservable and immeasurable components reduced from observable and measurable variables that were represented on one or more components. Some of the questions which the researcher found significant for the research analysis and interpretation were used together in appropriate and relevant variables to strengthen the richness of qualitative analysis and interpretation.

4.3.1.1. Factor Analysis of the Pre-Intervention Survey Questionnaires Variables

This research study used FA for the purpose of developing psychometric measures and to find meaningful patterns within a large amount of verbal data by using EFA involving PCA as an extraction method and Varimax with Kaiser Normalisation rotation method to assist in the analysis and interpretation of data. The FA was interpreted in conjunction with the Likert Scale statements and questions and supported by verbatim responses from students and lecturers in order to triangulate both qualitative and quantitative data to make suitable inferences regarding the aims and objectives of the study and in responding to and answering research questions.

Table 5: Pre-Intervention Reliability Statistics, Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMOMSA) and Bartlett's Test of Sphericity (BTS)

SECTIONS	Number of Items	Cronbach' Alpha Coefficient
A. Assessment	17 of 17	0.800
B. Learning	16 of 16	0.698
C. Teaching	5 of 5	0.600
D. Miscellaneous	21 of 21	0.858

SECTIONS	Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMOMSA)	Bartlett's Test of Sphericity (BTS)		
		Approx. Chi Square	df	Sig.
A. Assessment	0.576	137.383	66	0.000
B. Learning	0.608	129.696	55	0.000
C. Teaching	0.502	22.146	10	0.014
D. Miscellaneous	0.540	226.796	105	0.000

4.3.1.1.1. Reliability Analysis of Observed Variables

Cronbach's alpha coefficient was used to measure the reliability of all items that constituted the questionnaire as shown in Table 5, showing moderate to high internal consistency of the constructs and their stability (Nunnaly & Bernstein, 1994). In each section, Cronbach's alpha coefficient exceed Bagozzi and Yi's (1988) threshold of 0.600 and exceeded Nunnaly and Bernstein's (1994) thereshold of 0.700, therefore indicating a degree of consistency suitably reliable for data analysis. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMOMSA) for this set of variables is greater than 0.500 and the Bartlett's Test of Sphericity (BTS) tests the hypothesis that the correlation matrix is an identity matrix, that is, all diagonal elements are 1 and off-diagonal elements are 0, implying that all of the variables are uncorrelated. If the Sig. value for this test is less than the alpha level ($p \leq 0.05$), the null hypothesis is rejected that the population matrix is an identity matrix. The Sig. value for this analysis indicates that the null hypothesis should be rejected, and it can be concluded that there are correlations in the data set that are appropriate for factor analysis, and this analysis meets the requirement.

4.3.1.1.2. Pre-Intervention Rotated Component Matrix for Section A: Assessment

The values in the pre-intervention tables represent the varied component loadings of Section A: Assessment. The observable and measurable variables and the loadings determined how much the variable has contributed to one or more components. Table 6 and Figure 10 are representations of the Likert Scale percentages for statements and questions identified for EFA using PCA extraction methods and Varimax with Kaiser Normalisation rotation methods. Responses from both students and lecturers were used, where applicable, and theoretical and psychological knowledge from the researcher and reviewed literature to support and generate theory and conceptual understanding.

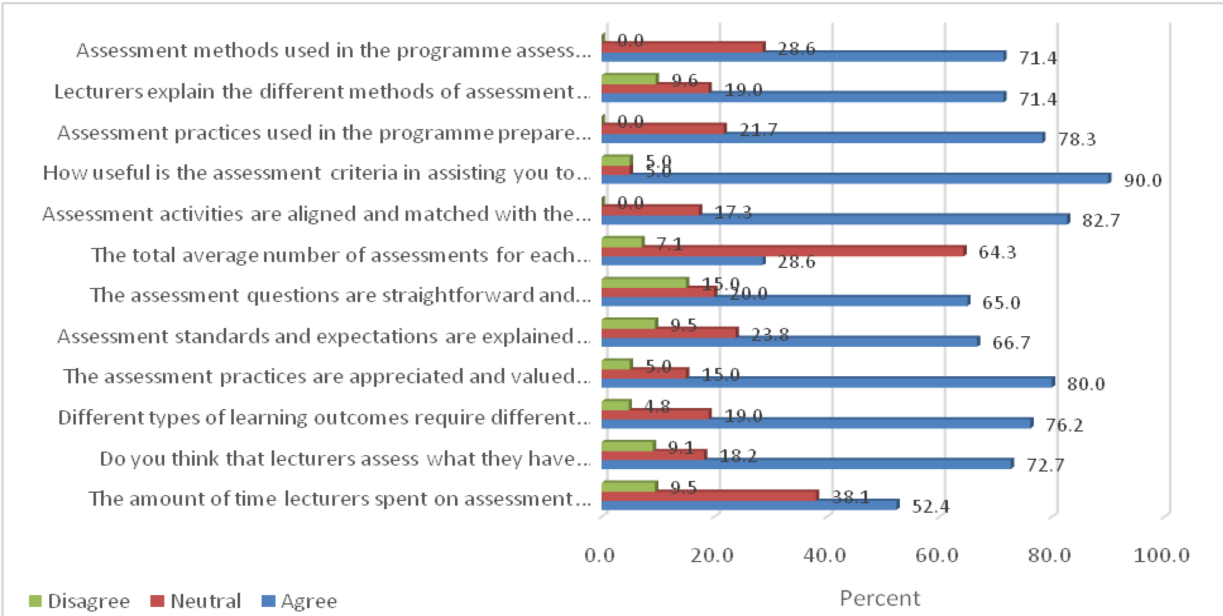

Figure 10: Pre-Intervention Bar Graph for Assessment

Table 6: Pre-Intervention Rotated Component Matrix for Section A: Assessment

PRE-INTERVENTION ASSESSMENT					
SECTION A VARIABLES	ROTATED COMPONENT CORRELATION MATRIX				
	1	2	3	4	5
A3	0.695	-0.050	-0.102	0.211	0.573
A4	0.829	-0.107	-0.271	0.229	0.212
A5	0.291	0.542	-0.198	-0.515	0.369
A7	0.162	0.010	0.094	0.910	-0.123
A8	-0.103	-0.093	0.158	-0.152	0.948
A9	-0.251	0.164	0.879	-0.058	0.150
A10	0.545	0.028	0.716	0.226	-0.024
A11	0.703	0.476	0.183	0.288	0.026
A12	0.867	0.131	0.235	-0.195	-0.157
A17	-0.012	0.895	0.000	-0.171	-0.107
A19	0.800	0.177	-0.142	0.346	-0.221
A20	0.140	0.775	0.327	0.271	-0.072
	Key Scales for Colour Coding of Factors for Section A				
	1. Assessment Practices	2. Assessment Methods	3. Assessment Activities	4. Assessment Criteria	5. Instructional Alignment

The Table 6 and Figure 10 show the FA and percentage response, respectively. The result of 0.867 is the loading of variable A12 on Component 1: Assessment Practices, and since loading appears to be high, there is a strong relationship with Component 1. Almost all students (80%) responded positively that they value the assessment practices used in the Clinical Technology programme because they assess their knowledge, skills and abilities. According to the lecturers, the strengths of the assessment practices are *"practical assessments, project preparation and presentations"* (Lecturer A), and *"quite varied to allow different student abilities & creativity to emerge"* (Lecturer B). They further pointed out that the weaknesses of assessment practices are *"up to date technology to assess students is lacking"* (Lecturer A), and *"over-assessing to some degree"* (Lecturer B). During subject documentation inspection, there was evidence of reliance on conventional assessment practices and over-assessing of the same theory, skills and abilities, for example, three written theoretical tests for each subject and more than four practical tests. The reflective reports used in one of the subjects are insubstantial snippets of reflective practices which are embedded in traditional instructional approach with a focus on easily quantifiable, small discreet components of the subject produced through recall and reproduction (Segers et al., 2001).

The majority of students (71%) stated that the goals of assessment methods are explained and assessment methods do assess what they are supposed to assess, especially the 'easier', factual knowledge, as observed in the tests and assignments. These conventional assessment practices promote factual recall and reproduction so that the desired results are manifested in quantitative data as required by external stakeholders, and do not necessarily reflect the quality of student learning and teaching. The current assessment practices focus on subject content and the product, and not on the process and reflection on assessment practices with a view to reappraisal of assessment practices that are responsive to demographics and abilities of students (Clarke, undated). The move nowadays is from assessing abilities such as recall of discreet factual and procedural knowledge to measuring students' ability to engage meaningfully in complex critical thinking and problem-solving activities (Fook & Sidhu, 2013).

The results 0.695 and 0.573 are loading onto variable A3, termed crossloading onto Component 2: Assessment Methods and Component 5: Instructional Alignment, thereby rendering the components unable to define a distinct cluster of interrelated variables (Yong & Pearce, 2013). The results 0.829 and 0.895 are loading on variables A4 and A17 onto Component 1: Assessment Practices and Component 2: Assessment Methods, respectively. All the variables showed moderate to high inter-correlation and inter-relatedness, with A4 showing a strong relationship with Component 1 as a result of its high contribution to the component, and A17 contributing highly on Component 2, indicating a very strong relationship with the component. The majority of students (71%) agreed that assessment methods assess what they were supposed to assess (A3), and lecturers explained the goals of different assessment methods of the programme (A4). Almost all students concurred (76%) that different types of LOs require different types of assessment (A17), and one of students who is in agreement indicated that *"some learning outcomes need practical experience (measurement of blood pressure), others require theoretical knowledge (cardiac cycle)"* (Student O). One of the two impartial students noted that *"there are a diversity of students & if different types of assessment is given then each students can in some way benefit"* (Student K), and the only student from the disagreeing group indicated that *"each learning outcome requirement will have different ways to improve our understanding of content through the different assessment"* (Student A). The latter students, in the researcher's opinion, are agreeing with the statement, and one might think that they misunderstood or confused the essence of what the statement intended to mean.

Students admitted that during the interviews that they prepared differently for different types and methods of assessment depending on how the questions are asked, which meant that students adapt and respond to their learning depending on the demands implicit in the questions given in the test or examination (Struyven et al., 2002). The students chose conventional written theory test and essay-writing as their preferred assessment methods as they *"makes it easier ... to see and know how much work I understand or know and what I should work on most"* (Student C), and essay-writing *"is easier to score marks, and if I perform poorly in tests and exams, my assignments mark will hopefully up my DP (course marks)"* (Student N). The lecturers had the proclivity to teach-to-the-test thereby promoting information and knowledge recall and reproduction of taught material (Scouller, 1998; Biggs, 1979; Marton & Saljo, 1976a). The examination causes students to become cue seekers by exhibiting tendencies to elicit from the lecturers what might come out of the written tests for them to pass (Entwistle, 1981). The lecturers most preferred methods of assessment are *"summative assessment"* and *"case studies"* and the least preferred methods of assessment are *“continuous assessment”* and *“theoretical questioning”* (Lecturers A and B, respectively). The lecturers’ choices demonstrated the “deeply embedded culture of traditional testing habits” and the case studies that seem authentic might be inundated with the assumptions of conventional instructional practice (Rennert-Ariev, 2005). The lecturers used traditional assessment methods focused on the easily quantifiable and narrowed the learning process to a consumption process of knowledge which is provided by the lecturers through lecture-mode instructional approach (Segers et al., 2001).

The varied and diverse assessment methods influenced and modified students’ learning approaches, altered their attitudes towards learning, albeit with concerns on assessment reliability and standards, and appeals for accountability by lecturers and HE institutions (O’Donovan et al., 2004; McKellar, 2002; Scouller, 1998). There is pressure on HE to uphold and maintain high and consistent academic standards at the same time that HE is experiencing massive expansion in terms of increased access and success of diverse student population, and the recent #FeesMustFall campaign, which has put a tremendous strain on HE funding (Newstead & Dennis, 1994). Some students indicated that assessment methods used are monotonous as as almost all lecturers predictably used the same assessment methods, namely, timed, which is a discouraging environment that elicits stress and anxiety, for example, one student said *“oral speech or presentation”*, which makes some students uncomfortable *“with talking and presenting to a class full of people as I get nervous and tend to mispronounce words and make mistakes”* (Student J). Group work was mentioned by Student H as a problem in that *“not all members would contribute, therefore, it is unfair to those who have to do all the work”*. Lecturers are responsible to ensure that all members of the group understand the academic benefits of groupwork such as peer learning, collaboration and cooperation with focus on common goals and achievement to enhance the quality of learning.

The students preferred written theory tests and least preferred examinations which are highly used in HE. Struyven et al., 2002 notes that examinations are seen as less supportive of students’ learning and development. Students are motivated to perform well on examinations dependent on the cognitive challenges and demands of examination questions which strongly influenced students’ study strategies (Scouller, 1998). In addition, Ramsden (1992) notes that examinations promote surface learning and the backwash of the highly exam-centric education is defined as the influence of assessment on teaching and learning, but students should be cognizant of the academic benefit of examination preparation by working together to pool knowledge and understanding rather than relying on a high achiever to provide all the answers (Guiliodori et al., 2008).

The Component 3: Assessment Activities consisted of variables and associated loadings: A9 (0.879), A10 (0.716), A11 (0.703) and A20 (0.775), with A9 and A10 loading onto Component 3: Assessment Activities, A11 loading onto Component 1: Assessment Practices, and A20 loading onto Component 2: Assessment Method. It is evident that there was high inter-correlation and inter-relatedness among the Assessment Activities variables, indicating high associations among the variables. The variable A9 is contributing highly to Assessment Activities, which means that is has a strong relationship with the component which is evident in that the majority of students (64%) are neutral about the adequacy and acceptability of the total average number of assessments for each subject. This impartiality of students is congruous with what the researcher suggested earlier, that the number of assessment are indicative of over-assessing and Lecturer B also acknlwedged some over-assessing in the afore-mentioned deliberations. One of the neutral majority students pointed out that *"tests are given & assignments are given throughout each semester after sections are completed resulting in many test & assignments being at a similar time, making it hard to continuously excel because there is less time to prepare for each test or assignment"* (Student F). One of the students from the concurring group noted that *"there is in fact too many assessments, if modules are supposed to be integrated, then assessments should be integrated – 1 big assessment"* (Student N), and one student from the differing two, noted that *"students prefer to have at least 4 to 5 assessments"* (Student B).

The neutrality of most students regarding the number of assessment demonstrated that lecturers are either over-assessing students which may be exacerbated by increased study effort placed on students or conventional assessment that seemed to be assessing the same skills albeit varied methods of assessment and lack of integrating assessment activities across subjects with similar themes (Havnes & Aamodt, 2005). A heavy workload could affect the depth at which students study. Students in this study thought that some workload should be reduced so that work does not just wash over students (Struyven et al., 2002). The student are suggesting that the number of assessment should be reduced by integrating assessments across subjects, especially where lecturers could synchronised their lecturs on similar subject offerings such as anatomy of the heart, pathophysiology of the heart, diagnosis of the heart with instrumentation system, and pharmacology of the heart so that there is a synergistic team-teaching approach to one system across varied disciplinary domains in order to make subjects interesting and enjoyable to students as suggested by the ITLMUA.

A very high correlation is demonstrated in variable A7 (0.910) for *assessment criteria* which indicates the utility and suitability of assessment criteria in HE regarding the provision of effective and quality education. Almost all students (90%) noted that assessment criteria are useful in assisting them to perform exceptionally in assessment activities, and the comment from one of the student who concurred is that *"assessment criteria gives us guidelines as to how we should conduct and present our assessment"* (Student H). Student C noted that assessment criteria were *"not very useful"* and commented that *"when everything becomes too much at one go, you expected to juggle all the work that you've never even came across, and you expected to do everything in a short period of time"*. Lecturers must be made aware that assessment criteria (AC) is central to any form of assessment and AC frames the provision of meaningful feedback to students, shows links between assessment tasks and the LOs of the subjects, and enables assessors to pinpoint areas of disagreement between the assessors (McKellar, 2002).

The results 0.948 and 0.800 are the loading for A8 and A19 onto Component 5: Instructional Alignment and Component 1: Assessment Practices, respectively, with the A8 variable showing a high contribution to Component 5, which means that the variable has a very strong relationship with the component, and demonstrates a high inter-correlation and inter-relatedness between the variables. The majority of students (83%) agreed that assessment activities are aligned and matched with LOs which was demonstrated by comments such as *"activities are given that are based on learning topics allowing for better insight into areas & also based on helping us in the workplace"* (Student F). Some of the students who disagreed pointed out that *"all activities given to students are exactly what we will do at the workplace and it is highly needed"* (Student X), and one of the impartial students noted that assessment guidelines are *"not always accurate as some students follow it and the assessment are different"* (Student B). The lecturers should be wary of lecturers' educational and career experiences, and lack of educational qualification that may negatively affect instructional alignment (Polikoff, 2013). Biggs (1999) describes the task of good pedagogical design as one of ensuring absence of inconsistency between the curriculum we teach, the teaching methods we use, the learning environment we choose, and the assessment procedures we adopt, and to achieve complete consistency, we need to carefully examine what assumptions we are making at each stage and align those (Mayes & Freitas, 2004). The majority of students (64%) were impartial that the total average number of assessments for each subject are adequate and acceptable for A9, with comments from Student D that *"some subjects have enough but some too much of which in the end when they are added together it becomes too many to handle within the time allocated"* (Student D). The majority of students (65%) indicated that assessment questions are straightforward and easily understood.

The students are provided with criterion assessment rubrics that plot commonly used assessment criteria in matrix format against marks which result in mark descriptors that detail acceptable performance for each criterion, which must be explicitly articulated and have accurate receipt of understanding by students and lecturers for it to have meaningful knowledge and information (O'Donovan et al., 2004). The *assessment criteria* and *assessment alignment* had a rotated component matrix of 0.910 (A7) and 0.948 (A8), respectively, which demonstrated high inter-correlation, thereby excellent internal consistency and reliability for assessment criteria given to students and that the assessment activities are well-aligned with instructional activities. Almost all students (84%) agreed that assessment activities are aligned and matched with learning outcomes for A8, and Student H noted that *"what we learn in theory is linked up to the activity which makes students have a greater understanding about the concept"*. The lecturers should ensure that content overlap is achieved so that what is taught is assessed, and the students should realize the importance of engaging successfully with subject content in order to obtain high achievement and performance (Daly et al., 1996).

It was satisfying that lecturers indicated that they review all assessments regularly and put improvement strategies in place, and discuss assessment information with students, but failed to explain the academic benefit of these strategic intervention. In addition, they had varied choices to indicate their viewpoint when assessing students, for example, Lecturer A selected 'academic achievement, and Lecturer B chose knowledge use/application, which are equally acceptable as they demonstrate that learning has taken place as expected.

Table 7: Pre-Intervention Total Variance Explained for Section A: Assessment

TOTAL VARIANCE EXPLAINED FOR A PRINCIPAL COMPONENT ANALYSIS OF THE ASSESSMENT									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.414	36.785	36.785	4.414	36.785	36.785	3.558	29.647	29.647
2	2.089	17.405	54.190	2.089	17.405	54.190	2.022	16.846	46.493
3	1.582	13.186	67.376	1.582	13.186	67.376	1.658	13.820	60.313
4	1.263	10.525	77.901	1.263	10.525	77.901	1.611	13.426	73.739
5	1.038	8.648	86.549	1.038	8.648	86.549	1.537	12.809	86.549
6	0.431	3.589	90.137						
7	0.383	3.193	93.330						
8	0.266	2.213	95.543						
9	0.225	1.874	97.417						
10	0.179	1.488	98.905						
11	0.095	0.791	99.696						
12	0.036	0.304	100.000						

The FA identified five factors that are important to the students with regard to Section A: Assessment in the Clinical Technology programme, as shown in Table 7. The five factors collectively influence 85.5% of the participants' perceptions with regard to assessment, the highest contributor being Component 1 indicating the importance of this component to assessment (Yong & Pearce, 2013; Tabachnick & Fidell, 2001).

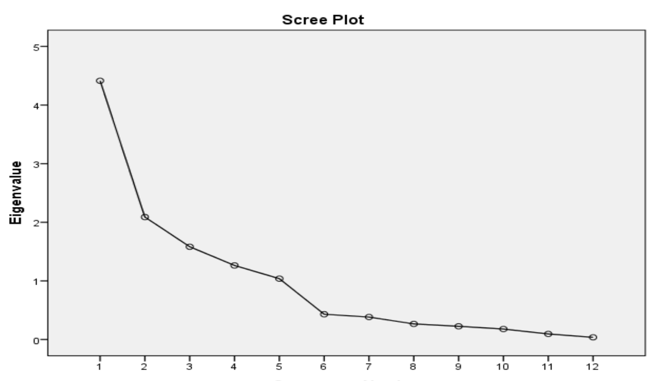

Figure 11: Pre-Intervention SPSS Assessment Cattel Scree Plot

Figure 11 demonstrates the Scree Plot of the eigenvalues and factors from the Assessment category extraction seen in Table 7. This helps in determining the optimal number of the components to be retained. In the case of this study, only the first five components were retained with the eigenvalue of each component above in the initial solution being plotted (Fabrigar et al., 1999). Generally, the components on the steep slope are extracted, and based on eigenvalues and Scree Plot five factors are extracted in this study for assessment. Zwick and Velicer (1986) note that underextraction can lead to the loss of relevant information and a substantial distortion in the variables loading, and overextraction could lead to factors with few substantial loading, which can be difficult to interpret and/or replicate.

4.3.1.1.3. The Pre-Intervention Rotated Component Matrix for Section B: Learning

The values in pre-intervention tables represent the varied component loadings of Section A: Assessment observable and measurable variables and the loadings determine how much the variable has contributed to one or more components. Table 8 and Figure 12 are representations of the Likert Scale percentages for statements and questions identified for EFA using PCA extraction methods and Varimax with Kaiser Normalisation rotation methods. The responses from both the students and lecturers were used, where applicable, and theoretical and psychological knowledge from the researcher and reviewed literature to support and generated theory and conceptual understanding.

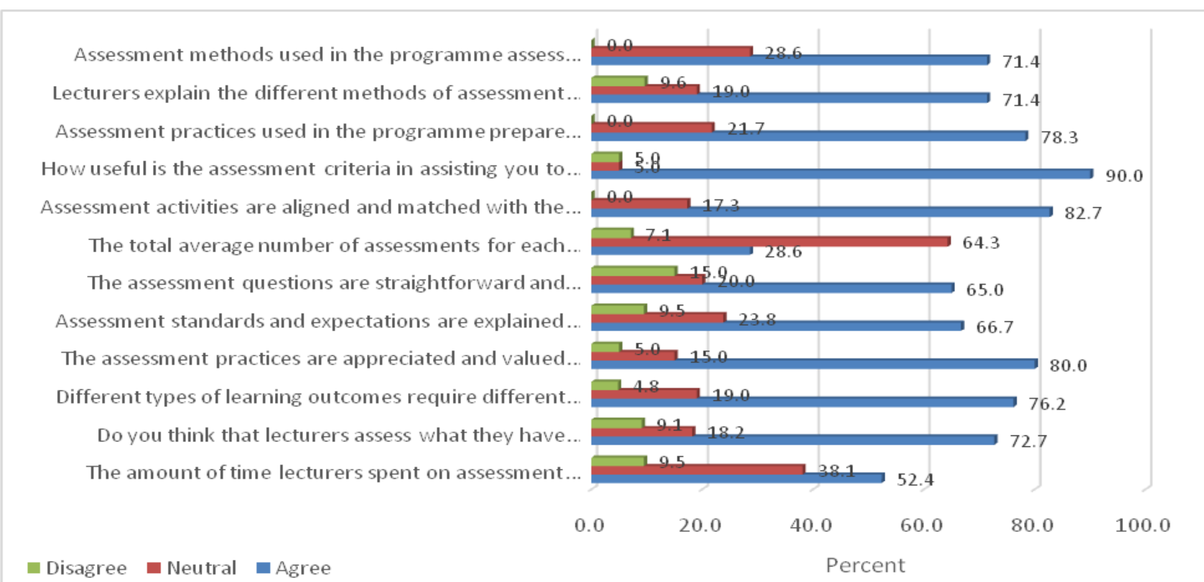

Figure 12: Pre-Intervention Learning Bar Graph for Learning

PRE-INTERVENTION LEARNING						
SECTION B VARIABLES	**ROTATED COMPONENT CORRELATION MATRIX**					
	1	**2**	**3**			
B7	-0.050	**0.618**	**0.600**			
B12	**0.740**	0.359	-0.020			
B14	0.419	0.355	**0.683**			
B18	0.308	**0.772**	0.269			
B19	-0.071	0.055	**0.896**			
B24	**0.898**	0.021	-0.126	Key Scales for Colour Coding of Themes for Section B		
B25	**0.843**	-0.142	0.319			
B26	-0.047	**0.878**	0.040	1. Learning Outcomes	2. Learning Strategies	3. Instructional Alignment

Table 8: Pre-Intervention Rotated Component Matrix for Section B: Learning

Table 8 and Figure 12 show the FA and percentage response, respectively. The results 0.618 and 0.600 are the loadings for variable B7, with crossloading onto Component 2: Learning Strategies and Component 3: Instructional Alignment. The majority of students (85%) concur that the LOs of all programme subjects are relevant and appropriate, which indicates the significance of the variables for factor analysis. The loadings on variables B12 and B24 are 0.740 and 0.898 respectively, and both loaded onto Component 1: Learning Outcomes, with B24 having contributed highly to the component, which means that there is a very strong relationship with the component. The variables show high inter-correlation and inter-relatedness, and a strong relationship. Almost all students (86%) agree that pedagogical practices are aligned with LOs and most students (70%) report that they coped well with increasing complexities of the learning outcomes as they progress to the subsequent levels of the programme. Instructional alignment is the reform efforts aimed at compelling lecturers to improve the quality of their instructional activities and student learning (Smith & O'Day, 1991). Lecturers commented that skill demonstrations were aligned with Los, for example, *"to outline the procedures for recording 12*

Lead ECG" (Lecturer A), and *"use of case studies to illustrate a scenario, e.g. how anemia occurs as a result of chronic renal failure"* (Lecturer B).

