METRIC SCOPE FOR INDEXING UNIVERSITY INFORMATION TECHNOLOGY PROFESSIONALS’ CONTINUOUS IMPROVEMENT IN ICT INTEGRATION

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Operationalizing Key terms

- **Current ICT integration Index**: An instantaneous measure of ICT integration
- **ICT**: Digitized hardware, software and persware used to aid learning process
- **ICT integration Index**: These are the dispersed range of output as a result of varied metric factors influencing ICT integration. It is defined by four levels; verbal (LI), written (LII), courseware (LIII) and combination of the first three approaches (LIV) used by teaching professional during a lesson.
- **Improvement**: A resultant organizational learning, measured by positive change from a lower to a higher level in ICT integration performance level (LI to LN) of a university IT teaching professional.
- **Index**: a measure or external summative metrics of ICT integration
- **Integration**: is a process in which UITTPs is using either ICTs verbally, or written ICTs or courseware or all the three ICTs suitably in learning process to achieve learning objectives.
- **Metrics for UITTP ICT integration**: These are the internal measurable variables that influences ICT integration index; they include factors like attitude of the teaching professional towards ICT integration, level of problems in ICT integration and conditions of essentials of ICT integration.
- **University information technology teaching professionals (UITTPs)**: The personnel involved in ICT integration process during dissemination of knowledge, skills and attitude through use of ICT in the universities.
ABSTRACT

• There is progress in the development of ICT integration indices to support management of teaching in institutions,
• little empirical research on metrics for continuous improvement in ICT integration indexing of university information technology teaching professionals (UITTP)
• However, UITTP continuous improvement indexes can offer leadership role
• The UITTPs index of ICT integration can improve the graduates’ ability’s effective use of ICTs.
• The UITTPs with higher index will expose students to relevant ICT experiences during their teaching.
• The UITTPs with better ICT integration index can have better influence to the graduates’ ICT integration level.
• The aim of this study was to derive a metric scope for indexing continuous improvement of ICT integration by UITTP.
• In particular the study involved survey:
  (a) to examine the current ICT integration Indexes based on Wan et al (2009) ICT integration four levels model.
  b) to establish the extent to which use is made of existing metrics.
  c) Establish Experts view on Suitability of the existing metrics
Research methodology

• The study adopted design based mixed research approach by undertaking a desktop research and descriptive survey

• purposively sampled 2 public and 2 private Kenyan universities’ Information Technology Professionals populace practicing in Information Technology and computing departments

• Interviews were done to 30 University IT teaching professionals and 6 human resource, 6 quality assurance officers and 6 ICT directors. 6 head of departments

• findings were quantitatively and qualitatively analyzed.
Findings

A) Currently UIITTP integrate ICT at level III (70.4%), (teaches with the aid of computer, courseware, software or internet only.)

- despite the existence of essential conditions (84.6%), the Lecturers would still not integrate ICT.

- Therefore there is need to continuously support integrators, monitor them.

B) Use of Existing metrics to index integration (33.8%) - generally less frequent

- UITTP motivation and commitment metrics and workshop content relevance metrics being the most frequently used metric (48%), least used metric being technical malfunction metrics at (27.4%).

- that the university managements do not know whether the ICT investments are worthwhile, neither do they know whether the students are benefiting from the ICT integration efforts.

WORSE Danger with non UITTP

C) Metrics are highly suitable (92%) for managing university teaching

- the most perceived suitable metric was attitude while internet access from home metric was the least perceived suitable metric

- human factors is still perceived as more suitable metrics compared to technological factors metrics

- Tech factors need to be given same emphasis as human factors
The ICT Integration Improvement Challenge in University Teaching

• A study by National Council for Science and Technology-June, (2010) confirmed that ICT tools and practices have not improved education quality and quantity.
• An earlier study by Olson, (1981) found out that ICT as a teaching tool is being abused in covering the curriculum, this could be worse more so in universities whereas they are expected to provide leadership to other lower level institutions and other sectors.
• Recent studies in Vietnam similarly found out that although lecturers recognized the potential of ICT, they will not necessarily put integration of ICT into their practice (Ly Thanh Hue and Habibah Ab Jalil, 2013).

• ICT alone therefore will not improve the effectiveness of teaching and learning; they need to be integrated into the curriculum through a systematic approach.

• Atsumbe, Raymond, Enoch and Duhu (2014) also found out that lecturers and students in Federal University of Technology, Minna, had computers and laptops and can access the internet but, they do not use them for teaching and learning.
• possession or availability of ICT resources is one thing while utilization of the resources is another.
IS Continuous Improvement in ICT Integration Possible?

• According to Argyris (1978) double loop organizational learning theory an organization’s employee individual’s mind map and actions can be aligned to the organization’s objectives (first loop), and the difference (chaos) in such alignment need to be determined (second loop).