Educational and professional experience might give rise to alignment disparity if the lecturers are not educationally qualified and have adequate experience in the instructional practices and professional careers they are involved in (Anderson & Stillman, 2013). Porter (2002) described instructional alignment as the extent to which the content of the lecturers' instruction agrees with the specified content as defined in the content standards and LOs of the programme. Fortunately, the leturers are responsible for curriculum development and appraisal, but the challenge is lack of lecturers' expertise in curriculum development, which inadvertently impact on the curriculum alignment (Case et al., 2004). The ITLMUA promotes and supports the alignment of assessment with LOs across learning units and subjects in order to reduce academic workload in conjunction with team-teaching and integrated assessment strategies utilizing alternative, innovative, dynamic and authentic types and methods of assessment to facilitate better understanding of subjects' principles and concepts (James et al., 2006; Biggs, 1999). Positive academic benefits can be accrued from instructional alignment and alternative assessment methods if lecturers were not rigidly adhering to conventional methods of assessment, which inadvertently, could influence students' approach to learning and assessment.

The results 0.772, 0.896, 0.843 and 0.878 are loadings for variables B18, B19, B25 and B26, respectively, with B18 and B26 loading onto Component 2: Learning Strategies and B19 and B25 loading onto Component 3: Instructional Alignment and Component 1: Learning Outcomes. All the variables are very highly correlated, with B19 highly contributing to Instructional Alignment Component 3, which means that B19 strength of relationship is very high. Almost all students (95%) indicated that they were informed about the subject expectations and achievements in the respective subject study guides (B18), and further reported that the various methods of assessment used influenced their approach to learning (B19). Furthermore, 84% of students confirmed that academic activities and assessments are aligned with the LOs (B25), and 60% of students indicated that lecturers use learning theories when teaching (B26). Information dissemination about what is expected from student with regard to their learning requirements tend to sway them to adopt either a deep approach, which focuses on meaning and understanding, or a surface approach, which focuses on recall and reproduction (Marton & Saljo, 1976a; Biggs, 1979). It has been reported that students may vary their learning approach according to situational factors such as methods of assessment in terms of shaping how much, how (their approach), and what (the content) students learn (Scouller, 1998). Lecturers are encouraged to practice instruction alignment linking their teaching targets and students' learning goals, which could be realized if they have requisite skills and experience, coupled with educational qualification (Polikoff, 2013). If the students are informed about what they should know, understand and be able to do at the end of the learning period in terms of the description and the quality of the subjects, they would be able to adapt appropriate learning approaches from surface to deep learning (Gosling & Moon, 2002).

The comment from one of the students from affirmative group for B26 indicated that *"because they try by all means to make us understand and pass"* (Student R). The comments from one of the students from the neutral group pointed out that *"lecturers just read from the slides they prepared and discuss same things"* (Student G), and one student from the disagreeing group noted that *"only 1 of our lecturers uses learning theories"*" (Student O). Both lecturers agreed that they use learning theories such as *"cognitive and transformative learning"* (Lecturer A), and *"situative and cognitive"* (Lecturer B). The students' comments are lost with regard to what is meant by learning theories despite the lecturers claiming that they use learning theories as indicated. The study guides do not mention any learning theories related to teaching strategies, so lecturers may ave used snippets of learning theories without understanding the basic principled, philosophies and concepts of learning and teaching theories. The result 0.683 is the loading for variable B14 onto Component 3: Learning Alignment, and it is the only variable that is contributing to this component, therefore, demonstrated a slightly high contribution to the component, which meant that there is a strong relationship with component. The majority of students (80%) agreed that instructional strategies are aligned with LOs.

Table 9: Pre-Intervention Total Variance Explained for Section B: Learning

TOTAL VARIANCE EXPLAINED FOR PRINCIPAL COMPONENT ANALYSIS OF THE LEARNING									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.231	40.389	40.389	3.231	40.389	40.389	2.345	29.314	29.314
2	1.896	23.694	64.084	1.896	23.694	64.084	2.027	25.340	54.654
3	1.068	13.349	77.432	1.068	13.349	77.432	1.822	22.778	77.432
4	0.621	7.766	85.198						
5	0.525	6.562	91.760						
6	0.363	4.533	96.293						
7	0.206	2.580	98.873						
8	0.090	1.127	100.000						

The FA identified three factors that are important to the students with regard to Section B: Learning in the Clinical Technology programme, as shown in Table 9. These three factors collectively influence 77.4% of the participants' perceptions with regard to assessment, the highest contributor being Component 1 indicating the importance of this component to assessment (Tabachnick & Fidell, 2001; Yong & Pearce, 2013).

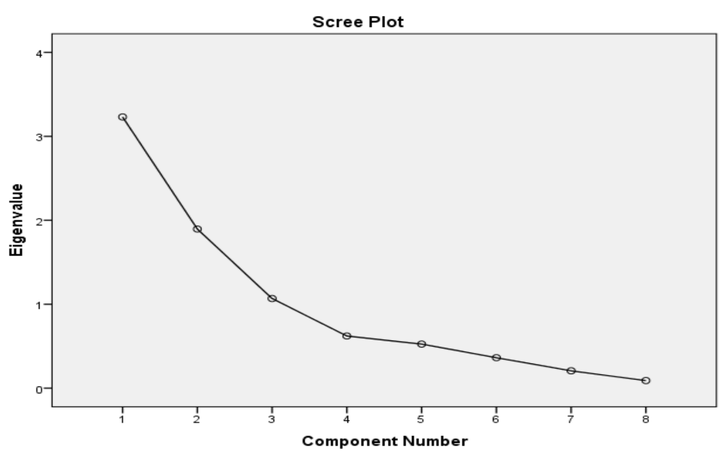

Figure 13: Pre-Intervention SPSS Learning Cattel Scree Plot

Figure 13 demonstrates the Scree Plot of the eigenvalues and factors from the learning category extraction seen in Table 9, and helps to determine the optimal number of components to be retained, and in the case of this study, only the first five components were retained with the eigenvalue of each component above the initial solution being plotted (Fabrigar et al., 1999). Generally, the components on the steep slope are extracted, and based on eigenvalues and Scree Plot three factors were extracted in this study for assessment. Zwick and Velicer (1986) note that underextraction can lead to the loss of relevant information and a substantial distortion in the variables loading, and overextraction could lead to factors with few substantial loading, which can be difficult to interpret and/or replicate.

4.3.1.1.4. The Pre-Intervention Rotated Component Matrix for Section C: Teaching

The values in pre-intervention tables represent the varied component loadings of Section A: Assessment observable and measurable variables and the loadings determin how much the variable has contributed to one or more components. Table 10 and Figure 14 are representations of the Likert Scale percentages for statements and questions identified for EFA using PCA extraction methods and Varimax with Kaiser Normalisation rotation methods. The responses from both the students and lecturers were used, where applicable, and theoretical and psychological knowledge from the researcher and reviewed literature to support and generated theory and conceptual understanding.

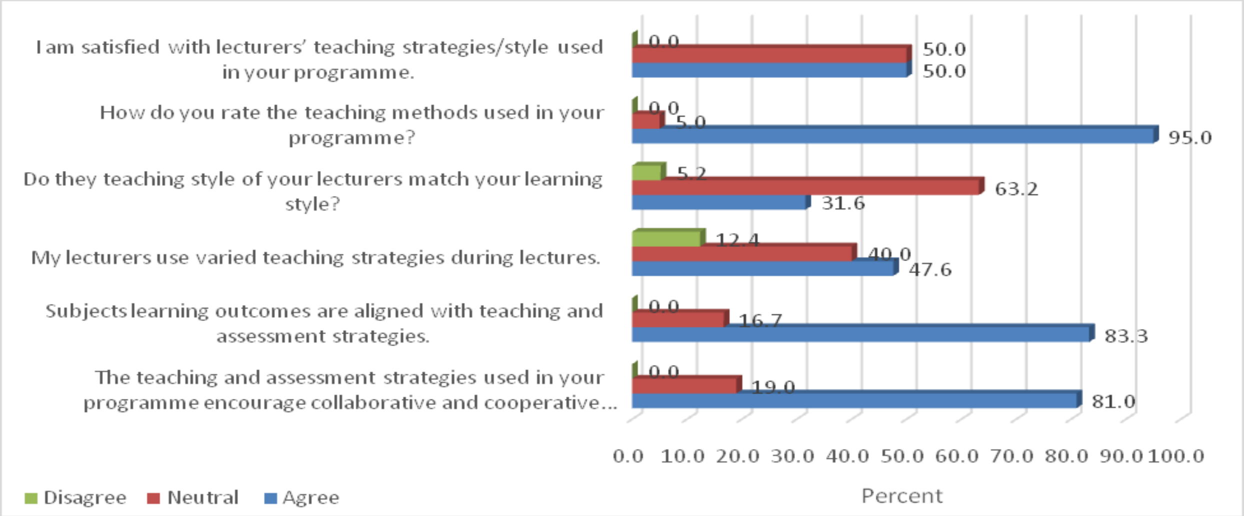

Figure 14: Pre-Intervention Teaching Bar Graph for Teaching

Table 10: Pre-Intervention Rotated Component Matrix for Section C: Teaching

PRE-INTERVENTION ASSESSMENT		
SECTION A VARIABLES	**ROTATED COMPONENT MATRIX**	
	1. Instructional Strategy	
C2	**0.668**	
C4	**0.840**	
C6	0.471	
C10	**0.686**	
C11	**0.512**	

The values in Table 10 represent the varied component loadings of Section C: Teaching with their associated variables, and Figure 14 is the representation of the Likert Scale percentages for statements and questions. The results 0.668 and 0.512 are the loading for variables C2 and C11, respectively onto Component 1: Instructional Strategies, showing moderate inter-correlation and inter-relatedness between the variables. The is a split agreement (50%:50%) on the students' satisfaction regarding the lecturers teaching strategies/styles, and this could be attributed to reluctance of the lecturers to utilize alternative, innovative and dynamics teaching strategies such as active learning, along the lines of 'you can't teach an old dog new tricks'. Lecturer A indicated that *"contact"* and *"scenarios"* are the teaching strategies used. Lecturer B pointed out that teaching strategies used allow *"students to understand that what they are learning is relevant to what they need to know, arouse interest in the subject matter and enhance learning"* without mentioning the teaching strategies. The majority of students (59%) indicated that *"facilitate and guide learning"* (Student X) as their preferential teaching strategies and the rest of students opted for *"convey factual information and concepts"* (Student X). The latter group of students are used to knowledge transmission as embraced by traditional teaching methods whereas the former group of students are more in favour of student learning facilitation, guidance and supervision embraced by alternative teaching strategies such as AL. The researcher's observation revealed that there are some lecturers who are reluctant to change the tried and tested conventional teaching strategies, while others are willing and keen to experiment with different types of teaching and learning strategies (Davis & Wilcock, 2003).

The majority of students (81%) concurred that the teaching and assessment strategies used in their programme encouraged collaborative and cooperative learning. One of the students from the affirmative group indicated that these strategies *"make you want to work as a team, give your views and listen to others views"* (Student I), and the students from the impartial group pointed out that *"it is not very good but it does encourage abit of learning etc."* (Student G). The lecturers indicated that they encouraged and developed students' collaborative and cooperative learning by using *"group projects"* and *"practicals are always done in groups after demonstration"* (Lecturer A), and by *"creating a classroom atmosphere which encourages questioning"* (Lecturer B). Furthermore, they both agreed that they are proponents of team-teaching, which further supports collaboration and cooperation of lecturers among themselves and across subject domains, which augurs well for student learning and teaching.

Collaborative and cooperative learning is one of the strategies used in the Clinical Technology programme and includes groupwork or team-based learning to encourage students to work in a team with the purpose of creating an environment that is student controlled and managed to achieve a common academic objective, but more importantly to share views and ideas among themselves for a common good. Gokhale (1995) points out that collaborative learning persuades students from various socio-cultural and economic status, and varied capabilities and abilities to work together in small groups toward a common goal. Felder and Brent (2007) states that cooperative learning maximizes learning and satisfaction that arise from being in a team, and allows students to exhibit higher academic achievement and performance, and improves reasoning and critical thinking skills. Prince (2004) indicated that collaborative and cooperative learning allows students to work and learn together towards a common goal, engaging students in active participation in class activities, thereby helping students to find and articulate their critical thinking and problem-solving abilities with the framework of the team (Border & van note Chism, 1992; Russel et al., 2007). It is the lecturers' responsibility to ensure that the requirements, standards and expectations of any academic activity are explicitly articulated to students, and to allow students to ask questions so that there is no confusion. It must be understood that students have natural tendencies towards particular learning strategies and styles which should be accommodated by the lecturers by modifying their teaching strategies and style to match the diversity of students' learning (Kolb, 1984). Felder and Henriques (1995) noted that when students are comfortable with particular teaching styles, this enables them to learn better.

The result 0.840 is the loading for variable C4, and contributes highly onto the only component, which means that there is a high positive and strong relationship with the component. Almost all students (95%) indicated they were very satisfied with the teaching methods of the programme. One of the students from the satisfied group noted that *"the use the board, diagrams and flow diagrams as well as loud, audible voices with interesting tones to keep students interested and learn"* (Student N). The only student who was not very satisfied indicated that *"for me some methods don't work, but I try and make it work"* (Student C). It is evident that the lecturers are using teaching methods that are appreciated and valued by the students. Lecturers indicated varied teaching methods and selected demonstrations and lecturs as their preferred teaching methods. The students' satisfaction with currently used conventional methods of assessment was based on the 'easier' tests and examination that were used indiscreetly without resorting to alternative assessment methods. The quantitative input indicators (QII) which aimed to facilitate the quality of TLA is observed not necessarily in the results, but in the quality of questions asked and students' responses, with the objective of transforming the programme of the Clinical Technology programme activities and processes, which are discussed later in the chapter (Scheerens et al, 2010). The result 0.686 is the loading for variable C10, and the majority of students (83%) agreed that subjects LOs are aligned with teaching and assessment strategies. Alignment refers to the extent to which the specified content of the subjects are interconnected in order to have a positive and meaningful impact on student learning and teaching (Porter, 2002).

Table 11: Pre-Intervention Total Variance Explained for Section C: Teaching

TOTAL VARIANCE EXPLAINED FOR PRINCIPAL COMPONENT ANALYSIS OFTHE TEACHING									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.041	34.017	34.017	2.041	34.017	34.017	1.766	29.429	29.429
2	1.247	20.787	54.804	1.247	20.787	54.804	1.468	24.469	53.899
3	1.082	18.026	72.830	1.082	18.026	72.830	1.136	18.931	72.830
4	0.900	15.007	87.837						
5	0.450	7.507	95.343						
6	0.279	4.657	100.000						

The FA identified three factors that are important to the students with regard to Section C: Teaching in the Clinical Technology programme as shown in Table 11. The three factors collectively influence 72.8% of the participants' perceptions with regard to assessment, the highest contributor being Component 1 indicating the importance of this component to assessment (Tabachnick & Fidell, 2001; Yong & Pearce, 2013)

Figure 15: Pre-Intervention SPSS Teaching Cattel Scree Plot

Figure 15 demonstrates the Scree Plot of the eigenvalues and factors from the Assessment category extraction seen in Table 11, and help in determining the optimal number of the components to be retained. In the case of this study, only the first five components were retained with the eigenvalue of each component above in the initial solution being plotted (Fabrigar et al., 1999). Generally, the components on the steep slope are extracted, and based on eigenvalues and the Scree Plot three factors were extracted in this study for assessment. Zwick and Velicer (1986) noted that underextraction can lead to the loss of relevant information and a substantial distortion in the variable loading, and overextraction could lead to factors with few substantial loading, which can be difficult to interpret and/or replicate.

4.3.1.1.5. The Pre-Intervention Rotated Component Matrices for Miscellaneous

The values in pre-intervention tables represent the varied component loadings of Section A: Assessment observable and measurable variables and the loadings determined how much the variable has contributed to one or more components. Table 12 and Figure 15 are representations of the Likert Scale percentages for statements and questions identified for EFA using PCA extraction methods and Varimax with Kaiser Normalisation rotation methods. The responses from both the students and lecturers were used, where applicable, and theoretical and psychological knowledge from the researcher and reviewed literature to support and generated theory and conceptual understanding.

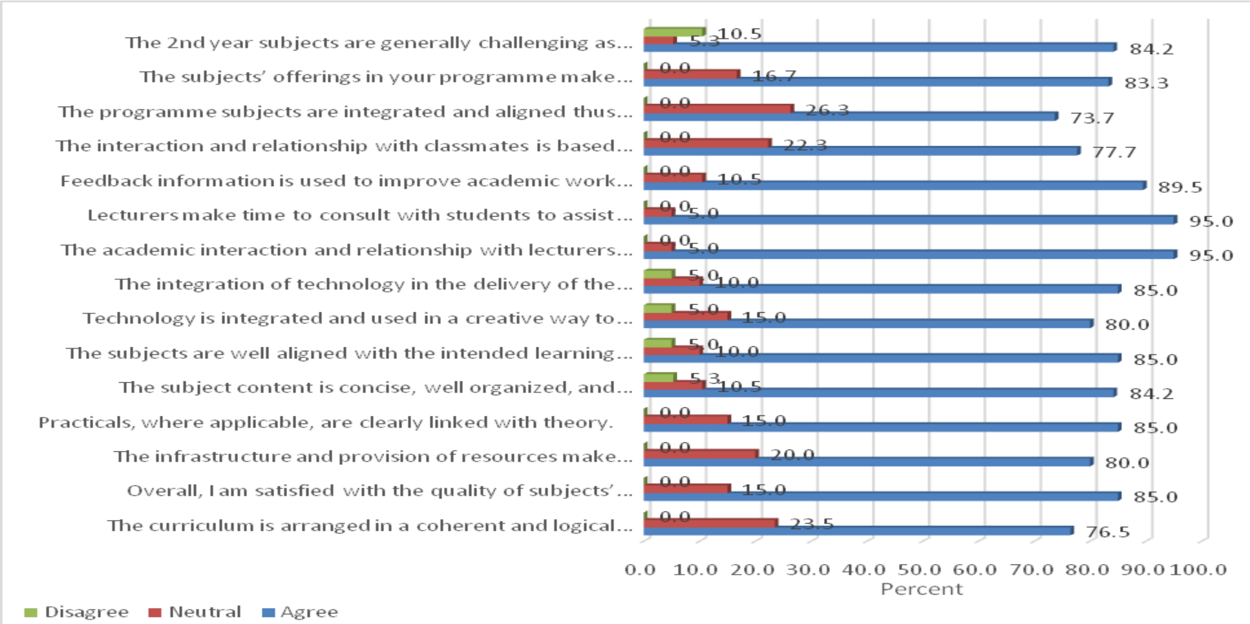

Figure 16: Pre-Intervention Bar Graph for Miscellaneous

Table 12: Pre-Intervention Rotated Component Analysis for Section D: Miscellaneous

PRE-INTERVENTION MISCELLANEOUS					
SECTION A VARIABLES	ROTATED COMPONENT MATRIX				
	1	2	3	4	5
D1	0.147	-0.114	-0.027	**0.504**	**0.616**
D6	0.128	**0.541**	0.423	**0.500**	-0.051
D12	0.083	0.179	**0.903**	-0.095	0.088
D13	-0.009	0.162	-0.016	**0.929**	0.191
D14	0.398	**0.564**	0.027	**0.558**	-0.016
D18	**0.913**	0.142	0.089	0.151	-0.149
D19	**0.875**	0.258	-0.061	0.055	-0.011
D20	0.496	**0.755**	0.064	0.065	-0.002
D22	0.034	**0.767**	0.329	0.031	0.005
D24	**0.711**	0.053	0.391	-0.084	0.237
D25	**0.719**	0.097	0.064	0.116	0.388
D26	0.092	0.034	0.075	0.042	**0.877**
D27	**0.609**	**0.546**	0.130	0.174	0.415
D28	0.080	0.213	**0.846**	0.136	-0.016
	Key Scales for Colour Coding of Themes for Section A				
	1. Technology Integration	2. Positive Feedback	3. Subjects Characteristics	4. Interactive Relationships	5. Infrastructure Provision

The values in Table 12 represent the varied component loadings of Section D: Miscellaneous observable and measurable variables and the loadings determined how much the variable has contributed to one or more components and Figure 16 is the representation of the Likert Scale percentages for statements and questions.

The Component 1: Technology Integration has two variables, namely, D19 and D20 with loading of 0.875 and 0.755, demonstrating high inter-correlation and inter-relatedness, with D19 having a high contribution on Component 1: Technology Integration, which means the variables have a strong relationship with the component. The majority of students (85%) asserted that technology integration in the delivery of the subjects is up to standard, and most of the student (80%) noted that technology integration is used in a creative way to help students learn. During class observation, the lecturers used PowerPoint and YouTube videos during lectures, but the institutions is on an all-out drive to ensure that lecturers use Blackboard and other innovative ICTs to enhance student learning. The only concerns raised by students during the interviews were that the lecturers should first deliver the lecture, and only after that should they play the videos so that at least it is easy to follow the video. In addition, they pointed out that the sound system was inaudible for most of the students, and suggested that audible speakers be installed in class, and the lecturers were informed and promised to use appropriate and audible speakers. Rogers (2000) pointed out that training in technology skills and competencies alone does not guarantee that it will be used in class, let alone being used effectively to enhance the effectiveness and quality of instructional provision and delivery. Effective and efficient use of integrated technology requires a paradigm shift from ‘teaching’ to ‘learning’, which requires adequate training in technology and learning styles, including technical support (Rogers, 2000). Rogers (2000) reported that instructional technology assists student to problem-solve and work in teams, which supports and promotes the development of interpersonal skills.

The results 0.564 and 0.558 are crossloadings for variable D14 onto Component 2: Positive Feedback and Component 4: Interactive Relationships, respectively, with moderate inter-correlation and inter-relatedness between the variables. The variable is contributing moderately to Component 2: Positive Feedback, indicating a moderately strong and positive relationship with the component. The overwhelming majority of students (90%) agreed that feedback information was used to improve academic work and learning for variable D14, and as for D26, the majority of students (80%) pointed out that the infrastructure and provision of resources make practicals efficient. The lecturers must take advantage of ensuring that students are already assessing their own academic work and that they do generate their own feedback, and lecturers should build on this ability (Nicol & Macfarlane, 2006). Feedback is intended to improve and accelerate learning, and empower students as self-regulated students, that is, they must be able to regulate aspects of their thinking, motivation and behaviour during learning (Nicol & Macfarlane, 2006; Sadler, 1998).

The Subject Characteristics component has eleven (11) variables occupying all the components; the highly loaded ones are D12, D22, D24, D25 and D28, with loadings of 0.903, 0.767, 0.711, 0.719 and 0.846, respectively. The variable loadings showed very high inter-correlation and inter-relatedness, with D12 showing a very high contribution to component 3: Subject Characteristics, which means that there is a strong and positive relationship between D12 and component 3. There is crossloading for variables D1 on Component 4: Interactive Relationships and component 5: Infrastructure Provision, and D6 on Component 2: Positive Feedback and component 4: Interactive Relationships. Overall, there is a general moderate to very high inter-correlation and inter-relatedness among the variables. The majority of students (74%) indicated that the subjects were integrated and aligned, thus made learning easier, and most of them (77%) pointed out that curriculum was arranged in a coherent and logical sequence to promote student learning and growth.

The results 0.929 and 0.913 are the loadings of observable and measurable variables D13 and D18 onto Component 4: Interactive Relationships and Component 1: Technology Integration, respectively. The variables are very highly inter-correlated and inter-related, and show the highest degree of contribution which indicates a strong and positive relationship with respective components. Almost all students (78%) indicated that their interaction and relationship with their classmates was based on collaboration and cooperation, and, furthermore, overwhelming numbers of students (95%) expressed that their academic interaction and relationship with lecturers was supportive and accommodative. It is hoped that collaboration and cooperation among the participants is based on alternative teaching strategies such as active learning, but the interaction and collaboration might be based on a social level as students tend to cringe and groan, termed ‘grouphate’, and overlook the development of teamwork skills such as communication and social skills (Burke, 2011). The majority of students (80%) pointed out that their interaction and relationship with classmates was based on collaboration and cooperation, and one of the students indicated that *"as a class, we get along, share information so we can help each other who have weak points"* (Student H). One of the students from impartial group, indicated that *"alot of work is given, therefore a lot of student interaction"* (Student G), who was the only one who disagreed, said *"domination and an ability in listening to other people opinion is not evident if co-operation and group meetings are difficult"* (Student E).

Table 13: Pre-Intervention Total Variance Explained for Section D: Miscellaneous

TOTAL VARIANCE EXPLAINED FOR A PRINCIPAL COMPONENT ANALYSIS OF THE MISCELLANEOUS									
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.633	37.554	37.554	5.633	37.554	37.554	3.618	24.118	24.118
2	1.949	12.993	50.547	1.949	12.993	50.547	2.326	15.503	39.621
3	1.719	11.461	62.007	1.719	11.461	62.007	2.189	14.596	54.217
4	1.427	9.513	71.520	1.427	9.513	71.520	1.982	13.212	67.429
5	1.165	7.766	79.286	1.165	7.766	79.286	1.778	11.857	79.286
6	.974	6.494	85.780						
7	.643	4.289	90.068						
8	.402	2.677	92.746						
9	.301	2.004	94.750						
10	.245	1.635	96.385						
11	.175	1.166	97.551						
12	.152	1.014	98.565						
13	.123	.822	99.387						
14	.058	.384	99.770						
15	.034	.230	100.000						

The FA identified five factors that are important to students with regard to Section D: Miscellaneous in the Clinical Technology programme as shown in Table 13. The five factors collectively influence 79.3% of the participants' perceptions with regard to assessment, the highest contributor being Component 1 indicating the importance of this component to assessment (Tabachnick & Fidell, 2001; Yong & Pearce, 2013).

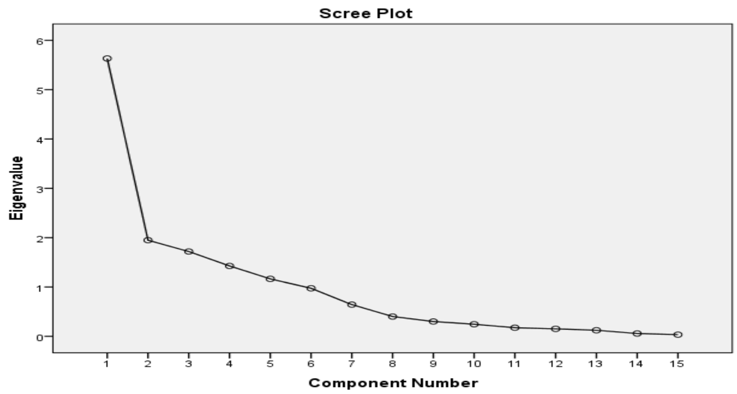

Figure 17: Pre-Intervention Miscellaneous Scree Plot

Figure 17 demonstrates the Scree Plot of the eigenvalues and factors from the Miscellaneous category extraction shown in Table 13, which helps in determining the optimal number of components to be retained. In the case of this study, only the first five components were retained with the eigenvalue of each component above in the initial solution being plotted (Fabrigar et al., 1999). Generally, the components on the steep slope are extracted, and based on eigenvalues and Scree Plot five factors were extracted in this study for assessment. Zwick and Velicer (1986) noted that underextraction can lead to the loss of relevant information and a substantial distortion in the variables loading, and overextraction could lead to factors with few substantial loading, which can be difficult to interpret and/or replicate.

4.3.2. Construction of Categories for the Post-Intervention Survey Questionnaire

The construction of categories were used for EFA as unobservable and immeasurable components reduced from observable and measurable variables that were represented on one or more components. Some of the questions which the researcher found significant for the research analysis and interpretation, were used together in appropriate and relevant variables to strengthen the richness of qualitative analysis and interpretation.

4.3.2.1. Factor Analysis of the Post-Intervention Survey Questionnaires Variables

This research study used FA for the purpose of developing psychometric measures and to find meaningful patterns within a large amount of verbal data by using EFA involving PCA as an extraction method and Varimax with Kaiser Normalisation rotation method to assist in the analysis and interpretation of data. The FA was interpreted in conjunction with the Likert Scale statements and questions and supported with verbatim responses from students and lecturers in order to triangulate both qualitative and quantitative data to make inferences rearding the aims and objectives of the study and in responding and answering research questions.

Table 14: Post-Intervention Reliability Statistics, Kaiser-Meyer-Olkin Measure o Sampling Adequacy (KMOMSA) and Bartlett's Test of Sphericity (BTS)

SECTIONS	Number of Items	Cronbach' Alpha Coefficient
A. Assessment	14 of 14	0.832
B. Learning	9 of 9	0.675
C. Teaching	7 of 7	0.677
D. Miscellaneous	14 of 14	0.723

SECTIONS	Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMOMSA)	Bartlett's Test of Sphericity (BTS)		
		Approx. Chi Square	df	Sig.
A. Assessment	0.483	140.977	66	0.000
B. Learning	0.531	43.004	36	0.196
C. Teaching	0.540	37.832	28	0.102

4.3.2.1.1. Reliability Analysis of Observed Variables

Cronbach's alpha coefficient was used to measure the reliability of all items that constituted the questionnaire as shown in Table 14, which demonstrates moderate to high internal consistency of the constructs and their stability (Nunnaly & Bernstein, 1994). In each section, Cronbach's alpha coefficients are equal to or exceed Bagozzi and Yi's (1988) threshold of 0.600 and Nunnaly and Bernstein's (1994) threshold of 0.700, and accordingly, the items sufficiently reliable for data analysis. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMOMSA) for this set of variables is greater than 0.500 and the Bartlett's Test of Sphericity (BTS) tests the hypothesis that the correlation matrix is an identity matrix, that is, all diagonal elements are 1 and off-diagonal elements are 0, implying that all of the variables are uncorrelated. If the Sig. value for this test is less than the alpha level, the null hypothesis is rejected that the population matrix is an identity matrix. The Sig. value for this analysis indicates that the null hypothesis should be rejected, and it can be concluded that there are correlations in the data set that are appropriate for factor analysis, and this analysis meets the requirement.

4.3.2.1.2. Post-Intervention Rotated Component Matrix for Section A: Assessment

The values in post-intervention Table 15 represent the varied component loadings of Section A: Assessment observable and measurable variables and the loadings determin how much the variable has contributed to one or more components. Table 15 and Figure 18 are representations of the Likert Scale percentages for statements and questions identified for EFA using PCA extraction methods and Varimax with Kaiser Normalisation rotation methods. The responses from both the students and lecturers were used, where applicable, and theoretical and psychological knowledge from the researcher and reviewed literature to support and generated theory and conceptual understanding.

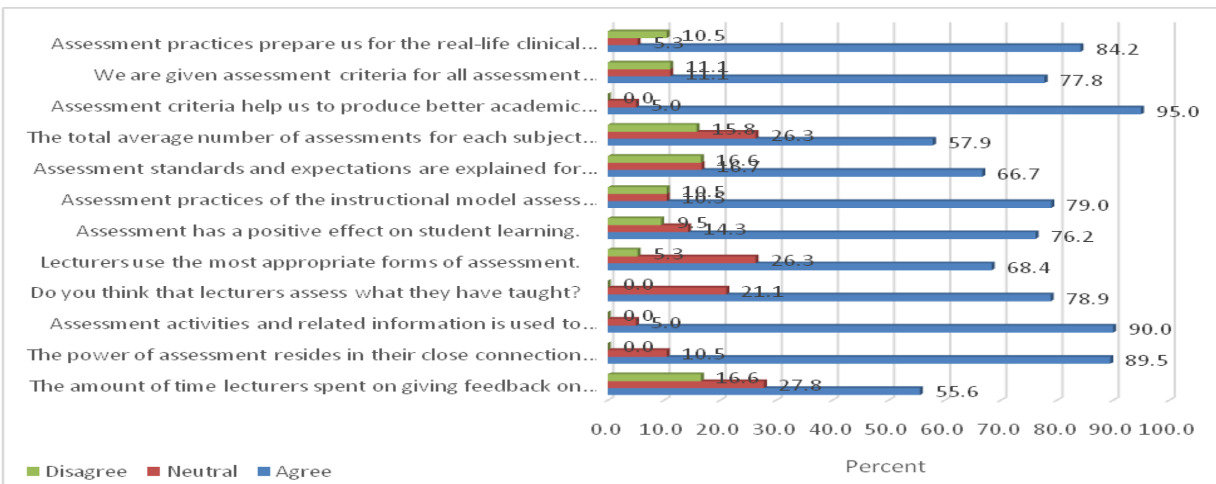

Figure 18: Post-Intervention Bar Graph for Assessment

Table 15: Post-Intervention Rotated Component Matrix for Section A: Assessment

POST-INTERVENTION ASSESSMENT						
SECTION A VARIABLES	ROTATED COMPONENT CORRELATION MATRIX					
	1	2	3	4	5	
A2	0.581	0.062	0.217	0.687	-0.081	
A3	0.759	-0.041	-0.228	0.395	0.132	
A4	0.806	0.013	0.313	-0.085	0.154	
A5	-0.007	0.890	-0.045	-0.158	0.110	
A6	0.145	0.792	0.019	0.433	-0.051	
A9	0.780	0.324	0.081	0.151	0.088	
A11	0.024	-0.021	0.217	0.270	0.849	
A15	0.082	0.170	0.049	0.820	0.328	
A16	0.399	0.364	0.129	-0.035	0.748	
A17	0.004	0.237	0.880	0.311	0.081	
A18	0.185	-0.080	0.886	-0.116	0.243	
A19	0.215	0.695	0.331	0.273	0.198	
	Key Scale for Colour Coding of Themes for Section A: Assessment					
	1. Assessment Practices	2. Assessment Criteria	3. Assessment Activities	4. Assessment Standards	5. Assessment Feedback	

The values in Table 15 represent the varied component loadings of Section A: Assessment observable and measurable variables and the loadings determine how much the variable has contributed to one or more components. Figure 18 is the representation of the Likert Scale percentages for statements and questions. The results 0.759 and 0.806 are the loadings of variables A3 and A4 onto Component 1: Assessment Practices, with A4 showing a relatively high loading and strong relationship to this component as a result of high contribution, and these variables demonstrate high inter-correlation and inter-relatedness. Almost all students (78%) concurred in their response to A3 that they are being given assessment criteria (AC) for all their assessment activities, and overwhelming majority of students (95%) are agree that AC help them to produce better academic work. The AC are central to any form of assessment, and they provide a more consistent structural framework for students, who can be involved in the development of AC, and the lecturers (McKellar, 2002). The AC provides a helpful framework for lecturers to provide feedback to students in a meaningful way so that students can use the assessment information to improve their subsequent academic tasks (Brown et al., 2000). The

ITLMUA provides students with standards and AC for high quality students' assessment practices in order to promote deeper approaches to learning, and to promote students' ability to analyze, synthesize, prove and explain ideas (Darling-Hammond & Snyder, 2000). Criteria forassessing high-order cognitive skills (HOCS) include transferring learning to new situations and problems, implementation of authentic high-fidelity assessments of critical abilities such as collaboration and cooperation These criteria need to be comparable to compete with leading institutions, and should include assessment items that are instructionally sensitive and educationally valuable to stakeholders, and need to be valid, reliable and fair to accurately assess students abilities (Darling-Hammond & Snyder, 2000).

The result 0.687 is the loading for variable A2 onto component 4: Assessment Standards, the 0.780 is the loading for variable A9 onto Component 1: Assessment Practices, with demonstration of inter-correlation and inter-relatedness observed between these variables. The higher loading of variable A9 signifies the contribution of the variable to the component and the strength of the correlation, thereby increasing the validity and reliability of the students' responses (Yong & Pearce, 2013). Most of the students (84%) are in agreement that assessment practices have prepared them for the real-life clinical situation. One of the students from the positive group responded that *"we are taught & assessed on diseases that we will come across next year, even the equipment used to diagnose &treatment"* (Student K). One students from the neutral group indicated that the *"practicals are more helpful as doing something physically is better than theory"* (Student H), but those who disagree pointed that *"we do so much theory and only a small part of what we do affect our real life work"* (Student M). These students are satisfied with emphasis on detailed factual answers, and lack of integration in the delivery of the subject matter, despite introduction to active learning teaching strategies introduced with the implementation and evaluation of the ITLMUA. It is evident that lecturers participate in the study, but are reluctant to transform their instructional practices.

Lecturers in this study tended to resort to conventional assessment practices even though they were introduced to the ITLMUA integrated teaching strategies such as active learning, and integrated assessment strategies that are authentic, meaningful and engaging such as self- and peer assessment, and case-based and team-based assessments. During interviews with participating lecturers, they cited increased workload and preparation time, and this demonstrated negative attitudes towards change. The researcher hopes that in time with the roll out workshops and seminars on assessment and other instructional activities, they will adopt new instructional strategies. The majority of students (79%) concurred that assessment practices of the instructional model assessed not only knowledge, skills and abilities, but also application in varied educational and professional contexts in response to A9.

The results 0.890, 0.748, 0.880 and 0.886 are the loadings of variables A5, A16, A17 and A18, respectively, onto Component 2: Assessment Criteria, Component 5: Assessment Feedback, and Component 3: Assessment Activities. The variables showed very high inter-correlation and inter-relatedness, with A5 (0.890) contributing highly to the Assessment Criteria component, which means that A5 is positively related to Component 2. The majority of students (58%) pointed out that the total average number of assessments for each subject in the programme is adequate and acceptable as a response to A5, as illustrated by a comment from one of the students that *"the amount of work and the time available to finish the module is adequate for the structured assessment"* (Student L). A comment from one of the students who were impartial was that *"the assessment should be integrated and assessed as one since the work is so closely linked"* (Student S), and a student who as in disagreement indicated that *"it is enough but there are too many due in the same day or week and causes stress on student"* (Student F). The impression is that there are other 'unstructured' assessments that students are being given, which may or may not contribute to the final examination mark, and the impression is that the assessment activities are subject-based and fragmented, systematic and unscheduled.

The variables A6, A11 and A15 are loaded with 0.792, 0.849 and 0.820 onto Assessment Criteria, Assessment Feedback and Assessment Standards, respectively, with all the variables highly inter-correlated and inter-related. Variable A11 contributes highly to Assessment Feedback, which means that A11 is positively and highly related to the component. Almost all students (67%) agreed that assessment standards and expectations were explained for all assessments activities. Ecclestone (2001) noted that HE had to articulate assessment standards, requirements and criteria for public accountability based on ideas of good educational practice. Most students (76%) agreed that assessment had a positive effect on student learning, and the majority (68%) attested that the lecturers used the most appropriate forms of assessment as evident in a comment from one of the students from the agreeing group that *"all the methods* *used have challenged me to think critical and less cramming as they are unpredictable in terms of phrasing the questions"* (Student I). This student responded positively to the impact of the efficacy of the ITLMUA in terms of effective quality instructional provision and delivery through facilitation of quality instructional strategies in an attempt to transform student learning evident in challenging students to think critically and steer away from cramming as induced by conventional TLA strategies (Scheerens et al, 2010).

Generally, assessment influences students' learning behaviours and LOs, and the ITLMUA intended to encourage lecturers to adopt alternative, innovative and creative methods of assessment in order to support and promote student learning by stimulating their acquisition, processing and synthesizing information that might result in observable and measurable skills and thoughts processes improvements (Meyers & Nulty, 2002). One of the impartial students indicated that *"assessment should be integrated"* (Student S), and a comment from the only student disagreeing was that *"they use what has been the norm for years"* (Student M). This is another indication of lecturers' reluctance (or fear) to change to instructional activities and practices that are innovative, creative and dynamic, with a positive impact on quality students learning experience and quality teaching. The result 0.695 is the loading of variable A19 on Component 2: Assessment Criteria, despite A19 belonging to Component 5: Assessment Feedback. A19 is moderately correlated and related to Assessment Criteria. All the variables are very highly inter-correlated and inter-related among themselves, demonstrating that these responses from students were valid, reliable and trustworthy.

Table 16: Post-Intervention Total Variance Explained for Section A: Assessment

TOTAL VARIANCE EXPLAINED FOR PRINCIPAL COMPONENT ANALYSIS OF THE ASSESSMENT									
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.480	37.335	37.335	4.480	37.335	37.335	2.439	20.324	20.324
2	1.698	14.154	51.489	1.698	14.154	51.489	2.237	18.641	38.965
3	1.660	13.836	65.325	1.660	13.836	65.325	1.940	16.167	55.132
4	1.120	9.334	74.658	1.120	9.334	74.658	1.801	15.007	70.139
5	1.021	8.512	83.170	1.021	8.512	83.170	1.564	13.031	83.170
6	.616	5.131	88.301						
7	.461	3.841	92.142						
8	.383	3.194	95.337						
9	.232	1.933	97.270						
10	.194	1.620	98.890						
11	.091	.761	99.651						
12	.042	.349	100.000						

The FA identified five factors that are important to the students with regard to Section A: Assessment in the Clinical Technology programme as shown in Table 16. The five factors collectively influence 83.2% of the participants’ perceptions with regard to assessment, the highest contributor being Component 1 indicating the importance of this component to assessment (Tabachnick & Fidell, 2001; Yong & Pearce, 2013).

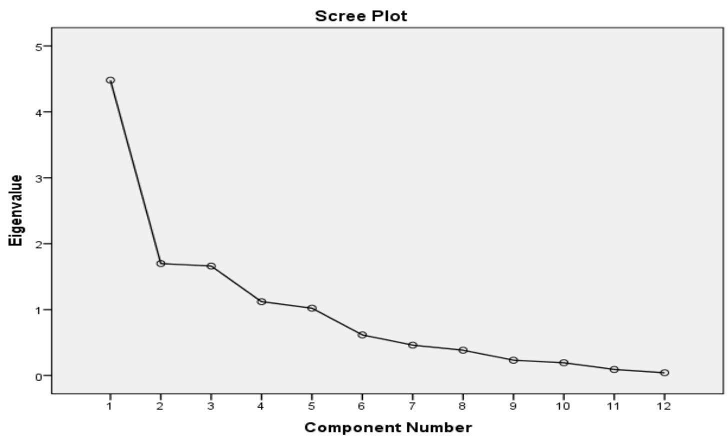

Figure 19: Post-Intervention Assessment Scree Plot

Figure 19 demonstrates the Scree Plot of the eigenvalues and factors from the Assessment category extraction seen in Table 16, and helps in determining the optimal number of components to be retained. In the case of this study, only the first five components were retained with the eigenvalue of each component above in the initial solution being plotted (Fabrigar et al., 1999). Generally, the components on the steep slope are extracted, and based on eigenvalues and Scree Plot five factors were extracted in this study for assessment. Zwick and Velicer (1986) noted that underextraction could lead to the loss of relevant information and a substantial distortion in the variables loading, and overextraction could lead to factors with few substantial loading, which can be difficult to interpret and/or replicate.

4.3.2.1.3. The Post-Intervention Rotated Component Matrix for Section B: Learning

The values in post-intervention Table 17 represent the varied component loadings of Section A: Assessment regarding observable and measurable variables and the loadings determined how much the variable has contributed to one or more components. Table 17 and Figure 20 are the representations of the Likert Scale percentages for statements and questions identified for EFA using PCA extraction methods and Varimax with Kaiser Normalisation rotation methods. The responses from both the students and lecturers were used, where applicable, and theoretical and psychological knowledge from the researcher and reviewed literature to support and generated theory and conceptual understanding.

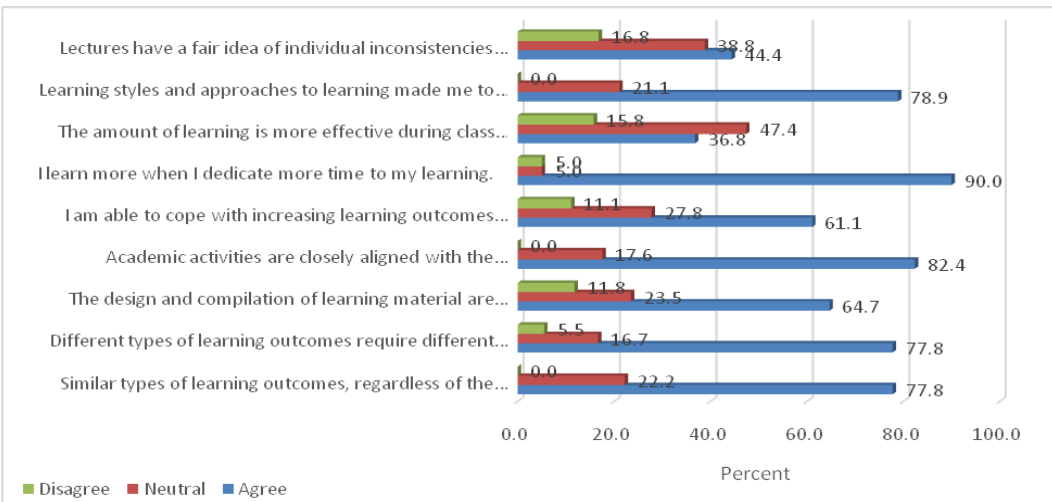

Figure 20: Post-Intervention Learning Bar Graph for Learning

Table 17: Rotated Component Matrix for Section B: Learning

PRE-INTERVENTION ASSESSMENT				
SECTION A VARIABLES	**ROTATED COMPONENT MATRIX**			
	1	**2**	**3**	**4**
B3	0.405	**0.782**	0.146	-0.101
B6	0.304	0.106	-0.039	**0.728**
B8	0.175	0.068	**0.720**	0.079
B9	-0.184	**0.798**	-0.023	0.352
B10	**0.584**	0.489	0.451	-0.069
B11	-0.100	0.031	**0.759**	0.061
B12	**0.725**	0.190	-0.194	0.088
B15	**0.788**	-0.120	0.246	0.190
B16	-0.033	0.044	0.178	**0.820**
	Key Scale for Colour Coding of Themes for Section B: Learning			
	1. Learning Material	2. Effective Learning	3. Learning Outcomes	4. Learning Strategies

The values in Table 17 represent the varied component loadings of Section B: Learning observable and measurable variables and the loadings determined how much the variable has contributed to one or more components. Figure 20 is the representation of the Likert Scale percentages for statements and questions identified for EFA using PCA extraction methods and Varimax with Kaiser Normalisation rotation methods. The responses from both the students and lecturers were used, where applicable, and theoretical and psychological knowledge from the researcher and reviewed literature to support and generated theory and conceptual understanding.

In Table 17, the results 0.584, 0.759, 0.788 and 0.820 are the loading on the variables which belong to Component 3: Learning Outcomes, and these are B10, B11, B15 and B16, respectively, with B16 having a strong factor loading coefficient which signified the large contribution and the strength of the variable to the Learning Strategies Component 4. The majority of the student participants (61%) are in concurrence that they use their coping skills to adapt to the increasing complexity of LOs as they progress through the levels of the programme, with 82% agreeing that academic activities were closely aligned with the LOs. The comments from one of the student in the affirmation was that *"as the years progress, you are able to multi-task and balance the workload"* (Student Q). The comment from one of the impartial students was that *"sometimes I find it difficult to cope as the workload increases. Too much work makes the brain forget some of the important information"* (Student O), and one response from the opposing group was *"too much volume and unnecessary stuff"* (Student F). It is reported that most of the students and academic staff are suffering from stress-related illnesses that, inadvertently, may impact on the quality of student learning and teaching as a result of increased workload. During the interviews with students, they pointed out increase in the workload was as a result of unscheduled tests, academic work volume, student protests, servicing departments, disorganized lecturers in terms of planning. The validity of the research data as indicators of performance and achievement could be maximized by producing factor scores that are highly correlated with a given component such as is evident in the degree of strength of the relationship between the variables. The observation is that there is a moderately high inter-correlation and inter-relatedness among the variables indicating validity of the responses from the participants.

The result 0.725 is the loading of variable B12 on Component 1: Learning Materials and it is highly loaded on this component, which means it has a high contribution, and, therefore, positively and strongly correlates and relates to the component. Most students (65%) indicated their satisfaction with the design and compilation of the learning materials. The result 0.782 was the loading of variable B3 onto Component 2: Effective Learning and 0,728 loading of variable B6 onto Component 4: Learning Strategies, with B3 highly contributing to the Effective Learning component, which means that there is a strong and positive relationship. There is high correlation and relatedness between the Learning Strategies which indicates validity of the responses from participants, evident in the majority (79%) responding that their learning styles and approaches to learning caused them to adapt to varied teaching strategies, and agreeing (44%) that the lecturers had a fair idea of individual inconsistencies with regard to the varied students' learning personalities. The loadings, 0.720 and 0.798 are for variables B8 and B9, respectively, with B9 loaded high on Component 2: Effective Learning. The variables show high correlation and relatedness between them, with an overall very high inter-correlation and inter-relatedness among all the variables in this meaningful theoretical category of Learning.

The students are likely to benefit academically if the LOs are broken down into behavioural statements in terms of cognitive and affective skills, knowledge acquisition and understanding based on explicit and sound rationale, and linked conceptually with learning goals, by being able to use their coping skills with increasing LOs complexities and related tasks (Lunenburg, 2011; Voorhees, 2001). In addition, it is important to link cognition and learning with assessment practices and the level of fitness between students' readiness and the teaching and assessment strategies used so that they impact positively on the effectiveness and quality of teaching and students learning (Cronbach, 1957).

The admission of low-to-moderate achievement gap students could be ameliorated by educationally qualified professional lecturers who have the passion to teach using pedagogical principles which are underpinned by a variety of educational and psychological theory guided by an integrated instructional model such as the ITLMUA developed by the researcher. Jansen (2011) cautioned that most lecturers in higher education institutions (HEI's) have no clue how to teach, except for the few who studied and practiced teaching. The lecturers are willing to be developed by calling for the university to embark on staff development workshops that will educate them to develop creative ways of delivery of instruction, mentoring systems and improvement in the utilization of technology. The further suggested that *"continuous staff* *development should be provided by institutions"* (Lecturer A), but time must be set aside to attend the workshops *"even though I'm unable to attend mostly because of too much workload or clashes"* (Lecturer A). Lecturer B added that *"all academics shall undergo formal HE teaching programme"* and engage *"with experienced lecturers"* so that our teaching skills and competencies could be enhanced.