• It also borrows from knowledge based theories of model view of knowledge engineering. The knowledge engineering approach suits this study because the ICT knowledge of an individual university teaching professional need to be mapped and indexed to solve the problems of ICT integration.

• This model view also gives a closer approximate to reality; and perceives problem (chaos) as dynamic, cyclic, incessant process that is dependent on the knowledge acquired and interpretations made by the systems; this is similar to how experts solve problems in real life.

• It is thus suitable for application in individualized continuous improvement in ICT integration indexing. However; continuous improvement has the challenge of complexity. This calls for the need to index such improvements.
Indexing Continuous Improvement of ICT Integration

• An index is a measure. Ability to measure what we are speaking of and expressing it in numbers enables us to know that on which we are discoursing. But if we cannot measure and express it in numbers then our knowledge is of a very meager and unsatisfactory kind (Lord Kelvin’s, 1824-1907, Deming, 1947 and Wagner et al, 2012).

• Index would help assess the extent that ICT has been aligned with pedagogy. Such plans and implementation should meet current and future teaching needs (UNECA, 2010).

• UITTPs ICT integration index critical for developing countries universities, since the pace at which ICT integration is taking place is worryingly slow, lack focus and non-systematic (Nangue, 2011).

• but most focus has been on primary and secondary schools (Shafiei, 2005; Toledo, 2005) and have mostly been based in developed countries.

• Akbulut, (2010) asserts that institutional ICT integration levels measurements or indexing and evaluations are necessary.

• Akbulut (2010) investigations suggested that the ICT integration levels indexing in teacher training institutions are needed, and therefore conducted investigations in the perspectives of pre-service teachers.

• Saud (2011) also did investigation in TIVET (Technical industrial, vocational, Entrepreneurship Training) institutions and found it necessary to integrate ICT but this had not been exploited.

• All these efforts can be viewed as ICT management diagnostic studies. Management diagnostics is rapidly gaining concern so as to have an overall impact or picture (index) of educational institution with regard to ICT integration levels (index) (Akbulut, Kesim and Odabasi, 2007). However, such indexes need to be based on sound basis or metrics.
Metrics for Indexing Improvement in ICT Integration

- **metric** was first coined in 1793 by the French government to mean a new system of standards called metric system based
- 1868 American signed metric system into law. This made it possible to have a basis or standardization of measurement globally.
- In organizations, metrics is gradually becoming popular as the concern to determine, control human productivity. This has led to purposeful measurements such performance. Performance metrics define in quantitative terms the performance of various activities in a business (Fletcher, 2015).
- With the emerging need for continuous integration of ICT in organizations managers need to have standards or basis for determining productivity of ICTs.
- Specifically determining the extent to which personnel use them effectively. Can we therefore have standards or basis (metrics) for indexing their continuous improvement in integration?
Software Based Metric in Improvement of ICT Integration

- Software makes it easy to handle complex systems such as continuous improvement.
- By identifying the entities (which belong to an entity class) and the attributes of these entities (which are the targets of the measurement process).
- Attributes and the information needs are related through measurable concepts (which belong to a Quality Model in this case, ICT integration).
- According to Fenton, attributes can be external or internal. Attributes whose value depends on the environment in which the software operates are external, as opposed to attributes that do not depend on this environment, which are internal. Then, these attributes can be measured using metrics. A metric relates a defined measurement approach and a measurement scale. A metric is expressed in units, and can be defined for more than one attribute. Three kinds of metrics can be distinguished: direct metrics, indirect metrics, and indicators.

- A measurement approach is a generalization of the different approaches used by the three kinds of metrics for obtaining their respective measures. A direct metric applies a measurement method. An indirect metric uses a measurement function (which rests upon other direct and/or indirect metrics). Thirdly, an indicator uses an analysis model (based on a decision criteria) to obtain a measure that satisfies an information need (Bertoa and Vallecillo, nd). The act of measuring software is a measurement (as an action), defined as a set of operations that aim at determining a value of a measure, for a given attribute of an entity, using a measurement approach. Measures are obtained as the result of performing measurements (actions). In this study we concentrate on one particular quality model, ISO 9126, which is defined in terms of a set of characteristics and sub-characteristics, as well as the relationships between them, that provide the basis for specifying quality requirements and for evaluating quality. The entities of our study will be ICT integration
Trends in Existing Metrics for Indexing ICT Integration

• An attempt to manage ICT integration through metrics can be traced in studies by UNESCO (2002), which established four success ICT integration indicators:

  (a) content and pedagogy indicators, (b) collaboration and networking indicators, (c) social indicators, and (d) technical indicators, they termed them four competencies.

• Akbulut et al., (2007) later resorted to the Odabasi et al., (2006) report and maintained subcomponents of each of these competencies, and considered the number and coverage of items in each title and found these competencies to be insufficient for a reliable measurement.

• Akbulut (2009) then proposed a new factor structure (indicators or index) which included e-learning, infrastructure, teaching-learning methods, policy, special education, health, teaching communities, ease of use, e-interaction, technical assistance and access.

• Unfortunately, these new indicators proposed by Akbulut (2009) suppressed other aspects such as; ICT in the curriculum, professional development among other indicators.

• Again although Akbulut (2009) study revealed relationships among these indicators and their best predictors, these indicators however suppressed the teaching professional skills indicators.

• Considering the reliable and consistent factor structure proposed, an ICT integration index model should be based on the following:

  a) theories of dynamics of learning organizations (Senge, 1990),
  b) the importance of contributive instructional technology management (Gay, Mahon, Devonish, Alleyne, and Alleyne, 2006),
  c) the significance of planning and management through resorting to all organization members (Lauerma, 2000), and
  d) effective management and collaboration (Mehra and Mital, 2007; Sife, Lwoga, and Sanga, 2007).
Space for a comprehensive metrics essentially comprises enablers and barriers to integration. This argument is based on the planning theory of management that argues that a comprehensive plan scope entails enablers which include strength and opportunities of the current status of integration and barriers which include weaknesses and threats at the current ICT integration level (Demming, 1947).

Examples of enablers

ICT facilities made available, there is no guarantee that teachers will integrate the technology extensively in their teaching. Smart School reports (MoE, 2000; MoE, 2001), research findings by Sathiamoorthy, (2001); and Lee, (2000) indicated that there was minimal use of ICT in schools and questioned why teachers in Smart School have minimal use of ICT in the classroom even after availing all the essential conditions, they therefore attempted to know the conditions that facilitates the teachers’ ability to integrate ICT.

Studies by Wan et, al (2009) in Malaysian Secondary Smart Schools identified conditions that facilitated the implementation of ICT integration as ; availability of ICT resources, acquisition of ICT knowledge, accessibility to ICT resources, existence of support, teacher’s commitment to the innovation, influence of external forces; desire to change school practice.

Based on further analysis, these eight enabler attributes can be categorized into two, namely the essential and the supporting conditions.

The essential conditions are the conditions needed for the ICT implementation, whereas the supporting conditions are the condition which assures the continuation of the ICT implementation. These essential and support conditions therefore can be viewed as enablers to ICT integration.

As already mentioned a continuous improvement entails learning. Any learning process begins from current knowledge and should take care of that individual learner’s weakness and strength (Enablers). Based on this view this section review literature on existing integration metrics scope as discussed below.
• Current integration level (index) here refers to the resultant process or practice (behavior-external).
• Such ICT integration practice level measurement can be approached at individual level or organizational perspective.
• Individual level measurement studies in secondary schools, conducted by Wan et al., (2009) found out that teachers integrated ICT at one of the four levels in their teaching. At level one (LI), the teachers behaviorally integrated ICT as a verbal resource, at level two (LII) through printed resources, at level three (LIII) as hands-on (courseware) experience and as a combination of all the above three practices at level four (LIV).

• Wan et al., (2009) further argues that at level one (LI); the teacher teaches with the aid of ICT as verbal resource, giving the website addresses or name of courseware that would help students to enhance their understanding of the topics. At level two (LII); the integrator teaches with the aid of ICT as printed resources; distributes printed downloaded information as teaching aids. Level three (LIII) also referred to as hands on experience; teacher teaches with the aid of computer, courseware, software or internet only. At level four (LIV); the teacher teaches with the aid of computer, courseware, software or internet in delivering the lesson. She or he also gives out handouts with information printed from the Internet or courseware.

• Sheindold and Hadleys, (1990) in an earlier study also studied levels of integration and segmented the individual ICT integrators into five segments; enthusiastic beginners, supported integrated, high school naturals, unsupported achievers, and struggling achievers. These sub groups of ICT integration performance level can be measured further on other basis such as; experience and comfort with technology, grade level taught, applications and practice used and the extent of support by colleague and others.
Metrics for Indexing ICT Integration Enablers

• a comprehensive plan scope entails enablers which include strength and opportunities of the current status of integration and barriers which include weaknesses and threats at the current ICT integration level (Humphrey, 1970).

• Studies by Wan et al. (2009) in Malaysian Secondary Dynamic Schools identified conditions that facilitated (enabled) the implementation of ICT integration as; availability of ICT resources, acquisition of ICT knowledge, accessibility to ICT resources, existence of support, teacher’s commitment to the innovation, influence of external forces; desire to change school practice.

• these eight enabler entities can be categorized into two, namely the essential and the supporting conditions.
Essential Conditions

- The