Table 18: Post-Intervention Total Variance Explained for Section B: Learning

TOTAL VARIANCE EXPLAINED FOR PRINCIPAL COMPONENT ANALYSIS OF THE LEARNING									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.654	29.483	29.483	2.654	29.483	29.483	1.821	20.233	20.233
2	1.267	14.079	43.563	1.267	14.079	43.563	1.555	17.279	37.511
3	1.187	13.192	56.754	1.187	13.192	56.754	1.449	16.102	53.613
4	1.113	12.365	69.119	1.113	12.365	69.119	1.396	15.506	69.119
5	.972	10.805	79.925						
6	.605	6.718	86.643						
7	.578	6.422	93.065						
8	.415	4.609	97.674						
9	.209	2.326	100.000						

The FA identified four factors that are important to the students with regard to Section B: Learning in the Clinical Technology programme as shown in Table 18. The four factors collectively influence 69.1% of the participants' perceptions with regard to assessment, the highest contributor being Component 1 indicating the importance of this component to assessment (Yong & Pearce, 2013; Tabachnick & Fidell, 2001).

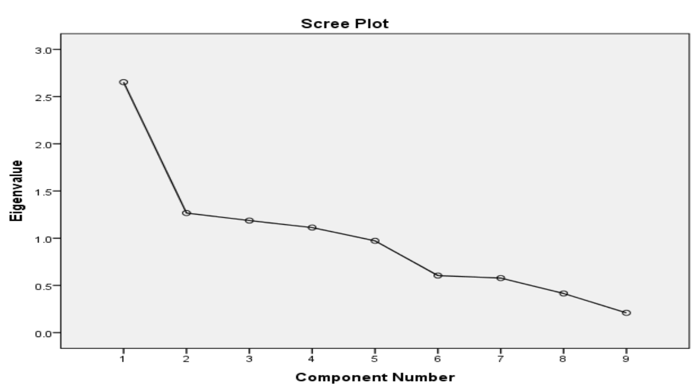

Figure 21: Post-Intervention Learning Scree Plot

Figure 21 shows the Scree Plot of the eigenvalues and factors from the Learning category extraction seen in Table 18, and helps in determining the optimal number of components to be retained. In the case of this study, only the first five components were retained for with the eigenvalue of each component above in the initial solution being plotted (Fabrigar et al., 1999). Generally, the components on the steep slope are extracted, and based on eigenvalues and Scree Plot four factors are extracted in this study for assessment. Zwick and Velicer (1986) note that underextraction could lead to the loss of relevant information and a substantial distortion in the variables loading, and overextraction could lead to factors with few substantial loading, which can be difficult to interpret and/or replicate.

4.3.2.1.4. The Post-Intervention Rotated Component Matrix for Section C: Teaching

The values in post-intervention Table 19 represent the varied component loadings of Section C: Teaching observable and measurable variables and the loadings determin how much the variable has contributed to one or more components. Table 19 and Figure 22 are representations of the Likert Scale percentages for statements and questions identified for EFA using PCA extraction methods and Varimax with Kaiser Normalisation rotation methods. The responses from both the students and lecturers were used, where applicable, and theoretical and psychological knowledge from the researcher and reviewed literature to support and generated theory and conceptual understanding.

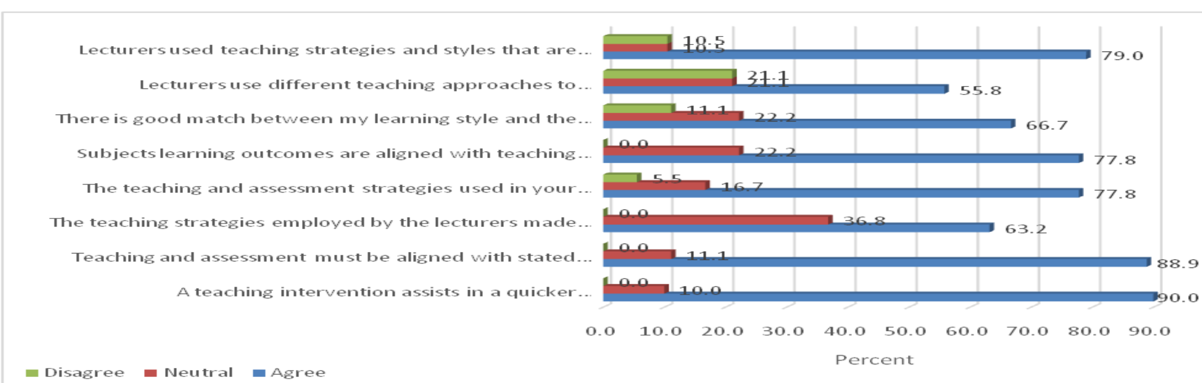

Figure 22: Post-Intervention Bar Graph for Teaching

Table 19: Post-Intervention Rotated Component Matrix for Section C: Teaching

PRE-INTERVENTION ASSESSMENT						
SECTION A VARIABLES	ROTATED COMPONENT MATRIX					
	1	2	3			
C1	0.160	**0.879**	0.019			
C2	**0.773**	0.125	0.010			
C4	**0.769**	0.104	-0.068			
C7	0.114	**0.532**	0.374			
C8	0.190	**0.813**	**-.113**			
C9	**0.625**	0.211	0.100			
C10	-.0285	0.107	**0.828**	Key Scale for Colour Coding of Themes for Section C: Teaching		
C11	0.288	-0.079	**0.843**	1. Teaching Strategies	2. Instructional Alignment	3. Instructional Model

The values in Table 19 represent the varied component loadings of Section C: Teaching observable and measurable variables and the loadings determin how much the variable has contributed to one or more components. Figure 22 is the representation of the Likert Scale percentages for statements and questions. The loadings 0.879, 0.773, 0.813, and 0.625 are for variables C1, C2, C8, and C9 onto Component 1: Teaching Strategies and Component 2: Instructional Alignment, with C1 with high loading among the variables, which means it has contributed more to Component 1: Teaching Strategies. The variables showed high inter-correlation and inter-relatedness among themselves, which indicates the credibility and trustworthiness of the participants' responses to the post-intervention survey questionnaire. The majority of students (79%) agreed that lecturers used teaching strategies such as AL and varied and accommodative teaching styles that are generally satisfactory to students. In addition, 56% of students indicated that lecturers used different teaching strategies to accommodate students' diverse characteristics, and one of those in affirmation noted that *"demonstrating and discussions, use of diagrams and asking questions during lecturers"* (Student L). One of the impartial students indicated that *"some lecturers use just PowerPoint presentations, others use presentations & videos"* (Student G), but a disagreeing student, Student F, noted that *"they all teach from slides which is not beneficial"*. The ITLMUA can assist lecturers to provide students with the opportunity to learn effectively, and accredit that learning according to publicly recognizable standards with an emphasis on developing accommodative teaching styles over and above their preferred teaching style (Biggs, 2001). The lecturers adhered to their usual presentation styles lecture-mode instruction using visual aids, powerpoint and slides although also use active learning strategies during class lectures, for example, question and asnwer sessions.

The results 0.769, 0.532 and 0.828 are the loadings for variables C4, C7 and C10 onto Component 1: Teaching Strategies, Component 2: Instructional Alignment, and Component 3: Instructional Model, respectively, with C10 having a strong component loading coefficient that signifies the high contribution of the variable to the component, hence a very strong relationship between the variables (Tabachnick & Fidell, 2001). There is moderate to high inter-correlation and inter-relatedness, which indicates the validity and reliability of the qualitative data from the participants. Almost all students (67%) agreed that there was a good match between students' learning styles and lecturers' teaching styles, with comments from one of the students who agreed that *"as long as the lecturers explains every detail and facts, my brains pick up everything"* (Student L). The comments from one of the impartial students noted that *"I had to adapt and adjust to each lecturers' teaching style"* (Student S), and one from the disagreeing group indicated that *"my learning style guides me to understand but they teach from slides and go fast through them"* (Student F). The affirming students' responses are as a result of the emphasis of the ITLMUA on student-centric curriculum, with a call for an integrated approach to the delivery of subject content, strengthening lecturers' teaching skills and capacity, including knowledge and understanding of students' characteristics, particularly students' varied learning styles and their approaches to learning. In addition, lecturers willingness to modify their teaching styles to accommodate the varied students learning styles in order to enhance the effective, efficient and quality student learning and teaching (Fischer & Fischer, 1979).

The appreciation and valuing of the active learning twin process of collaboration and cooperation by students as introduced in the implementation and evaluation of the ITLMUA is well understood as they are able to develop social and communication skills through active participatory learning. The 90% of students who agreed with the teaching intervention that the instructional model (ITLMUA) assisted in a quicker understanding of the subject LOs. Students commented that *"they teach us what we need to know, how it is integrated in reality, and what is expected of us"* (Student E), and *"anything that one doesn't understand gets the chance to ask and understand clearly"* (Student N). One of the impartial students commented that *"if a lecturer steps in and does beyond what they have to do and assists those who are struggling, then it helps"* (Student B). Both lecturers agreed that their involvement in the implementation of the ITLMUA has given them enough ammunition to engage in the curriculum reappraisal process, and *"improves student learning"* (Lecturer A). The researcher would recommend the utilization of ITLMUA at the departmental level, but the onus is on the departmental leadership and lecturers to use the principles and concepts of the model, and Biggs (2001) cautioned that if people are preventing effective operation of the instructional model, then the impediments need to be removed through constructive engagement, for example, workshops.

Table 20: Post-Intervention Total Variance Explained for Section C: Teaching

TOTAL VARIANCE EXPLAINED FOR PRINCIPAL COMPONENT ANALYSIS OF THE TEACHING									
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.448	30.600	30.600	2.448	30.600	30.600	1.819	22.740	22.740
2	1.557	19.465	50.064	1.557	19.465	50.064	1.805	22.563	45.303
3	1.184	14.796	64.860	1.184	14.796	64.860	1.565	19.557	64.860
4	.998	12.477	77.337						
5	.736	9.201	86.538						
6	.435	5.435	91.973						
7	.379	4.742	96.716						
8	.263	3.284	100.000						

The FA identified three factors that are important to the students with regard to Section C: Teaching in the Clinical Technology programme as shown in Table 21. The three factors collectively influence 64.9% of the participants' perceptions with regard to assessment, the highest contributor being Component 1 indicating the importance of this component to assessment (Yong & Pearce, 2013; Tabachnick & Fidell, 2001).

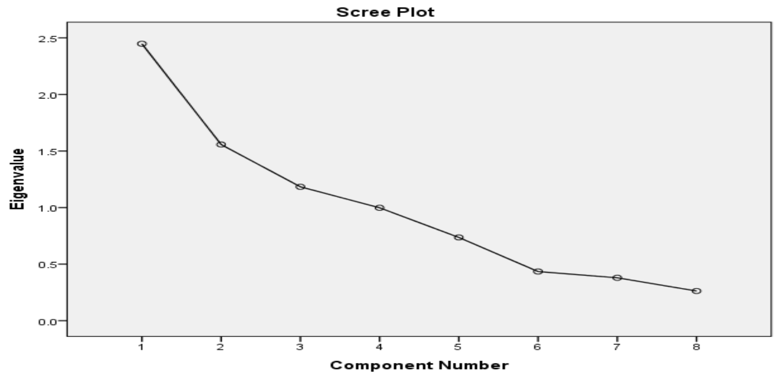

Figure 23: Post-Intervention Teaching Scree Plot

Figure 23 shows the Scree Plot of the eigenvalues and factors from the Assessment category extraction seen in Table 20, which helps in determining the optimal number of components to be retained. In the case of this study, only the first five components were retained with the eigenvalue of each component above in the initial solution being plotted (Fabrigar et al., 1999). Generally, the components on the steep slope are extracted, and based on eigenvalues and Scree Plot three factors are extracted in this study for assessment. Zwick and Velicer (1986) note that underextraction could lead to the loss of relevant information and a substantial distortion in the variables loading, and overextraction could lead to factors with few substantial loading, which can be difficult to interpret and/or replicate.

4.3.2.1.5. The Post-Intervention Rotated Component Matrix for Section D: Miscellaneous

The values in post-intervention Table 21 represent the varied component loadings of Section D: Miscellaneous observable and measurable variables and the loadings determine how much the variable contributes to one or more components. Table 21 and Figure 24 are representations of the Likert Scale percentages for statements and questions identified for EFA using PCA extraction methods and Varimax with Kaiser Normalisation rotation methods. The responses from both the students and lecturers were used, where applicable, and theoretical and psychological knowledge from the researcher and reviewed literature to support and generated theory and conceptual understanding.

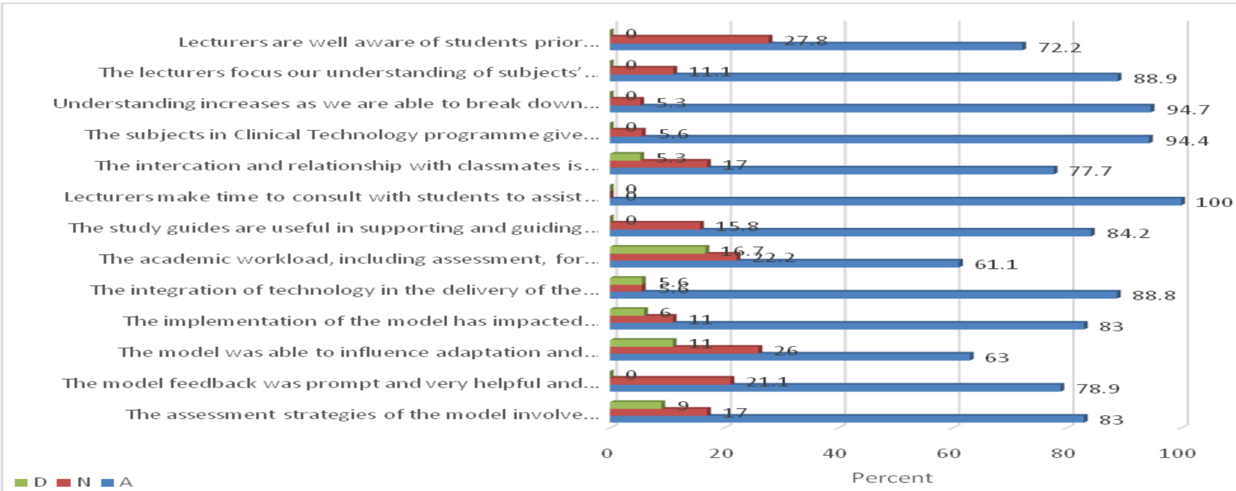

Figure 24: Post-Intervention Bar Graph for Miscellaneous

Table 21: Post-Intervention Rotated Component Matrix for Section D: Miscellaneous

PRE-INTERVENTION ASSESSMENT					
SECTION A VARIABLES	ROTATED COMPONENT MATRIX				
	1	2	3	4	5
D6	0.805	0.007	0.012	0.242	0.175
D7	0.070	-0.124	0.137	-0.123	0.882
D8	0.043	0.210	0.814	-0.089	-0.045
D9	0.770	0.127	0.222	-0.306	-0.100
D12	-0.053	0.145	0.812	-0.059	0.306
D15	0.377	-0.234	0.583	0.502	0.035
D16	0.179	0.142	-0.294	0.726	0.000
D17	-0.232	0.732	0.139	0.269	0.260
D18	0.131	0.437	0.063	0.360	0.667
D19	0.378	0.701	0.022	-0.026	-0.110
D20	0.169	0.728	0.162	0.150	-0.031
D21	0.729	0.258	-0.141	0.313	0.100
D22	-0.006	0.197	0.103	0.756	0.009
	Key Scale for Colour Coding of Themes for Section D: Miscellaneous				
	1. Skillful Abilities	2. Subject Materials	3. Interactive Relationships	4. Instructional Model	5.Knowledgeable Understanding

The values in Table 21 represent the varied component loadings of Section D: Miscellaneous observable and measurable variables and the loadings determine how much the variable contributes to one or more components. Figure 24 is the representation of the Likert Scale percentages for statements and questions. The loadings 0.805, 0,814 and 0.882 for variables D6, D7, and D8 belong to Component 5: Knowledgeable Understanding, and are highly inter-correlated and inter-related, with D8 having a strong component loading coefficient which signifies a high contribution of the variable to the component, indicating maximized validity as a result of high correlation and relationship with the component. The majority of students (72%) agreed that lecturers are well aware of students' prior knowledge and integrate it with new knowledge to enable accomplishment of highest academic achievement, and 89% are in agreement that the lecturers focused their understanding of subjects' concepts and their relationships which improved their learning. Furthermore, a staggering 95% of students concurred that understanding increases as they are able to break down information and rebuild it with logical connections to increase understanding. The ITLMUA supports and promotes the delivery of education in HE to ensure that students acquire high quality LOs that results from interplay between their prior knowledge, learning efforts, curricullum design and the instructional strategies employed (Leonard, 2000).

Variables D9, D15 and D18 are loaded with 0.770, 0.683 and 0.667 respectively, showing a slightly moderate inter-variable correlation and relatedness, with D9 showing more loading on Component 1: Skillful Ability which means that the contribution is high and strong demonstrating the strength of the relationship with the component. Almost all students (94%) are in agreement that the subjects in the Clinical Technology programme gave students the ability and skills to construct their own knowledge when solving real-world problems, and all the students agreed completely (100%) that lecturers make time to consult with students to assist with academic challenges. In addition, most students (89%) agreed that the integration of technology in the delivery of the subjects is up to standard. The university has embarked on a drive to improve student learning by making available ICT resources, and it is unfortunate that the fiscals are limited so cannot realize adequate availability of ICT to all students. Empirical reports indicate that increased availability of technology does not necessarily lead to improvement in classroom instructional practices and the quality of instruction to enhance student learning and performance (Inan & Lowther, 2010).

The results0.719, 0.701, 0.728 and 0.756 are loadings for variables D21, D19, D20 and D22, and these variables belong to Component 1: Skillful Abilities, Component 2: Subject Materials, and Component 4: Instructional Model, respectively. The variable D20 shows a high contribution to

Component 2: Subject Materials, indicating a strong and positive relationship with the component, and all the variables demonstrate a high inter-correlation and inter-relatedness, thus indicating that the validity of the research data is preserved by producing scores that are highly correlated with a given component. The majority of students (83%) agreed that the implementation of the model has impacted positively on their learning, with 63% noting that the model was able to influence adaptation and assimilation to varied types on academic tasks with ease. Almost all students agreed that the model inspired feedback was prompt and very helpful and impacted on our learning (79%), and the assessment strategies of the model involved students in assessment practices in HE (83%).

The varied comments from students with regard to their overall impression of the ITLMUA were summarized as follows:

- Improve understanding; encourage team-based learning and understanding; help with understanding and test preparation; help gain a better knowledge and understanding; encourage better learning and understanding; useful as it employs alternative methods of assessment; lectures are more informative; very useful in assisting with understanding; encourages and promote reading; subjects integration;
- Strongly beneficial and caters for each students' individual needs; it links and integrates; very useful for learning and understanding; very good; it's alright; too much information, small fraction is tested; quite beneficial and understandable; massive volume of work that is stressful; very good.

The students appeared to be impressed with the intervention that the instructional model, ITLMUA, had on their learning, knowledge and understanding, and that the ITLMUA was geared to address diversity of student's needs, characteristics, traits, and in particular, cognitive, affective and social needs by facilitating a differentiated educational system that would respond to the needs of students (Tomlinson et al., 1998; Buckler, 1996). The envisaged academic benefits of using ITLMUA is an increase in efficiency and productivity along with adequate provision of resources, support structural systems, academic learning time, in conjunction with the provision of quality instruction involving the twin processes of transmission and facilitation of declarative, conceptual and procedural knowledge (Mehlenbacher et al., 2005).

Table 22: Post-Intervention Total Variance Explained for Section D: Miscellaneous

TOTAL VARIANCE EXPLAINED FOR PRICIPAL COMPONENT ANALYSIS OF THE MISCELLANEOUS									
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.459	26.605	26.605	3.459	26.605	26.605	2.343	18.024	18.024
2	1.996	15.355	41.960	1.996	15.355	41.960	2.313	17.792	35.816
3	1.759	13.534	55.494	1.759	13.534	55.494	1.976	15.203	51.019
4	1.179	9.072	64.566	1.179	9.072	64.566	1.591	12.241	63.260
5	1.106	8.507	73.072	1.106	8.507	73.072	1.276	9.813	73.072
6	.791	6.085	79.158						
7	.649	4.989	84.146						
8	.567	4.365	88.511						
9	.535	4.117	92.628						
10	.419	3.225	95.853						
11	.270	2.078	97.931						
12	.172	1.324	99.255						
13	.097	.745	100.000						

The FA identified five factors that are important to the students with regard to Section D: Miscellaneous in the Clinical Technology programme as shown in Table 22. The five factors collectively influence 73.1% of the participants' perceptions with regard to assessment, the highest contributor being Component 1 indicating the importance of this component to assessment (Tabachnick & Fidell, 2001; Yong & Pearce, 2013;).

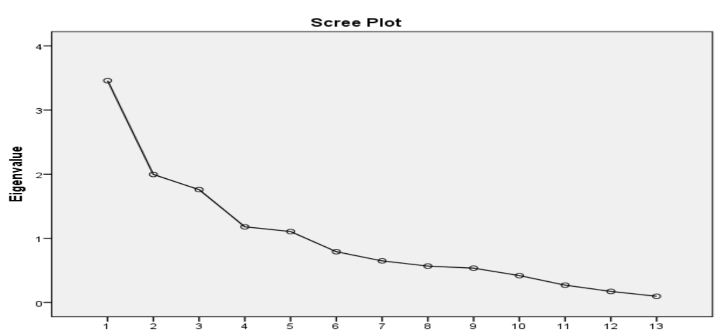

Figure 25: Post-Intervention Miscellaneous Scree Plot

Figure 25 demonstrates the Scree Plot of the eigenvalues and factors from the Miscellaneous category extraction as shown in Table 22, which helps in determining the optimal number of components to be retained. In the case of this study, only the first five components were retained with the eigenvalue of each component above in the initial solution being plotted (Fabrigar et al., 1999). Generally, the components on the steep slope are extracted, and based on eigenvalues and Scree Plot five factors are extracted in this study for assessment. Zwick and Velicer (1986) notethat underextraction could lead to the loss of relevant information and a substantial distortion in the variables loading, and overextraction could lead to factors with few substantial loading, which can be difficult to interpret and/or replicate.

Table 23: Biomedical Apparatus and Procedure 1 (BAPO201) Subject's Regression Model Summary and Analysis of Variance (ANOVA)

REGRESSION MODEL SUMMARY							
Model	R	R Square	Adjusted R Square		Std. Error of the Estimate		
1	0.722[a]	0.521	0.416		9.27911		
a. Predictors: (Constant), Groupwork, Test 1, Practical 2, Test 2, Practical 1							
ANALYSIS OF VARIANCE (ANOVA)							
Model		Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	2150.414	5	430.083	4.995	0.003[b]	
	Residual	1980.345	23	86.102			
	Total	**4130.759**	**28**				
a. Dependent Variable: Exam b. Predictors: (Constant), Groupwork, Test 1, Practical 2, Test 2, Practical 1							

The Regression Model Summary in Table 23 indicates a moderate reliability correlation coefficient of 0.722 for predictors test 1 and 2, practicals 1 and 2, and groupwork, which means that, collectively, the predictors do predict the dependent variable, namely, the examination. The linear regression analysis describes the statistical relationship between one or more predictor variables and the response dependable variable, and the regression coefficients represent the mean change in the response variable for one unit of change in the predictor variable while holding other predictors in the model constant (Frost, 2013). The Analysis of Variance (ANOVA) in Table 23 shows the item difficulty or p value was statistically significant among the predictor variables at 0.003, which indicates the rejection of the null hypothesis. In addition, there is high inter-correlation and inter-relatedness among the predictors, demonstrating the reliability of the assessments results.

Table 24: Biomedical Apparatus and Procedure 1 (BAPO201) Subject's Coefficients

COEFFICIENT[a]								
Model		Unstandardized Coefficient		Standardized Coefficients	t	Sig.		
		B	Std. Error	Beta				
1	(Constant)	51.380	11.157		4.605	0.000		
	Test 1	-0.500	0.163	-0.675	-3.061	0.006		
	Test 2	0.265	0.148	0.394	1.794	0.086		
	Practical 1	0.560	0.195	0.751	2.869	0.009		
	Practical 2	0.318	0.160	0.417	1.995	0.058		
	Group Work	-0.505	0.240	-0.489	-2.107	0.046		
a. Dependent Variable: Exams								

The standardized coefficients (highlighted) in Table 24 for each independent predictor variable of the different assessment methods for pre- and post-interventional implementation of the ITLMUA indicate both the positive and negative coefficients. According to Stellefson et al., (2008), the positive beta means that the slope of the regression line is positive, tilting from lower left to upper right, whereas a negative beta indicates that the slope of the regression is negative, tilting from upper left to lower right (Huck, 2004).

Table 25: Biomedical Apparatus and Procedure 1 (BAPO201) Subject's Correlations

CORRELATIONS							
		Test 1	Test 2	Prac 1	Prac 2	Groupwork	Exams
Test 1	Pearson Correlation Sig. (2-tailed) N	1 29					
Test 2	Pearson Correlation Sig. (2-tailed) N	0.620* 0.000 29	1 29				
Prac 1	Pearson Correlation Sig. (2-tailed) N	0.731*** 0.000 29	0.670** 0.000 29	1 29			
Prac 2	Pearson Correlation Sig. (2-tailed) N	0.485** 0.008 29	0.607** 0.000 29	0.488** 0.007 29	1 29		
Groupwork	Pearson Correlation Sig. (2-tailed) N	0.555** 0.002 29	0.558** 0.002 29	0.698** 0.000 29	0.649** 0.000 29	1 29	
Exam	Pearson Correlation Sig. (2-tailed) N	0.050 0.797 29	0.458 0.012 29	0.385#* 0.039 29	0.379* 0.043 29	0.152 0.431 29	1 29
## Correlation is significant at the 0.01 level (2-tailed) # Correlation is significant at the 0,05 level (2-tailed)							

Table 25 represents the different assessment methods for both formative and summative assessments to measure two variables on a continuous scale to compute the Pearson product-moment correlation coefficient (r) between the two variables, computed as:

$$R_{XY} = COV_{XY}/(SD_X \text{ X } SD_Y)$$

where COV_{XY} is a description of bivariate relationship called the covariance and SD_X and SD_Y are the standard deviations of both the independent (X) and dependent (Y) variables (Thompson, 2006). The covariance was used principally as an intermediate calculation in obtaining the Pearson product-moment correlation for the reason that it does not have a definitive range of possible values (Thompson, 2004). The Pearson correlation showed a positive relationship between and among variables, with moderate to high inter-correlation and inter-relatedness, which means there are good internal consistencies (Stellefson, Hanik, Chaney,& Chaney, 2008).

Table 126: Organ and System Pathophysiology 2 (OSSP201) Subject's Regression Model Summary and Analysis of Variance (ANOVA)

MODEL SUMMARY						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	0.817[a]	0.667	0.614	13.69742		
a. Predictors: (Constant), Groupwork, Test 4. Test 2, Test 1, Test 3						
ANALYSIS OF VARIANCE (ANOVA)						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9388.885	4	2347.221	12.511	0.000[b]
	Residual	4690.481	25	187.619		
	Total	**14079.367**	**29**			
a. Dependent Variable: Exams b. Predictors: (Constant), Test 4. Test 2, Test 1, Test 3						

The Regression Model Summary in Table 26 indicates a moderate reliability correlation coefficient of 0.817 for predictors test 1 and 2, practicals 1 and 2, and groupwork, which means that, collectively, the predictors do predict the dependent variable, namely, the examination. The linear regression analysis describes the statistical relationship between one or more predictor variables and the response dependable variable, and the regression coefficients represent the mean change in the response variable for one unit of change in the predictor variable while holding other predictors in the model constant (Frost, 2013). The Analysis of Variance (ANOVA) in Table 26 shows the item difficulty or p value was statistically significant among the predictor variables at 0.000, which indicated the rejection of the null hypothesis. In addition, there is high inter-correlation and inter-relatedness among the predictors, demonstrating the reliability of the assessment results.

Table 27: Organ and System Pathophysiology 2 (OSSP201) Subject's Coefficients

COEFFICIENT[a]						
Model		Unstandardized Coefficient		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-9.047	25.108		-0.360	0.722
	Test 1	0.365	0.230	0.285	1.584	0.126
	Test 2	-0.228	0.455	-0.083	-0.500	0.622
	Test 3	0.161	0.370	0.100	0.436	0.667
	Test 4	0.779	0.303	0.555	2.569	0.017
a. Dependent Variable: Exams						

The standardized coefficients (highlighted) in Table 27 for each independent predictor variables of the different assessment methods for pre- and post-interventional implementation of the ITLMUA indicated both the positive and negative coefficients. According to Stellefson et al., (2008), a positive beta means that the slope of the regression line is positive, tilting from lower left to upper right, whereas a negative beta indicate that the slope of the regression is negative, tilting from upper left to lower right (Huck, 2004).

Table 28: Organ and System Pathophysiology 2 (OSSP201) Subject's Correlations

CORRELATIONS							
		Test 1	Test 2	Test 3	Test 4	Exam	
Test 1	Pearson Correlation	1					
	Sig. (2-tailed)						
	N	30					
Test 2	Pearson Correlation	0.570**	1				
	Sig. (2-tailed)	0.001					
	N	30	30				
Test 3	Pearson Correlation	0.740**	0.701	1			
	Sig. (2-tailed)	0.000	0.000				
	N	30	30	30			
Test 4	Pearson Correlation	0.772**	0.699**	0.819	1		
	Sig. (2-tailed)	0.000	0.000	0.000			
	N	30	30	30	30		
Exam	Pearson Correlation	0.712**	0.520**	0.707**	0.787**	1	
	Sig. (2-tailed)	0.000	0.003	0.000	0.000		
	N	30	30	30	30	30	
## Correlation is significant at the 0.01 level (2-tailed)							

Table 28 represents the different assessment methods for both formative and summative assessments to measure two variables on a continuous scale to compute the Pearson product-moment correlation coefficient (r) between the two variables, computed as:

$$R_{XY} = COV_{XY}/(SD_X \text{ X } SD_Y)$$

where COV_{XY} is a description of bivariate relationship called the covariance and SD_X and SD_Y are the standard deviations of both the independent (X) and dependent (Y) variables (Thompson, 2006). The covariance was used principally as an intermediate calculation in obtaining the Pearson product-moment correlation for the reason that it does not have a definitive range of possible values (Thompson, 2004). The Pearson correlation shows a positive relationship between and among variables, with moderate to high inter-correlation and inter-relatedness, which means there are good internal consistencies (Stellefson et al., 2008).

4.4. EVALUATION OF THE QUALITY OF THE SUBJECT DOCUMENTATION USING REVISED BLOOM'S TAXONOMY

The meaning of quality among individuals varies, especially when it comes to teaching and learning, where variation is the rule and variety is the central part and not the spice of university life (Kulik & McKeachie, 1975). Qualitative content analysis was used in relation to documentation of specific institutional and programme with regard to mission statements, standards, LOs, and to make some inferences about what these entities hold as their primary reasons for existence (Stemler & Bebell, 1998).

An effective programme design relies on alignment of subject activities and assessment strategies with LOs to help lecturers to improve their teaching strategies with the aim of enhancing students learning experience and metacognition (Sundberg, 2002; Ebert-May et al., 2003; Tanner & Allen, 2004; Bissell & Lemons, 2006). The ITLMUA was developed to assist with integration, alignment and sequencing of instructional activities of the subjects under investigation. The ITLMUA ascertain that "academic success should be measured not just in terms of what students can remember, but what students are able to do with their knowledge" (Crowe et al., 2008:368). The aim of Bloom's Taxonomy of Cognitive Domain is to provide a framework for classifying statemenst and questions that we expect students to learn as a result of the instruction they receive at HEIs, and to facilitate the standardization and congruency of educational objectives, standards, learning goals and activities, and assessments among programme subjects and the programmes (Krathwohl, 2002). The examination questions of the two subjects under investigation showed that the focus was on simple to concrete cognitive domains limited to knowledge, comprehension and application. These cognitive domains emphasized heavily on objectives requiring only recognition and recall of factual information and knowledge. The goal of ITLMUA is to migrate to complex and abstract categories, where students are able to understand and use knowledge through AL that aligns LOs with assessment strategies better. The cognitive challenge of any subjects can strongly influence students' study strategies (Scouller, 1998). The general conception is that memorization and recall are lower-order cognitive skills (LOCS) that require only a minimum level of understanding, whereas the application of knowledge and critical thinking are higher-order cognitive skills (HOCS) that require deep conceptual understanding (Zoller, 1993).

4.4.1. Quality Evaluation of Examination Questions at Higher Education

The examination question papers of the two subjects were classified using Anderson et al's (2005) revised Bloom's Taxonomy as indicated in Table 29 below, by placing each question into one of the six categories on the specific tasks needed to answer the questions. The determination of the quality of examination questions were ranked at the possible highest level of the Revised Bloom's Taxonomy of Cognitive Domain for solution (Crowe et al., 2008). The Blooming Health Sciences Evaluation Instrument (BHSEI) assisted in better alignment of assessment and teaching activities and help students enhance their study skills and metacognition (Crowe et al., 2008). The students have a habit of not performing at the higher levels of cognitive demand because of the lack of educational intervention to develop their critical-thinking skills by actively engaging them in the TLA processes in HE (Zoller, 1993). The students are motivated to perform well in any assessment tasks when they are strongly inspired by the cognitive challenge of the assessment question, and it is therefore, fundamentally critical to set assessment questions at the appropriate level of their study and the level of the Revised Bloom Taxonomy if the objectives of cultivating students' critical thinking skills and application of knowledge are to be realized (Scouller, 1998). Crowe et al. (2008) alluded that the level of Bloom's Taxonomy that is assessed by a given type of question depends highly on what information is provided to the student, and which inferences or connections the student must make on his or her own.

The BHSEI as shown in Table 29 was used to rank the assessment questions of the subjects used in this study in terms of the knowledge and cognitive dimension of the Revised Bloom's Taxonomy:

Table 29: The Blooming Health Sciences Assessment Instrument (BHSAI)

1. Subjects: Organ and System Pathophysiology 2 (OSSP201)						
	1.0 Remember Knowledge	**2.0 Understand Comprehension**	**3.0 Apply Application**	**4.0 Analyze Analysis**	**5.0 Evaluate Evaluation**	**6.0 Create Synthesis**
	LOCS	LOCS	LOCS/HOCS	HOCS	HOCS	HOCS
Key Skills Assessed	State, name, briefly describe, choose,	Explain, differentiate, indicate	Briefly explain	Compare and contrast,		
OSSP201 MAIN	20 (**41%**)	27 (**55%**)	-	2 (**4%**)	-	-
OSSP201 SUPP	17 (**41%**)	24 (**57%**)	-	1 (**2%**)	-	-
2. Subjects: Biomedical Apparatus and Procedure 1 (BAPO201)						
	1.0 Remember Knowledge	**2.0 Understand Comprehension**	**3.0 Apply Application**	**4.0 Analyze Analysis**	**5.0 Evaluate Evaluation**	**6.0 Create Synthesis**
	LOCS	LOCS	LOCS/HOCS	HOCS	HOCS	HOCS
Key Skills Assessed	Explain, identify, name, list, outline,	Discuss,	Illustrate, classify	Identify	-	-
BAPO201 MAIN	18 (**51%**)	16 (**46%**)	-	1 (**3%**)	-	-
BAPO201 SUPP	8 (**26%**)	18 (**58%**)	-	5 (**16%**)	-	-

It is evident from the categorization of the examination question papers of the two subjects on the BHSAI, as shown in Table 29, that they focused mainly on knowledge and comprehension, which demanded that students recall and remember taught information the way it was presented in class. Understanding is demonstrated when students are able to construct meaning and apply knowledge from instructional messages and materials presented in class (Mayer, 2002). The examination questions that tapped into the analysis level were minimal as indicated in Table 29. It is obvious that the teaching strategies employed in these subjects focused primarily on retention and transmission of information, with disregard for using concepts in new situations, differentiating between facts and inferences, and building a structure or pattern of knowledge from diverse elements (Clark, 1999; Mayer, 2002). Students in HE often struggle to perform in terms of HOCS, but lecturers have the academic responsibility to equip students with all levels of knowledge and cognitive skills (Segers et al., 2003; Zoller, 1993; Bransford et al., 1999;) point out that the stance on assessment has transformed radically from a ‘test culture’ towards an ‘assessment culture’ with use of alternative, authentic and contextualized assessment practices.

The questions in the examination papers did not cover application, evaluation and creation. Evaluate is defined as making judgments based on criteria and standards, with criteria mostly dealing with quality, effectiveness, efficiency, consistency, and standards comprising either quantitative or qualitative knowledge (Mayer, 2002). Being creative involves locating elements together to develop a coherent or functional whole in order to be able reorganize elements into new structure or patterns of knowledge to produce an original product (Mayer, 2002). The researcher acknowledges that lecturers are not perfect in the execution of pedagogical practices, but efforts should be made to improve the effectiveness, efficiency and quality of teaching and learning in the HE by increasing the amount of, and time on learning, and the complexity of LOs, alignment of instructional activities, and academic support in terms of lecturers’ interventions where students are experiencing challenges (Raths, 2002).

The fundamental tenet that inspired the ITLMUA is to promote and sustain effective, effecient and quality TLA in HE underpinned by a blend of learning theories and pedagogical principles affording students worthwhile and meaningful learning experiences (Hadjerouit, 2008; Merriam et al., 2007; Havnes & Aamodt, 2005; Penner et al., 1998; Gagne et al., 1993; Bruner, 1990; Bandura, 1986). The range of student concerns about a variety of educational issues raised in their responses to the questionnaires and interviews, could be addressed by using Revised Bloom’s Taxonomy to plan and deliver team-taught, integrated thematic learning units across the subjects in order to help students become critical thinkers and astute writers (Ferguson, 2002). The BHSAI can assist lecturers to better align their assessments with instructional activities and to help students enhance their study skills and metacognition, and guide and enhance teaching in order for students to experience useful and meaningful learning (Crowe et al., 2008). Lecturers are aware that their success in their educational practice is not measured just in terms of what students can remember, but what student are able know and do with their knowledge (Crowe et al., 2008). The lack of predictive validity may be that the ability to recognize information when it is presented in a list of responses is significantly different from the ability to produce the same kind of analysis or to enact corresponding ideas in practice, and may also be that the assessments in use have featured decontextualized teaching scenarios which may not be so helpful and informative (Darling-Hammond & Snyder, 2000).

4.4.2. The Evaluation of Lecturer in Higher Education Institutions (HEIs)

Students are in a good position to judge the quality and effectiveness of lecturers in terms of their instructional activities, roles and responsibilities (Kulik & McKeachie, 1975). The following competency descriptions were taken from the Lecturer Evaluation Questionnaire (LEQ). The teaching competencies elements within each individual domain listed below are indicated in the brackets, as follows:

- Organization and planning: (preparation, time management, and instructional alignment).
- Teaching and learning: (comprehensible communication, utilization of varied teaching strategies, subject authenticity, metacognitive encouragement, utilization of questions and answers sessions, and utilization of visual aids).
- Individual rapport and support: (approachable, enthusiastic, encourage group work, available for consultation, and provide opportunities for counseling).
- Assessment: (comprehensible guidelines for assessment, assessment scheduled plan, utilization of varied assessment methods, and timely and useful feedback).
- Resources: (learning material to support learning, and useful sources of information for references).

The average rating for LEQ is as follows:

- 1 to 2.4: Mean value is within the quality guideline (ensure quality is sustained).
- 2.5 to 3.5: Mean value is within the range of tolerance (need to guard against slippage).
- 3.6. to 5: Mean value is below the quality guideline (urgent attention needed).

Each of the domains was matched to a teaching competency element indicated in brackets as used by Tigelaar et al. (2004), through the Delphi technique that developed a theoretical framework of teaching competencies as identified by educational specialist as significant in student-centric HE environment. Tigelaar et al. (2004) defined teaching competencies as "an integrated set of personal characteristics, knowledge, skills and attitudes that are needed for effective teaching performance." Dorasamy and Balkaran (2013) viewed teaching competencies as being integrated, the very spirit of the ITLMUA, which encourages lecturers to consciously set teaching and learning goals, and for lecturers to be cognizant of their varied teaching strategies and styles that should be matched with the students' diverse learning strategies and learning styles to enhanced learning. The merits of the teaching competency theoretical framework developed by Tigelaar et al., (2004) included (1) adoption of creative, innovative and dynamic strategies to teaching, and (2) teach and assess what is appropriate and relevant to students' learning and workplace requisites, that is, authenticism to instructional activities. In this study, the lecturers had mean values within the quality guidelines of 1 to 2.4 for all domain elements competencies, except for Lecturer B with the average value of 2.5, which is within the range of tolerance which is to be guarded against slippage below the quality guideline.

The students indicated that Lecturer A needed to improve in audible communication so that they can be able to engage in active listening and participation during lectures, and also to advise them how to improve their study skills in learning the subject content. Anonymous suggestions from students regarding the lecturer were slightly contradictory, such as *"explains clearly everything"* as their comments to what they like the best about the lecturer's teaching, and *"needs to be more clear when speaking"* when responding to the question on what the students would like to see improved. Other comments were positive such as *"he's always prepared and uses things like diagrams to facilitate learning"*, and he must *"stop discouraging students who are not performing well. Should be encouraging, not a dream killer"*. Students indicated that Lecturer B does not keep to the time allocated for the learning period, and does not provide timely feedback to students in order for students to improve in their subsequent assessment activities. Students commented what they like the best about this lecturer's teaching was that *"she's always willing to go an extra mile in assisting those who are struggling"*, but indicated that *"she must be punctual"*. The students want lecturers who are exemplary and who are willing and committed to the learning process and this would culminate in trust rather than mistrust. Furthermore, lecturers' attitudes determine the students' altitudes.

4.5. RELATIONSHIPS AND INTERACTION BETWEEN LECTURERS AND STUDENTS DURING CLASS OBSERVATIONS

Teaching is a complex activity that is shaped by the teaching context, and further compounded by the changing visions on student learning and the lecturer's role requiring continuous self-development in own profession (Darling-Hammond, 1997). The current useful teaching competency framework could be utilized to assist lecturers to set their learning goals, and be responsive to differentiated lecturers' profiles and behaviours (Tigelaar et al., 2004; Uhlenbeck et al., 2002). The conventional view in education sector is that assessment follows teaching with the aim of determining how much has been learned rather than determine the effectiveness and efficiency of teaching, and its impact on the quality of student in terms of useful and meaningful learning experience. There is a distinction that must be made in these modern approaches to teaching, which is the centralization of teaching around the lecturer and the student (Kember, 1997).

Tigelaar et al., (2004) state that if a student is more active in the learning situation, the teaching orientation is more student-centered and students are stimulated to construct their own knowledge using prior and learned knowledge. The teaching strategies virtually matches the lecturer's orientation to teaching, for example, if the teaching conception of a lecturer is transmission of factual knowledge, his/her orientation is lecturer-focused, and alternatively, if the conception of teaching is to develop and change the conception of students, their teaching strategy is student-centred, thereby resulting in a positive relation between teaching strategy and LOs (Tigelaar et al., 2004; Trigwell et al., 1999; Prosser & Trigwell, 1999). Learning is viewed quantitatively in terms that can be absorbed with less interest in the specifics of which questions had been correctly answered, and whether the methods of assessment employed were appropriate and relevant to all students with diverse learning styles and preferential methods of assessment (McGourty et al., 2000).

Class observations play a major role in any teaching and learning process to determine the planning and designing of lessons, lecturer-student interaction and both lecturers' and students' strengths and weaknesses, including the development areas in a lecture room (Moallem, 1994). The pre- and post-observation checklist for lecturers' performance outcomes assessment (Annexure K) is divided into three domains and their related conceptual framework principles or observation criteria:

- Domain 1: Planning, Preparation and Content Organization that simply indicates the 'get ready activities to interact with students in the classroom environment'.
- Domain 2: Instruction and Student Management which covers controlling student behavior.
- Domain 3: Professional responsibility (Huitt, 1995).

Classroom observation informs evaluation of LOs, teaching and learning strategies, instructional activities and delivery, lecture room leadership and management and student engagement and mastery of LOs. In this study, learning and teaching activities were observed in the lecturer room for the two selected subjects. The discourse analysis was used for the observations. The researcher wrote some comments which may not have been covered in the three domains and the observation tool helped the observer to provide developmental feedback to lecturers.

The challenges and expectations have noticeably transformed with the new educational philosophy and goals that focuses on knowledge construction and application, and transferable skills and knowledge application. The lecturers must realize that this education shift requires alternative ways of delivering subject content, and how student learn. The conventional philosophy of rule-based learning led by informational lecturing, tends to focus on the means to provide 'information' to the masses, leading to standardized tests that draw out this 'information', and those who can extract it are judged to be high achievers and 'intelligent' (Kort & Reilly, undated). This approach does not assess students' ability to organize and corretly apply lerarned information (Bransford et al., 1999; Talbert & McLaughlin, 1993). This study encourage lecturers and academic support staff to recognize the affective and cognitive circumstances of the students, and be responsive by modifying and adjusting their teaching practices to match student learning styles. Students who are emotionally upset will be mentally/intellectually affected, and those students who are anxious, angry or depressed don't learn well, and appropriate intervention based upon that affective state would facilitate and scaffold learning in a positive manner (Kort & Reilly, undated). The teaching strategies of lecturers should demonstrate a shift in focus from curriculum to the student, and this claim is justified on the basis that lecturers are still entrenched in their separate knowledge disciplines (O'Connor, 2006; Bucat, 2004). Our teaching strategies ought to change as a direct response to the complex of forces at the workplace, including "diversifying and universalizing", so we have to rethink the way the curriculum is delivered (O'Connor, 2006:2).

Understandably, systemic change is not easy to effect, but there is pressure to abandon the conventional ways of teaching and these are being challenged. The desirable option is for the lecturers to obtain an educational qualification over and above their professional qualification so that they equip themselves with knowledge and understanding of educational practices used in HE context (McKellar, 2002). Havnes (2002) observes that there are dominant diverse patterns of educational practices in HE, and the researcher observed that these varied patterns exist among lecturers because of lack of instructional models that would guide them to streamline their educational practices to maximize effective, efficient and quality student learning. There are lecturers who are professionals, there are lecturers who are qualified, there are lecturers who are certified to teach, and their approach to educational practices differ in the delivery of their respective subject matter. Changing educational practice is not only changing how we think about TLA, but also about changing the artefacts that we rely upon in our daily practices as lecturers and students (Havnes, 2002).

The participating lecturers were using constructivist learning theory sketchily in their teaching practices, and learning theory for their assessment practices was non-existent, and it was suggested that a blend of explicit espoused TLA theories should be the driving force in their pedagogical practices and teaching-related decisions (Biggs, 2001). Lecturers are urged to design their own teaching delivery system in accordance with their espoused blended theories, with built-in mechanisms that allow them to be reflective practitioners who continually review and improve their current pedagogical practices. Such reviews are motivated by the challenges and changes in the educational landscape of HE such as new knowledge content, educational and technological innovations and advances, socio-cultural and linguistic diversity and internal and external demand factors such as accountability and emerging societal demands for value for money (Engelbrecht, 2003; Alexandra, 2001; Biggs, 2001; Ryan et al., 2000).

The ITLMUA utilizes varied educational theories built on two basic conceptions of teaching: (a) lecturer-centered transmitting of knowledge where the lecturer is the guardian of knowledge with the responsibility to know and explain subject content well, and the students to attend lectures, listen attentively and take notes; (b) facilitative learning based on a combination of transmission of complex knowledge structures and teaching that leads to influencing students to learn by skillful, competent and expert lecturers, who utilize master teaching techniques (Biggs, 2001; Prosser & Trigwell, 1999). The design of the teaching plan must be effective in such a way that the desired LOs are clearly specified, and the level of skill and/or understanding are clearly specified, using active words (verbs) such as indicated in Blooms' Table of Taxonomy. Teaching and learning activities, and related teaching methods, need to be developed so that students are encouraged to learn and do activities that make it likely to attain the desired LOs (Biggs, 2001). The purpose of assessment in ITLMUA is, firstly, to establish whether the desired outcomes and level of understanding have been achieved at varying levels of suitability and satisfactoriness, and secondly, to use assessment information/results and questionnaire and interview responses to refine the ITLMUA, and positive and helpful (Biggs, 2001).

The students are expected to learn as their fundamental responsibility and the lecturers' fundamental task is to ensure students are actively engaged in learning by facilitating the teaching-learning processes and guaranteeing that students are supported by well-aligned teaching methods and assessment tasks, and learning environment that are conducive to learning. The Blooming Biology Tool (BBT), an assessment tool based on Bloom's Taxonomy, would assist lecturers in better aligning their assessments with their teaching activities and assisting students to enhance their study skills and metacognition (Crowe et al., 2008).

4.5.1. Pre-Intervention Class Observation and Dialogic Discussions

Effective teaching starts with effective instructional planning and design, and it was evident from the lecturers' PowerPoint presentations that the planning and designs were focused on subject content and broad programme and subject LOs demonstrated by there being a lack of specific LOs at the beginning of the presentation. This may be attributed to lack of training in educational systematic planning techniques offered in teacher training programs. The key element in a student's personal growth and learning is an effective interactive student-lecturer relationship based on trust, and if this trust is not established at the outset, the teaching and learning process may be curtailed (Hanna, 2000; Hawken & Worrall, 2000). The researcher noticed 'power disparity' in the role of the lecturers and students where the lecturers assumed the role of an 'expert' who transmit knowledge to passively listening recipients, which could cause distress, tension and mistrust in the student-lecturer relationship (Tsien & Tsui, 2007). Lecturers should encourage students to assume the responsibility for their own learning while their responsibility is to facilitate the learning through active questioning to provide opportunities for students to actively engage in discussions that might deepen their learning and motivation. According to Hanna (2000), mistrust limits the sincerity and honesty of the academic and social exchange between students and lecturers, and their ability to share professional perceptions and also dissuades students' creativity and initiative.

Lecture-based instruction, which does not yield better training outcomes relative to behaviour modeling, was used extensively by participating lecturers, but students tend to resist to the one-size-fits-all learning approach that often fails to address their individual differences, expectations, preferences, and heterogeneous needs (Chatti et al., 2010; Bolt, et al., 2001; Johnson & Marakas, 2000; Simon & Werner, 1996). This one-way teaching method from lecturers to students based on the conventional lecture mode encourages students to be passive recipients by passively listening and dependent on the lecturers 'broadcasting' of the subject's content (Tsien & Tsui, 2007). The current educational practices in the educational system do more to perpetuate dependency than to promote self-directed learning (Grow, 1991).

The ITLMUA is a student-centered, flexible, dynamic and nonlinear model that provide students with time and opportunity to control and direct their learning with total authority and power to regulate what is learned, and to navigate navigate toward knowledge acquisition, termed 'knowledge-pull', and encourages "a shift from command-and-control to coordinated-and-channel; from hierarchy to wirearchy" (Chatti et al., 2010:75). According to Husband (1999) this is a "dynamic two-way flow of power and authority based on information, knowledge, trust and credibility enabled by interconnected people and technology". In addition, ITLMUA focuses on helping students to construct their own meaningful and conceptually functional representation of connected knowledge, but also to follow an objectivist view of learning which asserts that there is a particular body of knowledge that needs to be transmitted to students, and that learning is the acquisition and accumulation of a finite set of knowledge, skills and facts (Tam, 2000). Although ITLMUA encourages the integration of technology during active subject content delivery, the researcher observed in the course of this study that technology was utilized superficially and in uncreative ways by both lecturers and students, that is, PowerPoint presentations and communication, termed lowest level instructional methods (Hokanson & Hooper, 2004). Rather than using technology in creative ways allowing for innovative learning experiences, lecturers tend to use technology as a tool that replaces existing practices of overhead projectors and transparencies (Doering & Veletsianos, 2008).

Zhao (2007) described how lecturers' technology use falls along a spectrum of lecturer-to-student-centered methods with the lecturer integrating technology in a (a) efficiency-oriented manner, where technology is used as a tool to enhance information recording and retrieval, (b) enhancement-oriented manner, where technology is used to enhance learning and teaching, and (c) 'relaxation' oriented manner, where technology is used as a way to motivate and give 'breaks' to students. Barron et al., (2003) observe two trends when lecturers attempt to adopt and integrate technology in their classroom: (1) non-use or basic technology use, and (2) a higher phase focusing on more creative, student-centered, and diverse use. Hughes (2005) note that three categories of technology use in the classroom, that is, replacement, amplification and transformation, with each successive category being more innovative and student-centered than the previous ones. Yi and Davis (2003) state that effective computer training skills and utilization in classroom and in any organization, is a major contributor to student and organizational performance. Noordin et al. (2011) conclude that students aided with multimedia courseware showed significant improvement in attention, responses and recall of the subject content. Keegan (2000) indicated that continual developments in ICT, including the internet, has offered a global platform for information storage and display in text, graphics, audio and video format, as well as communication tools for synchronous and asynchronous interaction.

In this study, LOs of the subjects being taught were non-existent, and where they were stated, there was a deficiency in complying with the definition by Gosling and Moon (2002) and the South African Universities' Vice Chancellors Association (SAUVCA) guide (1999) which states that students are expected to achieve knowledge, skills, competencies and attitudes at the threshold standards at the end of learning process. For example, one subject state objectives that included functions and anatomy of urinary system, gross and microscopic anatomy of the kidneys and blood supply. Obviously, these 'LOs' are implicit and may confuse the students as they are inherently ill-defined and the instructional strategies will be inappropriate and undifferentiated, and academic tasks/activities will fail to actively engage students in the learning processes. In an environment that does not maximize students' engagement, discipline and reinforcement of positive behavior will be a challenge to maintain. In this study the end-of-class determination whether learning had taken place was conducted by superficial questioning which, inadvertently perhaps, expected factual parroting of 'broadcasted' lecture as the standard for evidence of learning.

Lecturers rely on simple mastering of a single specialized skill or subject rather than possession and development of relevant pedagogical skills and abilities in order to survive in the HE environment (Hilvonen & Ovaska, 2010). Lecturers prepared PowerPoint notes and pictorial diagrams on the blackboard for students to access, which in my view, channels students to only concentrate on the lecturers' notes and does not drive students to expand their learning beyond the lecturers' notes. The ITLMUA allows lecturers and students to develop interactional skills that allow them to facilitate positive classroom interactions, and lecturers' attention to diversity which improves students' qualitative learning. Lecturers in this study adopted a positivist view to knowledge transfer that is based on a knowledge transfer model where students are passive recipients of 'packaged' of knowledge. The lecturers expected students to have studied the blackboard notes, and this approach encourages rote learning where the intention is to reproduce the same information during assessment. The limitation of this approach is evident in the lack of responses to questions with one or two students mumbling and garbling in an attempt to answer questions. The teaching strategy of revising the previous lecture should be approached by means of purposive questioning to determine whether students have studied the material before attending the lectures.

Classroom management needs attention as most lecturers displayed the need to be trained in how to manage classroom and students during lectures as most students are not focusing on what is happening in the lecture room, and not paying attention to the happenings in class. Another issue is student absenteeism, particularly if lectures are early in the day, which might lead to decreased academic learning time and students' non-participation in classroom pedagogical practices. The institutional lecturers' induction programme covers minimal reflective practice, but does not cover classroom management skills at all. The reflective practice is the term coined by Schon (1987), and focuses on the ways people think about their experiences and formulate responses as the experiences happen, with a clear distinction between 'thinking on action' and 'thinking in action (Clarke, undated). Thinking on action is the way of analyzing experiences as they happen while thinking in action determines how responses are formulated (Krause, 2004).

The ITLMUA encourages reflective practices to occur in all stages of the teaching-learning-assessment process, in planning, implementing and evaluation. Reflection refers to thinking about pedagogical practices which must happened pre, intra, and post the actual enactment of a lecture, and most importantly, reflection on teaching strategies, teaching goals and methods, and how these interface with the varied demographics and abilities of students. The process would allow lecturers and students to clarify their knowledge base, the subject content covered, and how their teaching and learning styles, to an extent, match. Lecturers must evaluate whether the learning outcomes have been met and define the points at which difficulties emerged so that modifications can be made where necessary, and if not, there will be an impediment to the lecturers' self-improvement and students' achievements (Clarke, undated). In education, using intuition to inform teaching and learning is referred to as developing metacognitive and critical skills, which are important in developing the ability to understand, make sense of experience and are all integral processes of reflection (Clarke, undated). Hinnet (2002) states that encouraging students to acknowledge their intuitive capacity helps them to appreciate their strengths and weaknesses.

Lecturers should be aware of conceptual changes in the nature of TLA and endeavor to meet the requirements of the conceptual changes and to meet the 'new' standards that are increasingly focused on the learning that takes place in the education system as a whole (Marchant et al., 2003). The change in focus from lecturers' teaching to student learning mandates a change in how students are prepared and evaluated, therefore, it is incumbent on lecturers to change how they teach and assess by using more active forms of teaching, learning and assessment (Marchant et al., 2003). The lecturers participating in this study were lecturing different subject content, for example, the reproductive system and the nervous system, when it would have made educational sense for the lecturers to teach the same subject content with different foci as determined by their subject, that is, team-teaching, and then have a systematic approach and integrated assessment strategy. The researcher did observe the use of active learning strategies which indicated that the lecturers were feeling more consciously comfortable about using the active learning strategies, and there were more interactions between students and the lecturer, and among students evident in reciprocal questioning and answers sessions during teaching.

4.5.2. Post-Intervention Class Observation and Dialogic Discussions

The South African Department of Higher Education and Training White Paper entitled *Post-School Education and Training: Building an Expanded, Effective and Integrated Post-School System*. (2013) reminds us that the success of students is the most important indicator of quality of the education offered , and to accomplish this feat of quality education, the institutions of higher learning need suitable, well-educated, capable and qualified professional lecturing staff. Furthermore, new lecturers must be trained and many existing lecturers needed to be re-skilled in the art of teaching methodologies that are appropriate for teaching students, so that they have the capacity to provide the conditions which will guarantee maximum opportunity for successful quality learning experiences.

Fortunately, students and lecturers participating in this study demonstrated an open attitude and willingness to slowly adopt the new strategies of teaching and learning for effective teaching, learning and reflection (Davys, 2000; Hawken & Worrall, 2000). During class observation, all participating lecturers still adopted the conventional teaching strategy of conveying a lot of information and facts to the students, and they have not modeled the teaching and learning process (Kort & Reilley, undated). The participants' feedback made it clear that the partnership and collaboration in the implementation of ITLMUA was an enjoyable learning experience, as noted by Student K: *"the relationship between lecturers & students is excellent because lecturers ask questions & also allow students to ask questions to make their understanding much* *better"* (Yueng-Tsang & Tsien-Wong, 2004 in Tsien and Tsui, 2007). Student B noted that *"we have the best lecturers. They are very helpful and understanding and they try to make our learning experience the best that it can be".*

The researcher observed an improved interaction between students and lecturers and among the students themselves as they actively engaged by adding to the presentation and also questioning the student presenter, and the lecturer facilitated the students' interaction. There was an atmosphere of 'gap closure' in the power disparity that was evident compared to the pre-intervention class observation. The researcher hopes that through continued use of the theoretical principles of ITLMUA, this 'gap closure' may culminate in an equal student-lecturer partnership. The 'newly-found equal student-lecturer partnership' may become the productive soil where the new partnership can create a trusting and innovative learning environment, and make use of a variety of teaching and learning methods that ITLMUA is encouraging to be embraced and utilized, based on the needs of the student and the desired learning outcomes (Tsien & Tsui, 2007).

As can be seen, students and lecturers can work and perform as partners in complementary roles, in an independent, interdependent, trusting and empathetic environment, which may encourage the adoption of a new teaching and learning model. The ITLMUA has encouraged the lecturers and students to adopt a two-way interactive teaching and learning process based on discussions and sharing of ideas, values, knowledge, skills, feelings and behaviours, where both parties plan, implement and evaluate the impact of the intervention model process together. The new lecturer-student relationship allowed students to become contributors rather than simply recipients, and students are empowered to have greater ownership, autonomy, and independence in the teaching and learning process.

CHAPTER 5: SUMMARY OF FINDING, CONCLUSIONS AND RECOMMENDATIONS

5.1. INTRODUCTION

The research study was undertaken to investigate the efficacy of the ITLMUA designed by the researcher with the intention of answering the research questions in this study which are primarily focused on the enhancement of effective and efficient quality teaching and student learning. The study was premised on the assertion that conventional instructional models fall short of recognizing the significance of student diversity, and addressing and facilitating a differentiated educational system that is responsive to the cognitive, affective and social needs of students (Tomlinson et al., 1998; Buckler, 1996). This research study, in hindsight, was aimed to serve students' needs based on useful information to develop the ITLMUA design in order to impact on the quality educational provision of the Clinical Technology programme. The researcher envisaged a convergent approach in defining quality in terms of the effects on students' cognitive, affective and social development and improvement, regardless of the students' level of ability (Nordvall & Braxton, 1996).

The quality evaluation of institutional programmes is stipulative and the inconsistencies in the use of the evaluation terminology 'muddied the waters' of quality evaluation a great deal, negatively affecting the success of evaluation efforts in HE (Wittingslow, 1986). Harper and Bell (1982) refer to evaluation as the planned collection, collation and analysis of information to enable judgements about value and worth of instructional practices. Some definitions focused on the determination of the intervention with the aim of improving the educational system and subject offerings. Educational effectiveness and efficiency has been cited as the main problem encountered in modern educational systems, which also fail to meet the challenges of providing equity in education, which may lead to achievement gaps in the diverse student population (Stavroula et al., 20111). Lecturers have the responsibility to provide students with conducive learning environment that are authentic if their intention is to maximize student learning through enhancement of the effectiveness, efficiency and quality of learning by employing alternative, innovative, dynamic and authentic instructional practices. The ITLMUA attempts to delimit the profound differences in values and ideologies, and increase the degree of relatedness and mutual support of instructional models by adopting an integrated approach which is underpinned by learning theories in order be responsive to the varied characteristics, traits and needs of students (Tomlinson et al., 1998; Buckler, 1996).

There is a lack of enthusiasm and disposition of lecturers to use alternative, innovative, creative and dynamic instructional strategies such as the variations of active learning strategies to accommodate students' different levels of knowledge given the individual complex subject content which, in essence, needs an integrated approach to assist students to master the subjects content (Alibali, 2006). When lecturers incorporate active learning in the classroom, they become mentors and facilitators of knowledge rather than the dominant subject content experts, and the teaching styles that the lecturers are using provide the incentives for students to take a more active participatory role in their own learning (Eison, 2010; Felder & Brent, 2009; Huitt, 1995; Meyers & Jones, 1993). Students have the responsibility to share teaching and learning through active learning and engagement that requires them to go beyond their current skill and knowledge levels, and through this active interaction, students are able to take ownership of the teaching-learning process (Bonwell & Eison, 1991). This study advocated student involvement in the instructional activities such as TLA which are grounded in the philosophies of AL demonstrable in knowledge construction, meaning making and social interaction that promote effective quality learning, reciprocal feedback and adaptation of cognitive processes (Falchikov & Goldfinch, 2000).

Central to the study was to have a paradigm shift from conventional instructional practices where the focus is on simple rote learning common to the industrial age, towards useful and meaningful learning suitable for the information age, where students understand what they are learning in combination with their experiences and their unique cognitive perspective (Ausubel, 2000;

Reigeluth, 1999). In addition, active participation of student in the learning-teaching-assessment process is encouraged, supported and promoted by the study through integrated team-based academic activities, peer teaching and learning, collaborative and cooperative learning, and involvement in self- and peer assessment practices in HE if the fundamental principle of student-centric approach is to be realized. The researcher was able to confirm many of the academic benefits and strengths, and identify areas that needed improvement by using information from a variety of sources such as formative assessment information, participants' comments and perspectives, and information from reviewed literature.

The research study might have focused on the improvement of quality student learning and teaching, but the driving force is on the conceptualization of the development process by identifying certain and pertinent principles and procedures that the descriptive, inductive and nonlinear nature of the ITLMUA could provide in assisting other stakeholders such as curriculum developers advance programme curriculum quality, resulting in greater efficiency and productivity (Lunenberg, 2011; Oliva, 2009). The study encouraged the kind of learning that is associated with experiential learning and discovery based on a case- and problem-oriented approach of active learning established on mutual relationship between students and the lecturers, and among students (Ostad & Soleymanpour, 2014). It must be mentioned forthrightly that assessment activities in this research study were formative with the sole purpose of assisting in the redesign, development and advancement of the ITLMUA in order to amplify the efficacy of the ITLMUA through cyclic and reiterative evaluation and implementation of the improved instructional model.

5.2. DISCUSSION

In this study the researcher sought to evaluate the efficacy of the ITLMUA as determined by the appreciation and satisfaction of the participants as a result of the implementation of the ITLMUA, and the effectiveness of the AL teaching strategies as evident in the quality of students' useful and meaningful learning and teaching.

5.2.1. Learning and Teaching Styles and Strategies

In the post-intervention phase, most students (79%) indicated that they adapt and modify their learning styles and strategies to the lecturers' teaching styles and strategies, and the lecturers are aware of their individual learning styles and strategies as a result of their involvement in the implementation of the ITLMUA. The main thrust of the ITLMUA is to impact positively on effective and quality teaching and student learning, with reflection on the learning and teaching experiences and monitoring of performances. The lecturers acknowledged the necessity of embarking on educational advancement programmes to develop their educational practices in order to impact positively on student learning through utilization of alternative, innovative and authentic instructional strategies.

5.2.2. Instructional Alignment and Assessment Criteria

The participants appreciated that the instructional activities in the Clinical Technology programme are well-aligned and coordinated to provide sequential, logical and coherent effective and quality education to students, and made teaching pleasurable. The insistence of the ITLMUA that lecturers should reiterate the LOs for every lesson so that students could focus on what is expected to be achieved can guide teaching and direct student learning, including provision and explanation of AC to students. Students indicated that the utility and suitability of AC assisted them to perform exceptionally in the formative assessment activities and improved the quality of their responses to the assessment questions, and in framing feedback (McKellar, 2002; Brown et al., 2000). The positive effect of formative assessment utilized in the ITLMUA had *"challenged"* students *"to think critically and less cramming"* (Student I). These comments demonstrate the chang in learning approach from cramming (surface learning) to thinking critically (deep to strategic learning approach). The relevance and appropriateness of learning outcomes are demonstrated by their alignment with instructional strategies and are representative of the skills that students are expected to demonstrate after completion of the instruction.

The ITLMUA supports and promotes the systematic integration of common thematic learning across the subjects, particularly human sciences subjects that cover human anatomy, physiology, pathophysiology and biomedical instrumentation systems to diagnose patients' disorders and diseases. The current teaching strategies are not integrated and systematically well-aligned in order for academically sound TLA. The formative nature of assessment as envisaged and implemented in the ITLMUA was intended to provide timely, positive and helpful feedback so that the impact is effective and can be used to advance and improve learning and teaching. More importantly, students are participants in the teaching and assessment activities of the programme through peer teaching and learning, self and peer assessment and peer feedback.

Teaching and assessment are tools that should support and enhance the quality of students' transformative learning, and assessment provides students with valuable learning experience, in addition to allocating marks to students (Segers and Dochy, 2001; Brown & Knight, 1994). This research study stresses the formative function of assessment, and that the student as an active participant in the teaching-learning-assessment process, shares the responsibility and practices of self-assessment, reflection and collaborative partnership. A narrow conception of TLA is conveyed by those lecturers who rely on conventional approaches to instructional practices, with resistance to develop a paradigm shift to alternative, innovative, dynamics and authentic instructional practices that seek to develop and advance the quality of educational delivery to the varied and diverse student population. It is imperative to access context sensitive understandings of pedagogical and personal principles that underpin the work of teaching (Tellez, 1996, p. 704). Savery and Duffy (1995) noted that authentic assessment tasks display the cognitive demands or the thinking required which are consistent with the cognitive demand in the environment for which lecturers are preparing the students. This notion is a suitable and satisfying because students appreciate when they are being informed about the requirements, standards and expectations of the programme and the subjects, including clear briefs and explicit assessment criteria (Struyven et al., 2002). The HE and its lecturers are obliged to maintain consistent academic standards and ask questions in their assessment activities that are aligned with what they have covered in class during instructional activities (O'Donovan et al., 2004; Lucas & Webster, 1998).

5.2.3. Articulation of Academic Standards, Expectation and Achievement

The ITLMUA facilitated the philosophical suitability and morality of educational practice by enabling the lecturers to articulate educational standards and requirements to students. The students appreciated lecturers' explanations of instructional standards, expectations, achievements and performances as it offered pre-understanding and pre-conception of the targeted achievement goals (Doering & Veletsianos, 2008; Ecclestone, 2001). The students attested to the affirmative and helpful effects of instructional activities on their learning as influenced by the formative nature of instructional activities during the implementation of the ITLMUA. It is imperative that lecturers articulate the thematic learning units to assist students direct their learning efforts and time appropriately and can better monitor their quality learning progress, achievement and performance, particularly when students have a clear understanding of the criteria for measurement. The positive academic benefits enshrined in the generic philosophy of the ITLMUA can be gathered from the degree to which the content of subjects are linked with instructional activities by the utilization of alternative, innovative, dynamic and authentic instructional activities (Porter, 2002).

5.2.4. Multiple Instructional Strategies and Students' Experience

The ranking of the examination questions of the two subjects under study indicated clearly that the questions focused on low order cognitive skills (knowledge and comprehension) for main the examination (96% and 97%), and for the supplementary paper (98% and 84%), respectively. The students valued the utility of assessment practices as utilized in the ITLMUA since it was not only assessing knowledge, skills and abilities, but also application in varied educational and professional contexts. The ITLMUA's assessment strategies advocates that students be prepared for the real-life clinical situations they will be facing post-graduation, thus emphasise formative alternative, innovative, dynamic and authentic assessment practices. Although students were not sure about the adequacy and acceptability of the average number of assessments, they indicated that they were over-assessed.

Lecturers also had the impression that students were over-assessed to some degree by indicating that they preferred summative assessment because it reduces workload. There was pressure from the institution to increase the pass rate through the quota pass system as it attracts more funding but this has a detrimental effect on the quality of learning and teaching. Adherence and compliance with quota system obligates the lecturers to set 'easier' tests to score marks, demonstrating reliance on superficial rote learning that focuses on recall, and 'cut and paste' in essay writing, which is fraught with some degree of plagiarism. The underpinning principle of

ITLMUA is integration of instructional strategies through team-teaching and integrated assessment strategies to reduce workload and over-assessing. The students' comments that they *"are able to multi-task and balance the workload"* (Student Q), is testimony to the efficacy of the ITLMUA in that its instructional and assessment strategies not only assess knowledge, skills and abilities, but also development of other skills such as coping skills and multi-tasking.

5.2.5. Interrelationships and Collaboration

The teaching strategies were satisfactory and acceptable to students, but were more interesting when they incorporated the AL teaching strategies of the ITLMUA that promoted and encouraged active participation of students in the teaching-learning-assessment process. Their participation was evident in peer teaching and learning through involvement in class presentations, which were followed by question and answer sessions. They were also evident in their involvement in assessment practices as a result of self and peer assessment, and the articulation of assessment criteria that foster learning through understanding of what should be achieved through assessment. Team-based projects were undertaken where students were involved in collaboration and cooperation among themselves to achieve the common goal as determined by the assessment utilized. The students indicated that they learnt more effectively when they were engaged and involve in AL teaching strategies as they were able to share their ideas with their peers and learn from each other. The power shift from the lecturers to students caused them to maximize their learning through collaborative and cooperative learning strategies of AL. The majority of students (59%) selected 'facilitate and guide learning' as their preferred teaching strategies rather than 'convey factual information and concepts' although lecturers employed the conventional lecture mode of instruction.

The overwhelming majority of students appreciated and were satisfied with the supportive and accommodative nature of the lecturers' interactive relationships with them as a result of collaborative and cooperative learning used in the ITLMUA. Students indicated that they got along, shared information to help each other, especially with students who were the 'weaker links' in order to enhance their achievement and performance. Some of the students pointed out that some students like to dominate the group, which does not augur well for group morale and motivation. The dominating behavior could be lessened by ensuring that all students are aware that their contribution and participation to group work should be equal. The students were satisfied with the teaching methods used in the Clinical Technology programme because they are used to conventional lecture mode of transmitting information to passive recipients of information. They suggested that lecturers should use teaching methods that encourage more interaction rather than reading from PowerPoint slides in class, and the onus is on on lecturers to modify their teaching strategies in order to accommodate the varied and diverse student learning styles and strategies. Students would be satisfied if the methods of teaching and assessment are ‘easy’ to accomplish their achievements. Students noted that demonstration, discussions, use of visuals, and asking questions and answering them in class, encouraged them to study and eager to participate in class, and their confidence is boosted and they developed self-awareness and self-assurance.

Further engagement among students is when they ask questions and explain their answers during peer teaching and assessment feedback, which is formative, timely, immediate and helpful to enhance the effectiveness and quality of student learning. The lecturers’ feedback on students’ performance identifies weaknesses and strengths in students’ academic tasks and reflection on teaching strategies, with the improvement on subsequent tasks and teaching, thereby enhancing the quality of student learning and teaching effectiveness. The students’ collaboration significantly enhanced students’ participation, greater student activities, students’ motivation and meaningful experience, as well as numerous academic activities that motivates both lecturers and students alike (Doering & Veletsianos, 2008).

5.2.6. Technology Integration

Technology integration was welcomed by most students, though still limited to PowerPoint presentations, and the use of Blackboard for posting notes and announcements. The researcher’s ITLMUA proposed that e-learning should be rolled out for other usage such as assessment and academic interaction among students and between students and lecturers. Hokanson and Hooper (2004) point out that lecturers use technology in superficial and uncreative ways in what can be termed lower-level instructional methods, for example, as a communication tool (Barron et al, 2003). The lecturers should shift from a teaching to a learning paradigm and start using technology in enhancement-oriented manner where technology is used to enhance the quality of learning and teaching (Zhao, 2007). Furthermore, integrate technology in s ‘relaxation’ oriented manner, where technology is used as a way to motivate and give ‘breaks’ to students (Zhao, 2007). The shift to a learning paradigm needs adequate training, technology training and technical support to assist students to problem solve, work in teams to develop and advance interpersonal skills (Rogers, 2000).

5.3. CONCLUSION

The researcher is fully aware that innovations foster resistance, and the ITLMUA is no exception (Voorhees, 2001). The motivation is not for lecturers to use ITLMUA to explain and justify their professional practices in teaching, but to adopt an attitude and take a stance to be amenable to the use of alternative instructional practice in conjunction with traditional practices, to foster quality student learning and teaching. Young and Irving (2005) note that effective and quality education is not only based on integrity of practice but also on lecturers’ ability to describe and substantiate how they teach and assess, and on the use of alternative, innovative, dynamic and authentic TLA strategies underpinned by learning theories and pedagogical practices.

We cannot only develop students’ academic potential and prowess from their intellectual ability, but also must afford students the opportunity to showcase their ability to self-regulate and self-reflect on their learning and take responsibility and accountability for their own learning. Furthermore, student involvement in assessment practices through self and peer assessment, would help them be responsible to set and use standards of excellence to evaluate whether they have accomplished their learning goals (Moallem, 2007). The serious business of knowing students characteristic behaviours, traits, needs, learning styles and learning strategies, and their approaches to learning, would assist in modifying teaching styles and strategies in order to accommodate the varied and diverse student population in HE.

The DUT has a strategy to embark on the implementation of e-learning, and it has a roll-out plan for implementation of e-leaning initiatives to maximize technology to enhance the learning and teaching process for optimal utilization. Engelbrecht (2003) oabserves that planning for the implementation of quality and sustainable e-learning programmes requires an understanding of the impact of ICT on the HE environment, and on the current teaching and learning practices in order to identify critical success factors that have to be addressed in an e-learning strategy. The application and integration of multimedia and networks in teaching strategies can enhance students' learning efficiency, enthusiasm and lecturers' teaching to more diversified student population. Technology integration alone cannot solve all the challenges of lecturing in HE such as reluctance to adopt other teaching strategies other than traditional lecture mode of teaching, and the use of assessment strategies that elicit low order cognitive skills rather than high order cognitive skills. The ITLMUA supports TLA strategies that combine traditional instructional strategies with alternative instructional strategies in an attempt to realize and maximize the complementary advantages of both modes of instruction. Lecturers in HE should undergo educational training or obtain an academic qualification to improve their pedagogical practices in order for them to impact positively on the quality of learning and teaching. Moreover, the lecturers need to acquire computer software skills through facilitated and guided training in order to bridge and advance the software theory and practice, thereby have the potential to significantly enhance the overall performance of students and lecturers.

The utilization and implementation of AL as a teaching strategy employing the twin processes of collaboration and cooperation, enhanced lecturers and students' interactive participation and experiences. The importance of AL is that it can be used in conjunction with the conventional classical lecture method to improve the quality of learning and teaching. There was also utilization of interactive teaching through group discussions, hands-on practical sessions, self-learning, visuals, real exemplars and quizzes during lectures to improve learning and teaching. The lecturers showed eagerness, willingness and interest in further developing and advancing themselves by calling out for continuous staff development programmes, and to undergo formal HE teaching programmes. They further suggested that students take charge of their own learning, and learn to understand and be able to apply knowledge, and not to regurgitate information. Student learning vastly improves when they explain learned information to their peers through rehearsal and repetition. The majority of lecturers are persistently using the traditional lecture mode to teach students, but this study supports the integration of conventional lecture mode to supplement rather than replace lectures. The students were able to actively engage in teaching and learning activity as opposed to passively listening to a lecturer in class like a pastor preaching the gospel truth in a church sermon.

Active learning, like any other alternative instructional strategies, inculcates principles and values of positive interdependence among students, with individual accountability and supportive structures for students, where they are able to freely, without fear or favour, seeking assistance from team members to foster and advance their learning. The academic benefits, with longer and sustainable implementation, may produce positive results in academic achievement and performance, enhance social interaction skills such as communication and interactive relationships (Faust & Paulson, 1998). Introduction of alternative, innovative, dynamic and authentic instructional strategies needs time to learn and prepare, but as time goes by, the increase in students' active participation and them providing the lecturers with feedback concerning students' retention and understanding of the subject material, speeds up the process.

The ITLMUA is inspired by theory in order to pronounce the integrated component interactions of the ITLMUA, which in essence, provides a theoretical framework to enhance the effectiveness and quality of student learning and teaching. Central to ITLMUA is the assumption that effective and quality health care delivery is influenced by the manner in which students acquire, retain and retrieve informational knowledge and are inducted into the clinical practice of the profession. The ITLMUA shares the power with students by its nature and design of student-centeredness and lecturers as facilitators and supervisory supporters, a moral and material scaffold, for student learning (Leclercq & Poumay, 2005). Furthermore, the ITLMUA can assist lecturers to conceive and describe lecturing sequences in a logical and coherent manner underpinned by learning theories and pedagogical practices. According to Leclercq and Poumay (2005), the effectiveness and quality of the instructional model depends on its power to reduce complexity, without lapsing into a simplistic approach. The researcher relied on the continuous implementation, utilization and evaluation of the ITLMUA in order to determine how to iteratively improve the instructional model for optimal utilization. The ITLMUA is based on the knowledge that cooperation and collaboration is more effective than individualistic or competitive efforts Johnson, Maruyama, Johnson, Nelson, & Skon, 1981). It has been reported that "if the instructional model solves the learning-teaching problems, it means that it is an effective instruction", and such an instruction enables student to acquire specified skills, knowledge, abilities and attitudes (Isman, 2011; Reiser & Dick, 1996).

5.4. RESEARCH LIMITATIONS

The research study limitation could be attributed to:

- Response bias to the questionnaires by the participants could be attributed to random responding wherein participants answer the questions without applying their minds, or it might be that the dichotomy of the questions made them unable to provide direct answers (Cronbach, 1950; Osborne & Blanchard, 2011). The researcher could have attempted to reduce response bias by scrambling the order of the questions, and reversing the scale of some questions such as high-scale values reflecting a low-scale value in the measured characteristics (Ruble & Stout, 1991; Tibbles et al., 1998).
- Extensive introductory workshop on the design and purpose of the ITLMUA instructional model for thorough comprehension of the intended determination of the model so that the participants could respond judiciously to well-defined questions and statements.

5.5. RECOMMENDATIONS

The following are the recommendations that seek to improve pedagogical practices in higher education sector:

- Knowledge of students' characteristics, behaviours, traits, and learning styles and learning strategies in order to modify our teaching styles and strategies to accommodate the diverse student population.

- The integration of instructional strategies with technology and collaboration and cooperation through systematic and coordinated team-teaching to maximize students' useful and meaningful learning experiences, and to reduce the academic workload and avert over-assessment.
- The should be a requirement that to teach in HE one should have an academic qualification or a very strong in-house postgraduate certificate in pedagogical and didactic education to equip lecturers on the principles and concepts of educational practice, particularly assessment practices and reflection on practice (Vosniadou, De Cortes, Glaser, & Mandl, 1996).
- Universities should invest in multimedia and network education in order to rationally re-allocate traditional education resources, consolidate the educational advantages, actively develope continuing education and training, and simultaneously expand diversified strategies in order to have a competitive advantage in the face of fierce external conditions and complex internal conditions (Wu et al., 2013).
- Create a fully computerized automated assessment instrument integrated with a fully operational longitudinal tracking system, and design a back-end process to provide continuous feedback to students, lecturers and faculty (McGourty et al, 2000).
- Active learning assessment strategies such as projects that actively involve students are the most effective way of maximizing students' participation and learning (Ferguson, 2002), but traditional teaching methods such as lectures, discussions and textbook assignments are necessary to introduce students to the factual and conceptual knowledge they need to complete the projects (Ferguson, 2002).
- Lecturers should be able to incorporate alternative instructional strategies in a gradual manner as they identify the resources, time and support that is needed in order to impact positively on students teaching, learning and assessment.
- This research study intended to provide lecturers with an integrated instructional model in order to implement and refine the ITLMUA in their pedagogical practices, and the faculty

must not be overwhelmed by the razzmatazz of the model; it is a pragmatical and friendly model.

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APPENDICES

Appendix A

LETTER OF INFORMATION

Dear Participant

Thank you very much for your participation in this research study, and your contribution is highly appreciated.

The title of my research study is '**Efficacy of an Instructional Model on the Quality of Teaching and Learning Using Assessment.'**

My name is Mogapi Jeremia Mohapi and I am the **principal investigator/researcher** for this research study. I am a Senior Lecturer in the Department of Biomedical and Clinical Technology, Faculty of Health Sciences, Durban University of Technology. My highest academic qualification is Masters' Degree in Education obtained from University of Kwa-Zulu Natal in 2010.

My **co-investigators/supervisors** are Prof J K Adam (D Tech: Clinical Technology), who is an Associate Director in the Department of Biomedical and Clinical Technology, Durban University of Technology, and Prof T Ngwenya (PhD), Director at CELT at the Durban University of Technology.

Brief Introduction and Purpose of the Study: The research study aims to evaluate a newly-developed instructional model namely **Integrated Teaching and Learning Model Using Assessment (ITLMA)**. The ITLMA was developed from the assistance of reviewed literature, developed teaching, learning and assessment models, researcher's pedagogical intuition and practical experience. The purpose of the study is to implement and evaluate the impact of Integrated Teaching and Learning Model Using Assessment (ITLMA) on students' learning experience and pedagogical practices. The ITLMA is underpinned by learning theories and pedagogical strategies in an attempt to improve the quality of student learning and pedagogical practices. The answering of the both pre- and post-intervention survey questionnaires will take approximately twenty (20) minutes each, and will be completed separately at different times.

Outline of the Procedures: All registered, informed and consented 2^{nd} year Clinical Technology students will participate in this research study, and informed and consented lecturers teaching 2^{nd} year subjects in Clinical Technology programme, will be participants in this research study. Multiple data collecting instruments will be used to gather qualitative and quantitative data analyzed using sequential analysis using in vivo and open coding, and constant comparative method. The developed instructional model will be implemented in successive cyclic and iterative experimentation for approximately three months. The model will be implemented through blending of learning theories over approximately three months period, delivering three to four thematic learning units over three-four weeks in a cyclic and iterative experimentation. The four phases research process will be conducted covering programme documentation analysis, questionnaires, class observation, sequential analysis of collected data, implementation and evaluation of the instructional model, data analysis and interpretation and interviews that will be audio-recorded and transcribed.

Risks or Discomforts to the Participant: I will ensure that you are not at any risk or discomfort during the conduct of the research. If you are experiencing or exposed to any risk or discomfort, do not hesitate to engage me in addressing them.

Benefits: As a participant in this research study, you will benefit academically through the renewed pedagogical approaches to teaching, learning and assessment as may be evident in the enhancement of a better understanding of subjects concepts and principles, improvement in your achievement and competencies.

Reason/s why the Participant May Be Withdrawn from the Study: As your participation is voluntary, you may withdraw at any time from participating and your withdrawal will not be held against you or be prejudiced in any way. You cannot withdraw from instructional offering of the subject content by respective lecturers as this is part of your normal instruction. .

Remuneration: You will not be remunerated for your participation in this study as you have volunteered to participate willingly.

Costs of the Study: You are not going to be requested to bear the cost of the research study.

Confidentiality: All data and information collected will be kept confidential and numerical or alphabetical letters will be used to protect the identity of participants, including the subjects. In addition, a statement of confidentiality will be signed by both my supervisors and me.

Research-related Injury: There will be no research-related injury as the normal conduct of pedagogical practices will remain the same.

Persons to Contact in the Event of Any Problems or Queries:
Please contact me, Mr M J Mohapi at (031-373 5296/ 082 740 3252), my supervisor, Prof J K Adam at (031 373 5291) or the Institutional Research Ethics administrator on 031 373 2900. Complaints can be reported to the DVC: TIP, Prof F. Otieno on 031 373 2382 or dvctip@dut.ac.za.

mjm/letter/of/information/ITLMAU/20150715

Appendix B

Institutional Research Ethics Committee
Faculty of Health Sciences
Room MS 49, Mansfield School Site
Gate 8, Ritson Campus
Durban University of Technology

P O Box 1334, Durban, South Africa, 4001

Tel: 031 373 2900
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http://www.dut.ac.za/research/institutional_research_ethics

www.dut.ac.za

DUT
DURBAN
UNIVERSITY OF
TECHNOLOGY

13 February 2014

IREC Reference Number: **REC 87/13**

Mr M J Mohapi
149 Cato Manor Road
Manor Gardens
Durban
4001

Dear Mr Mohapi

Efficacy of an instructional model on the quality of student learning using assessment

I am pleased to inform you that Full Approval has been granted to your proposal REC 87/13.

The Proposal has been allocated the following Ethical Clearance number **IREC 007/14**. Please use this number in all communication with this office.

Approval has been granted for a period of one year, before the expiry of which you are required to apply for safety monitoring and annual recertification. Please use the Safety Monitoring and Annual Recertification Report form which can be found in the Standard Operating Procedures [SOP's] of the IREC. This form must be submitted to the IREC at least 3 months before the ethics approval for the study expires.

Any adverse events [serious or minor] which occur in connection with this study and/or which may alter its ethical consideration must be reported to the IREC according to the IREC SOP's. In addition, you will be responsible to ensure gatekeeper permission.

Please note that any deviations from the approved proposal require the approval of the IREC as outlined in the IREC SOP's.

Please note that you may continue with validity testing and piloting of the questionnaire. Research on the proposed project may not proceed until IREC reviews and approves the final questionnaire. if there are no changes to the questionnaire kindly notify IREC in writing.

Yours Sincerely

[redacted]

Prof M N Sibiya
Deputy Chair: IREC

LECTURERS' PREINTERVENTION SURVEY QUESTIONNAIRE (LPREISQ)	APPENDIX C

Dear Participants

Your participation in this research study is highly appreciated and welcomed. Please respond and answer the following statements and questions as best as you can since your input to this study is vital.

Tick the appropriate box in demographics template section below, and the Likert Scale statements. Answer the questions as best as you can.

Male			Black		Indian			Participant Staff No.		
Female			Coloured		White			Subject		
Others			Others					Programme		

PART A : TEACHING

A1. What are your teaching philosophies and how do you ensure they are sustained?

Philosophies and their sustainability:

A2. What are your teaching strategies and what are they intended to accomplish?

Strategies and associated intended accomplishment:

A3. What are your teaching goals and how do you ensure that they are achieved?

Goals and achievement:

A4. What are your teaching styles, and how do they influence student learning?

Teaching styles and their influences:

A5. How do you measure improvement in your teaching?

A6. Subjects learning outcomes are aligned with teaching strategies

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Provide an example where a learning outcome is aligned with teaching strategies:				

A7. What do you value about teaching in higher education?

A8. Indicate in an ascending order from 1 to 6 your preferred teaching methodology.

Lecture		Demonstration		Concepts & Principles	
Application		Memorization		Understanding	

A9. How do you know how compatible is you teaching style with students' learning styles?

A10. What learning theory do you currently use to teach your students?

A12. How do you encourage and develop students' collaborative and cooperative learning?

A13. Teaching must be aligned with stated learning outcomes.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Provide an example of such an alignment:				

A14. I am a proponent of team-teaching strategies.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree		
			Yes		No	

A15. What is it that you would like to do to improve educational practices in higher education?

A16. What is your perception about the reasonable assumption that all lecturers are not perfect in their educational practice?

A17. What formal educational training programme have you undergone?

A18. How would you describe students' behaviour with regard to teaching style?

A19. What is the frequency of review or re-teaching the subject concepts?

1.Always	2. Seldom	3. Rarely	4. Not necessary	5. Never

A20. What is your perception of students' mastery of the subject concepts that are taught?

A21. What is your underlying assumption about teaching?

A22. How would you suggest to improve teaching practices in higher education sector?

PART B : LEARNING

B1. I use a combination of learning theories during my lectures.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Give two examples of learning theories:				

B2. What are your desired and expected students' learning outcomes?

B3. Tick the appropriate box that indicate the learning approach majority of students are using when they studying.

Focus on meaning and understanding		Focus on lectures and assessment tasks.		Focus on recall and reproduction	

B4. Tick the appropriate box that indicate the learning style majority of students are using.

Auditory		Visual		Tactile		Kinesthetic	

B5. Connection is made between the subject learning goals and students' prior knowledge.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Explain how the connection is made:				

B6. Tick the appropriate box that indicate the learning approach majority of students are using when they studying.

Construction of knowledge based upon prior knowledge and experience.		Understanding of concepts and their relationships.		Learning is through discussions, dialogue, collaboration, information sharing, and interaction with others.	

B7. Different types of learning outcomes require different types of assessment.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Explain your choice:				

B8. Similar types of learning outcomes, regardless of the subject matter, require similar approaches to assessment.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree		5. Strongly Agree
Justify your option:					

B9. If the learning outcomes, teaching and assessment are well aligned, the assessment results are likely to be reasonably valid.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Validate your selection:				

B10. Instructional activities and assessment tasks are distinct, yet complementary.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Substantiate your selection:				

B11. What is your perception of students' mastery of the subjects' concepts?

B12. What strategies are you employing to encourage students to know and understand the subject content that has been previously taught?

B13. What strategies are you using to motivate and helping student with learning difficulties?

B14. What is your underlying assumption about teaching?

B15. What would you suggest for students to improve their learning?

PART C : ASSESSMENT

C1. What is it that you aim to achieve when you are assessing students?

C2. What learning theories underpin your assessment strategies?

C3. How effective are your assessment activities in meeting the programme/subject learning outcomes?

C4. To what extent do the assessment activities meet the assessment criteria?

C5. What are the strengths and weaknesses of assessment practices used in your programme?

Strengths:
Weaknesses:

C6. Why it is that formative and summative want to achieve?

Formative:
Summative:

C7. How do you deal with assessment information?

C8. How do you assess and analyze students' learning?

C9. Tick the appropriate box that indicate your viewpoint when you are assessing.

Knowledge possession		Knowledge Use		Academic achievement	
Justify your selection:					

C10. Briefly explain the rationale for your varied assessment activities in your subject.

C11. Tick the appropriate box that indicate the purpose of assessment.

Process and product learning		Construction of knowledge and understanding		Empowering students	

C12. What are your most and least preferred methods of assessment?

Most preferred and explain your choice:
Least preferred and explain your choice:

C13. How do you adapt assessment to students' affective as well as cognitive characteristics in order to enhance validity of the assessment?

C14. Assessment is the first thing I consider when I develop subject content and learning material.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

C15. How do you know that your assessment methods are enjoyable and cognitively challenging?

C16. How appropriate and effective are the assessment methods in assessing the learning outcomes of your subject?

C17. During assessment, I do assess what I have taught.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

C18. Tick the appropriate box to estimate the percentage of your students who had been taught the minimum material necessary to pass each item on a standardized written theory (achievement) test.

50-59%		60-69%		70-79%		80-89%		90-99%	

C19. What is your underlying assumption about teaching?.

C20. What is your conception of assessment?

C21. How would suggest to improve assessment practices in higher education sector.

PART D : MISCELLANEOUS

D1. Subject critical information is identified and students are provided with indication which information is essential during the lecture.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Explain how are you doing it:				

D2. What are the three main objectives that underpin your learning units of the subject you are lecturing?

D3. How do you go about making students aware when they are not engaging with their academic tasks at the expected level and standards?

D4. What strategies are you using to ensure that students' response rate to questions is fair and equitable during lecturers?

D5. What strategies are you employing to encourage students to develop academic interactivity and effective relationship among and between themselves and the lecturer?

D6. How is information technology and communication integrated and utilized in instructional activities of your subject?

D7. What are your strength and weaknesses in teaching?

Strengths:
Weaknesses:

D8. How do you motivate and support students, particularly those students whose learning is at risk?

D9. How do you address the ineffectiveness and inefficiencies of your subject/s in your programme?

Subject:
Programme:

D10. What knowledge and skills your students need to have developed when they are through with your subject?

D11. Critical subject information is identified and reviewed so that it remains responsive to students' learning experience.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D12. Do you currently use an existent instructional model during your pedagogical practices?

Yes		No		Justify your selected answer in terms of rationale and purpose of the model:
Rationale:				
Purpose:				

D13. What is the theoretical framework that prompt the curriculum renewal process?

D14. How do you determine that the knowledge demands and the level of difficulty of your subject are appropriate?

D15. Marking and scoring rubrics assist in the fairness of academic tasks assessments.

D16. The Bloom's Taxonomy focuses on student learning rather than student performance.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D17. The curriculum is arranged in a coherent and logical sequence to promote student learning and growth.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D18. Tick the appropriate box to indicate your nature and type of the thematic learning units.

Content-Based Curriculum		Curriculum-Based Curriculum		Competency-Based Curriculum		Subject Matter-Based Curriculum	

D19. What are the specific curriculum objectives of your programme?

D20. What is the philosophy of your education programme?

D21. What is your overall impression with the subject you are teaching?

D22. It is useful to know more about the students' needs and characteristics than prior measure of academic achievement.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D23. What are the things that you would like to see improved in the overall educational experience in your programme subjects and curriculum?

Thank you for your time. Your valuable input is greatly appreciated!

LECTURERS' PREINTERVENTION INTERVIEW SCHEDULE (LPREIIS)	APPENDIX D

Tick the appropriate box.

Male			Black		Indian			Name of Participant
Female			Coloured		White			Subject
Others			Others					Programme

Introduction

Good morning/afternoon! Thank you for agreeing to meet with me and share your views.

As you may know, the purpose of this interview is to help us understand your learning, teaching and assessment experiences and the implementation of the instructional model, Integrated Teaching and Learning Model Using Assessment (ITLMUA).

Before we begin, let me review some important considerations. I am handwriting the interviews, followed by prompts where necessary, and will be reaffirm with you for authenticity during the interview, which will be kept confidential. I am just as interested in both the negative and positive comments and often the more challenging and in-depth comments are the most helpful.

Section 1: Educational Experiences

1.1. How long have you been a lecturer?

- Probing: Have you always been a lecturer in higher education sector?

1.2. What is your aim as a lecturer at the Durban University of Technology?

- Probing: do you think you have/will achieve this aim?

1.3. What is your perception of teaching and assessment in higher education institution?

- Probing: Is your perception in line with university policy on teaching and assessment?

1.4. What learning theories do you use in your teaching and assessment strategies?

- Probing: Which learning theory in particular do you mostly use?

Section 2: Educational Technology

2.1. How do you use educational technology in your teaching and learning process?

- Probing: In your opinion, which educational technologies impress you the most and least?

2.2. What instructional model do you employ in your teaching and learning process?

2.3. Do you have any suggestions that you need to share to improve Clinical Technology programme and subjects offerings?

Thank you for your time. Your valuable input is greatly appreciated!

LECTURERS' POSTINTERVENTION SURVEY QUESTIONNAIRE (LPOSTISQ)	APPENDIX E

Dear Participants

Your participation in this research study is highly appreciated and welcomed. Please respond and answer the following statements and questions as best as you can since your input to this study is vital.

Tick the appropriate box in demographics template section below, and the Likert Scale statements. Answer the questions as best as you can.

Male			Black		Indian			Participant Staff No.	
Female			Coloured		White			Subject	
Others			Others					Programme	

PART A : TEACHING

A1. Which learning theories and teaching strategies are you using during your lecturing sessions?

A2. What are your desired and expected goals when you are teaching?

A3. What are your strengths and weaknesses in teaching?

Strengths:
Weaknesses:

A4. How do you improve your teaching skills?

A5. Indicate from 1-6 your preferred teaching methodology:

Lecture		Demonstration		Concepts & Principles	
Application		Memorization		Understanding	

A6. I embrace team-teaching based on themes across subjects in Clinical Technology programme.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Justify:				

A7. What is your understanding of aligning teaching activities and assessments with learning outcomes?

A8. Briefly describe students; behavior when it comes to learning.

A9. What students are taught is more important than how they are taught.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Explain:				

A10. What is the frequency of review or re-teaching the subject concepts?.

1. Always	2. Seldom	3. Rarely	4. Not Necessary	5. Never

A11. How would suggest to improve teaching practices in higher education sector.

PART B : LEARNING

B1. What learning approach is adopted by students in your programme?

B2. If the learning outcomes, teaching and assessment are well aligned, the assessment results are likely to be reasonably valid.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Justify your selection:				

B4. What learning style/s the majority of your students are using?

B5. What strategies are you using to improve your teaching and influence students' learning?

Improve teaching:
Influence students' learning:

B6. What is your conception of learning?

B7. How would suggest to improve student learning in higher education sector?

B8. There is a distinct difference between learning outcomes and teaching activities.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Explain:				

B9. Instructional activities and assessment tasks are distinct, yet complementary.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Explain:				

B10. What is your perception of students' mastery of the subjects' concepts?

B11. What would you suggest for students to improve their learning?

PART C : ASSESSMENT

C1. Assessment strategies are well aligned with teaching strategies and learning outcomes.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Provide an illustrative example of alignment:				

C2. What is the rationale for assessing students?

C3. Tick the appropriate box that represents your opinion about the purpose of assessment.

Prove student learning	Improve student learning	Both to prove and improve student learning

C4. What is your understanding of mismatch between assessment practices, pedagogical practices and curriculum?

C5. Describe how learning theories impacted on your teaching strategies.

C6. Why it is important it is to know and understand students' learning styles and approaches?

C7. How is assessment information used in your subject that you are teaching?

C8. Tick the appropriate box to indicate the purpose of your assessment.

Knowledge possession		Knowledge Use		Academic achievement	
Justify your selection:					

C9. Why it is important to align teaching and assessment with stated learning outcomes?

C10. Different types of learning outcomes require different types of assessment.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Justify:				

C11. Similar types of learning outcomes, regardless of the subject matter, require similar approaches to assessment.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

C12. I have the competence to assess students at various taxonomic levels.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

C13. Changing the assessment method is a way to influence student's attitudes towards their studies.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

C14. Traditional assessment inhibits the development of students' independence and creativity when compared to alternative assessment.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

C15. What are the two significant role of assessment?

1.
2.

C16. What should students be assessed on during their learning experience?

C17. To what extent does your assessment measure the important curricular objectives?

C18. During assessment, I do assess what I have taught.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

C19. Tick the appropriate box to estimate the percentage of your students who had been taught the minimum material necessary to pass each item on a standardized written theory (achievement) test.

50-59%		60-69%		70-79%		80-89%		90-99%	

C20. The amount of time lecturers spent on assessment activities is adequate.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

C21. There is high degree of recognition and acceptance of assessment policy and assessment practices at DUT?

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

C22. How would suggest to improve assessment practices in higher education sector.

PART D : MISCELLANEOUS

D1. Students are being informed of the significant and critical subject matter information during lectures.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Explain how are you doing it:				

D2. What are the three main objectives that underpin your learning units of the subject you are lecturing?

D3. What instructional approaches are you using to ensure that students are involved in cognitively complex academic activities?

D4. What are your remedial interventional strategies that you use to motivate your students to engage in academic activities at the expected level and standard?

D5. How do you promote students' fair and equitable participation during lectures?

D6. What strategies are you employing to encourage students to develop academic interactivity and effective relationship among and between themselves and the lecturer?

D7. How is information technology and communication integrated and utilized in instructional activities of your subject?

D8. What are the strengths and limitations of the implemented instructional model?

Strengths:
Limitation:

D9. How do you address the ineffectiveness and inefficiencies of your subject/s in your programme?

Subject:
Programme:

D10. Programme resources and curriculum framework are aligned with subject content.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Explain:				

D11. Critical subject information is identified and reviewed so that it remains responsive to students' learning experience.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D12. Do you currently use an existent instructional model during your pedagogical practices?

Yes		No		Justify your selected answer in terms of rationale and purpose of the model:
Rationale:				
Purpose:				

D13. Involvement in the implementation of the ITLMA has given me enough ammunition to engage with curriculum reappraisal process.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D14. How do you determine that the knowledge demands and the level of difficulty of your subject are appropriate?

D15. The Bloom's Taxonomy focuses on student learning rather than student performance.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D16. The thematic learning units are arranged in a coherent and logical sequence to promote student learning and growth.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D17. Tick the appropriate box to indicate your nature and type of the thematic learning units.

Content-Based Curriculum		Curriculum-Based Curriculum		Competency-Based Curriculum		Subject Matter-Based Curriculum	

D18. What is the consequences and impact of the ITLMA on student learning and pedagogical practices?

Student learning:
Pedagogical practices:

D19. It is of increasingly significance for lecturers to demonstrate the importance of students being made aware of their metacognitive activity.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D20. What are the things that you would like to see improved in the overall educational experience in your programme subjects and curriculum?

D21. The Bloom's Taxonomy focuses on student learning rather than student performance.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D22. The model had informed me of the availability of blended learning theories and pedagogical principles that can be used to enhance both student learning and pedagogical practices.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D23. Teaching and learning models are a necessary component of the educational system in higher education.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Justify:				

D24. The model assisted students with to engage and interact with new information and knowledge.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D25. What is the impact of the model in your teaching, learning and assessment practices?

D26. The students' expectations and experience where accomplished as a result of the implementation of the model.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D27. My pedagogical practices in higher education were appraised by the utilization of the teaching and learning model.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D28. In your opinion, do you think that the teaching and learning model may necessitate change of curriculum?

D29. How do you prepare students for working in a changing world, for life-long learning and to be receptive to new situations?

D30. It is of increasingly significance for lecturers to demonstrate the importance of students being made aware of their metacognitive activity.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D31. What are the specific curriculum objectives of your programme?

D32. What is the philosophy of your educational programme?

D33. What is your overall impression with the teaching and learning model using assessment?

D34. What would you like to see improved in the model of teaching and learning using assessment?

Thank you for your time. Your valuable input is greatly appreciated!

LECTURERS' POSTINTERVENTION INTERVIEW SCHEDULE (LPOSTIS)	APPENDIX F

Tick the appropriate box.

Male			Black		Indian			Name of Participant		
Female			Coloured		White			Subject		
Others			Others					Programme		

Introduction

Good morning/afternoon! Thank you for agreeing to meet with me and share your views.

As you may know, the purpose of this interview is to help us understand your learning, teaching and assessment experiences and the implementation of the instructional model, Integrated Teaching and Learning Model Using Assessment (ITLMUA).

Before we begin, let me review some important considerations. I am handwriting the interviews, followed by prompts where necessary, and will be reaffirm with you for authenticity during the interview, which will be kept confidential. I am just as interested in both the negative and positive comments and often the more challenging and in-depth comments are the most helpful.

Introduction

Section 1: Educational Experiences

1.1. How important are learning theories in your teaching practice?
1.2. What is your view in using teaching strategies with learning theories?
1.3. What is your perception about the implementation of the instructional model in your teaching, learning and assessment?

Section 2: Educational Technology

2.1. How do you use educational technology in your teaching and assessment strategies?
■ Probing: In your opinion, which educational technologies impress you the most?
2.2. Are you using e-learning in your pedagogical practices?

Thank you for your time. Your valuable input is greatly appreciated!

STUDENTS' PREINTERVENTION SURVEY QUESTIONNAIRE (SPREISQ)	APPENDIX G

Dear Participants

Your participation in this research study is highly appreciated and welcomed. Please respond and answer the following statements and questions as best as you can since your input to this study is vital.

Tick the appropriate box in demographics section and Likert's scale statements. Answer the questions as best as you can.

Male			Black		Indian			Participant Student No.	
Female			Coloured		White			Subject	
Others			Others					Programme	

Tick the appropriate box.

PART A : ASSESSMENT

A1. What are your two most preferred method of assessment?

1ST choice: 2nd choice:
Explain your first choice:
Explain your second choice:

A2. What are your two least preferred method of assessment?

1ST choice: 2nd choice:
Explain your first choice:
Explain your second choice:

A3. Assessment methods used in the programme assess what they are supposed to assess.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A4. Lecturers explain the different methods of assessment for their subjects, and explain the goals of assessment approaches.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
List an assessment goal for any of your subjects in your programme:				

A5. Assessment practices used in the programme prepare me adequately for life after graduation.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A6. When you are being assessed, you expect a good mark or acquisition of knowledge.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A7. How useful is the assessment criteria in assisting you to perform exceptional in your assessment?

5. Very Useful	4. Somehow Useful	3.Not Very Useful	2.Useless	1. Very Useless
Explain:				

A8. Assessment activities are aligned and matched with the learning outcomes.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Elaborate:				

A9. The total average number of assessments for each subject in the programme is adequate and acceptable.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Briefly discuss your choice:				

A10. The assessment questions are straightforward and easily understood.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A11. Assessment standards and expectations are explained for all assessment activities.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A12. The assessment practices are appreciated and valued as they assess knowledge, skills and abilities.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A13. Lecturers' feedbacks on assessment activities are academically beneficial to student learning.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Explain:				

A14. Tick the most appropriate box to indicate the purpose of assessment.

Knowledge Acquisition	Knowledge Construction	Knowledge Application	Knowledge Sharing
Explain your selection:			

A15. Tick the appropriate box that indicates the focus of assessment.

Process and product of learning.		Construction of knowledge and understanding.		Student Learning and empowerment.	
Explain your selection:					

A16. The power of assessment resides in their close connection to the learning outcomes and teaching.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Give a reason for your choice:				

A17. Different types of learning outcomes require different types of assessment.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Brief explanation of your choice:				

A18. Changing the assessment method is a way to affect and influence your attitudes towards your studies.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A19. Do you think that lecturers assess what they have taught?

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A20. The amount of time lecturers spent on assessment activities is adequate.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A21. Prepare differently for different assessment methods.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A22. What would you suggest to improve assessment practices in higher education?

PART B : LEARNING

B1. What is your personal aspiration when your are engaged in a learning process?

B2. What is your preferred approach when studying for your different subjects in your programme?

B3. Tick the appropriate box that indicates your learning goal when studying.

Focus on memorizing and reproduction factual content.		Focus on meaning and understanding from the content to be learned.		Work hard to pass and maximizes the chances of academic success.	

B4. What strategies are you using to accomplish learning goal you ticked in B3. above?

B5. How do you know when you have learnt and understood something?

B6. What is your understanding of learning outcomes and assessment criteria?

Learning outcomes:
Assessment criteria:

B7. The learning outcomes of all subjects in your programme are relevant and appropriate.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

B8. Are the learning outcomes associated and coordinated with the assessment activities?

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

B9. How do you learn and approach your studies when you are preparing for any assessment activities?

B10. Tick the appropriate box to indicate your learning style (You may tick a maximum of two selections)

Visual (Seeing)		Kinesthetic		Auditory (Hearing)		Tactile (Touch)	

B11. How are you informed about the subject learning outcomes, teaching strategies and assessment methods?

B12. Teaching is aligned with stated learning outcomes.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Explain:				

B13. Similar types of learning outcomes, regardless of the subject matter, require similar approaches to learning and assessment.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

B14. Are the learning outcomes, teaching strategies and assessment methods aligned appropriately?

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

B15. When I am involved with learning, I persevere, work harder, and produce work of higher quality.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Justify your selection to the statement:				

B16. My expectation when I am participating in academic activities is to get good percentage marks.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

B17. The abilities that students must demonstrate are spoken and made available to students in their study guide.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

B18. We are informed about subjects' expectations and achievements in the respective subjects study guides.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

B19. Do you think that various methods of assessment influence your approach to learning?

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

B20. What is it that you expect and hope to achieve when you engage with learning?

B21. The amount of learning in class is increased as compared to when I am studying on my own.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Justify your selection:				

B22. I learn more when I take time to study.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Justify your selection:				

B23. A teaching intervention assists in a quicker understanding of the subject learning outcomes.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Justify your selection:				

B24. I am able to cope with increasing learning outcomes complexity as we progress with the course.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

B25. Academic activities assigned and assessments are closely aligned with the learning units learning outcomes.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

B26. Learning theories are used by the lecturers when teaching their respective subjects.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Justify your selection:				

B27. Are your lecturers used any learning theories in their teaching strategies? (Tick the appropriate box)

Yes		No		I am not sure		Not at all	

B28. What would you suggest to be improved in the subjects in the programme?

PART C : TEACHING

C1. How do you want to be taught in your different subjects in your programme?

C2. I am satisfied with lecturers' teaching strategies/style used in your programme.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

C3. What are your preferred teaching methods used in higher education?

C4. How do you rate the teaching methods used in your programme?

5. Very satisfactory	4. Somewhat satisfactory	3. Satisfactory	2. Not very satisfactory	1.Not at all satisfactory
Explain:				

C5. Tick the appropriate box to indicate your preferred teaching strategy.

Convey factual information and concepts		Facilitate and guide learning	

C6. Do they teaching style of your lecturers match your learning style?

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Justify your selection:				

C7. My lecturers use varied teaching strategies during lectures.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Give one preferred illustrative examples of a teaching strategy:				

C8. In your opinion, do you think that lecturers employ teaching strategies that encourage students to focus on their learning?

C9. Tick the appropriate box to indicate what you think is the main focus for teaching.

Test preparation		Facilitate learning		Lifelong learning	

C10. Subjects learning outcomes are aligned with teaching and assessment strategies.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

C11. The teaching and assessment strategies used in your programme encourage collaborative and cooperative learning.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Support your selection:				

C12. What would you suggest to improve teaching in Clinical Technology programme?

PART D : MISCELLANEOUS

D1. The 2nd year subjects are generally challenging as compared to the 1st year subjects.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D2. Tick the appropriate box to indicate the feedback format.

Verbal	Written	%Mark	All

D3. The lecturers' interaction and relationship and environment motivates student learning.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Describe the interaction and relationship:				

D4. The environment is conducive to student learning.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D5. What are your strengths and weaknesses in learning?

Strengths:
Weaknesses:

D6. The subjects' offerings in your programme make connections with learning outcomes and prior knowledge.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D7. How do you motivate and support yourself, particularly with areas of learning that are at risk?

D8. Tick the appropriate box that indicates the hours you study per week.

5 hours		10 hours		15 hours		20 hours		25 hours	

D9. Tick the appropriate box that indicates your study preparation for the next lectures.

1. Always	2. Seldom	3. Not at all

D10. How often do you answer questions posed by the lecturer during teaching?

1. Always	2. Seldom	3. Rarely	4. Never	5. Not necessary

D11. How is your lecturer managing and maintaining order and discipline during teaching?

D12. The programme subjects are integrated and aligned thus make the learning easier.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D13. The interaction and relationship with classmates is based on collaboration and co-operation.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Elaborate:				

D14. Feedback information is used to improve academic work and learning.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D15. There is a teaching and learning model that is used in my programme.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D16. In an order of 1-5, mark the appropriate box with your preferential participatory involvement during lectures.

Listening		Asking questions		Share idea		Quiet & passive		Active	

D17. Lecturers make time to consult with students to assist with academic challenges.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D18. The academic interaction and relationship with lecturers is supportive and accommodating.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D19. The integration of technology in the delivery of the subjects is up to standard.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D20. Technology is integrated and used in a creative way to help student learn.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D21. The design and compilation of learning material with regard to content, navigation, usability and structure are well-organized, user-friendly, and easily understood.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D22. The subjects are well aligned with the intended learning outcomes and goals of the programme.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D23. The use of technology in the delivery of the subjects', impacts positively on student learning.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D24. The subject content is concise, well organized, and stimulates to think critically.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D25. Practicals, where applicable, are clearly linked with theory.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D26. The infrastructure and provision of resources make practicals efficient.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D27. Overall, I am satisfied with the quality of subjects' offerings in my programme.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D28. The curriculum is arranged in a coherent and logical sequence to promote student learning and growth.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D29. What are the specific curriculum objectives of your programme?

D30. What is the philosophy of your education programme?

D31. What it is that you like and impresses you most about the subjects offering of this programme.

D32. What would you like to see improved in your programme.

Thank you for your time. Your valuable input is greatly appreciated!

STUDENTS' PREINTERVENTION INTERVIEW SCHEDULE (SPREIIS)	APPENDIX H

Tick the appropriate box.

Male			Black		Indian			Name of Participant	
Female			Coloured		White			Subject	
Others			Others					Programme	

Introduction

Good morning/afternoon! Thank you for agreeing to meet with me and share your views.

As you may know, the purpose of this interview is to help us understand your learning, teaching and assessment experiences and the implementation of the instructional model, Integrated Teaching and Learning Model Using Assessment (ITLMUA).

Before we begin, let me review some important considerations. I am handwriting the interviews, followed by prompts where necessary, and will be reaffirm with you for authenticity during the interview, which will be kept confidential. I am just as interested in both the negative and positive comments and often the more challenging and in-depth comments are the most helpful.

Section 1: Educational Experiences

1.1. What is your aim as a student at the Durban University of Technology (DUT)?

- Probing: do you think you have/will achieve this aim?

1.2. In general, what do you think about the way your lecturers teach?

- Probing: do you have any recommendation to them?

1.3. In general, what do you think about the way your lecturers assess?

- Probing: do you have any recommendation to them?

1.4. Do you think that you have a clear understanding of what you are expected to do when you are being assessed.

1.5. What are your views about the nature of feedback you receive from your lecturers?

- Probing: do you have any recommendation to them?

1.6. How do you use feedback information that you receive from your lecturers?

1.7. How useful is the learning material that you receive from lecturers?

Section 2: Educational Technology

2.1. In your own opinion, which educational technologies impress you the most and why?

2.2. Do you think that the use of lectures and technology help to develop as a student?

Section 3: Teaching Strategies and Learning Theories

3.1. What teaching strategies are used by the lecturers?

3.3. Do you have any suggestions that you need to share to improve Clinical Technology programme and subjects offerings?

Thank you for your time. Your valuable input is greatly appreciated!

STUDENTS’ POSTINTERVENTION SURVEY QUESTIONNAIRE (SPOSTISQ)	APPENDIX I

Dear Participants

Your participation in this research study is highly appreciated and welcomed. Please respond and answer the following statements and questions as best as you can since your input to this study is vital.

Tick the appropriate box in demographics section and Likert’s scale statements. Answer the questions as best as you can.

Male			Black		Indian			Participant Student No.	
Female			Coloured		White			Subject	
Others			Others					Programme	

Tick the appropriate box.

PART A : ASSESSMENT

A1. We are being assessed as indicated in the learning outcomes of each lecture.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A2. Assessment practices prepare us for the real-life clinical situation.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A3. We are given assessment criteria for all assessment activities.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A4. Assessment criteria help us to produce better academic work.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A5. The total average number of assessment for each subject in the programme is adequate and acceptable.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Justify your choice:				

A6. Assessment standards and expectations are explained for all assessment activities.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A7. Tick the most appropriate box to indicate the purpose of assessment.

Knowledge acquisition		Knowledge construction		Knowledge application		Knowledge Sharing	

A8. Tick the most appropriate box to indicate the focus of assessment.

Process and product learning		Construction of knowledge and understanding		Student learning and empowerment	

A9. Assessment practices of the instructional model assess not only knowledge, skills and abilities, but also application on varied educational and professional contexts.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A10. To what extent do instructional model’s assessment methods affect your learning?

A11. Assessment has a positive effect on student learning..

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A12. What are your views about alternative assessment methods used in the teaching and learning model as compared to the traditional assessment methods?

A13. What is your opinion about students' involvement in assessment practices in higher education?

A14. Changing the assessment methods is a way to influence your attitudes towards your studies.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A15. Lecturers use the most appropriate forms of assessment.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A16. Do you think that lecturers assess what they have taught?

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A17. Assessment activities and related information are used to improve learning.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A18. The power of assessment resides in their close connection to the learning outcomes and teaching.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A19. The amount of time lecturers spent on assessment activities is adequate.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

A20. What would you suggest to improve assessment practices in higher education?

PART B : LEARNING

B1. In your opinion, what it is that is easily observable when somebody states that learning has taken place?

B2. What are your desired and expected learning goals in your programme?

B3. Lecturers have fair idea of individual inconsistencies regarding the varied student learning personalities.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

B4. What are your preferred learning style, teaching style and assessment methods?

Learning style (how do you learn) and justify your choice:
Teaching style (How do you like to be taught) and justify your choice:
Assessment method (how do you like to be assessed) and justify your choice:

B5. What are your learning and weaknesses?

Strengths:
Weaknesses:

B6. Learning styles and approaches to learning made me to adapt to varied teaching strategies.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

B7. How influential is the environment at the Durban University of Technology to your learning?

B8. The amount of learning is more effective during class as compared to self-study.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Justify your selection:				

B9. I learn more when I dedicate more time to my learning.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Justify your selection:				

B10. I am able to cope with increasing learning outcomes complexity as we progress with the course.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Justify your selection:				

B11. Academic activities are closely aligned with the learning outcomes.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Justify your selection:				

B12. The design and compilation of learning material are satisfactory.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

B13. The learning outcomes arer clearly communicated to students.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

B14. Tick the appropriate box that indicate the hours you study per week.

5 hours		10 hours		15 hours		20 hours		25 hours	

B15. Different types of learning outcomes require different types of assessment.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

B16. Similar types of learning outcomes, regardless of the subject matter, require similar approaches to assessment.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

B17. What is your suggestion to improve in higher education?

PART C : TEACHING

C1. Lecturers used teaching strategies and styles that are generally satisfactory go students.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

C2. Lecturers use different teaching approaches to accommodate students' diversity of the class.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Give two example:				

C3. Tick the appropriate box to indicate your preferred teaching strategy.

Convey factual information and concepts		Facilitate and guide learning	

C4. There is a good match between learning styles and lecturers' teaching styles.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Justify your selection:				

C5. In your opinion, do you think that lecturers employ teaching strategies that encourage students to focus on their learning?

C6. Tick the appropriate box to indicate what you think is the main focus for teaching.

Test preparation		Facilitate learning		Lifelong learning	

C7. Subjects learning outcomes are aligned with teaching and assessment strategies.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

C8. The teaching and assessment strategies used in your programme encourage collaborative and cooperative learning.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Support your selection:				

C9. The teaching strategies employed by the lecturers made understanding of the subject factual information and concepts much easier.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

C10. The teaching and assessment must be aligned with stated learning outcomes.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

C11. A teaching intervention assist in a quicker understanding of the subject learning outcomes.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree
Justify your selection:				

C12. What would you suggest to improve teaching in your programme?

PART D : MISCELLANEOUS

D1. How are you using feedback information from your lecturers?

D2. Tick the appropriate box to indicate the feedback format.

Verbal	Written	%Mark	All

D3. How would you describe lecturers' interaction and relationship with students?

D4. Describe the adequacy of infrastructural support and lectures quality.

D5. How do you motivate and support yourself, particularly with areas of learning that are at risk?

D6. Lecturers are well aware of the students prior knowledge, and integrate it with new knowledge to enable accomplish of highest academic achievement.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D7. The lecturers focus our understanding of subjects' concepts and their relationship which improves learning.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D8. Understanding increases as we are able to break down information and rebuild it with logical connection to increase understanding,

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D9. The subjects in Clinical Technology programme give students the ability and skills to construct their own knowledge when solving real-world problems.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D10. Tick the appropriate box that indicates your study preparations for the next lectures.

1. Always		2. Seldom		Not at all	

D11. How often do you answer questions posed by the lecturer during teaching?

1. Always	2. Seldom	3. Rarely	4. Never	5. Not necessary

D12. The interaction and relationship with classmates is based on collaboration and co-operation.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D13. In your own opinion, is there any teaching and learning model in your programme?

Yes		No		Substantiate your answer:

D14. In an order of 1-5, mark the appropriate box with your preferential participatory involvement during lectures.

Listening		Asking questions		Share idea		Quiet & passive		Active	

D15. Lecturers make time to consult with students to assist with academic challenges.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D16. The study guides are useful in supporting and guiding my learning, and contain relevant information, for example, assessment activities, submission dates and assessment topics.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D17. The academic workload, including assessment, for programme subjects, is manageable.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D18. The integration of technology in the delivery of the subjects is up to standard.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D19.

The academic interaction and relationship with lecturers is supportive and accommodating.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D19. The implementation of the model has impacted positively in my learning.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D20. The model was able to influence adaptation and assimilation to varied types on academic tasks with ease.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D21. The model feedback was prompt and very helpful in our learning.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D22. The assessment strategies of the model involve students in assessment practices in higher education.

1. Strongly Disagree	2. Disagree	3. Neutral	4.Agree	5. Strongly Agree

D23. What are the specific curriculum objectives of your programme?

D24. What is your overall impression of the teaching and learning model using assessment?

D25 What would you like to see improved in the subject and the programme?

Thank you for your time. Your valuable input is greatly appreciated!

STUDENTS' POSTINTERVENTION INTERVIEW SCHEDULE (SPOSTIIS)	APPENDIX J

Tick the appropriate box.

Male			Black		Indian			Name of Participant	
Female			Coloured		White			Subject	
Others			Others					Programme	

Introduction

Good morning/afternoon! Thank you for agreeing to meet with me and share your views.

As you may know, the purpose of this interview is to help us understand your learning, teaching and assessment experiences and the implementation of the instructional model, Integrated Teaching and Learning Model Using Assessment (ITLMUA).

Before we begin, let me review some important considerations. I am handwriting the interviews, followed by prompts where necessary, and will be reaffirm with you for authenticity during the interview, which will be kept confidential. I am just as interested in both the negative and positive comments and often the more challenging and in-depth comments are the most helpful.

Section 1: Educational Experiences

1.1. What is it that you expect to achieve when you are attending the university such as the Durban University of Technology (DUT)?

- Probing: Do you think what you expected has been or will be achieved?

1.2. In your own opinion, do you think that the introduction of the instructional model facilitated teaching, learning and assessment?

- Probing: Give an example of such facilitation in teaching, learning and assessment.

1.3. Are you clear what it is that is required when you are being assessed?

- Probing: Do you think that clarity of assessment requirement has improved the way you answer questions?

1.4. ■ How useful is feedback you receive from the lecturers help you to improve your learning?

Section 2: Instructional Model

2.1. What are the changes that you recognized in the teaching approach of your lecturers?

2.2. Do you think the implementation of the instructional model has influenced how lecturers teach and how you learn?

2.3. Can you briefly describe your experience with the implementation of the instructional model?

Section 3: Educational Technology

3.1. What educational technologies are used in teaching and learning?

3.2. Do you have any suggestions that you need to share to improve Clinical Technology programme and subjects offerings?

Thank you for your time. Your valuable input is greatly appreciated!

OBSERVATION CHECKLIST FOR LECTURERS' PERFORMANCE OUTCOMES ASSESSMENT (OCLPQA)				APPENDIX K
Adapted from Armstrong Atlantic State University (AASU) Lecturer:__________________________________ Subject: ___________________________________ Date: _________________________ Observer: ____				
Domain 1: Planning, Preparation and Content Organization (Get ready activities to interact with students in the classroom- Huitt, 2003).				
Consistent Behaviour 3	Usual Behaviour 2	Rare Behaviour 1	**Conceptual Framework Principles**	
			Evidence of reflective knowledge of student diversity characteristics, including learning styles.	
			Made clear statement of the purpose and overview of the lesson, including teaching goals and learning outcomes.	
			Use effective teaching strategies and learning activities, including appropriate pacing linking and summary of the lesson.	
			There are clear assessment criteria and standards aligned to learning outcomes and the level of study.	
			Respond to problems raised during lessons and allow students to answer their peers questions and problems.	
Comments:				
Domain 2: Instruction and Student Management (Controlling student behavior-Huitt, 2003).				
			Use intonation to vary emphasis with easily heard projected voice and clarity in explaining ideas.	
			Maintain eye contact with students and project non-verbal gestures consistent with intention, thereby making students attentive and focused.	
			Defined unfamiliar terms, concepts, principles and present examples to clarify points by relating new ideas to familiar concepts.	
			Restate important ideas at appropriate times and provide varied explanations for complex and difficult material.	
			Ensure student safety through effective organization of all aspects of the classroom physical environment.	
			Use humour appropriately to strengthen retention and interest and use limited use of repetitive phrases.	
			Encourages critical thinking through questioning and discussions techniques.	
			Monitors learning, provides feedback and adjust learning activities to meet the needs of students.	
			Use formative assessment to modify teaching and summative to measure learning.	
			Integrate technology to enhance learning and teaching.	
Comments:				
Domain 3: Professional responsibility.				
			Reflects on teaching and improves his/her teaching.	
			Timely interaction with students, provision of feedback and advocacy.	
			Promote collaboration and co-operation among programmes and colleagues.	
			Communication with external stakeholders w.r.t. students' progress and achievement.	
			Adheres to policies, rules and other legal frameworks.	

Comments: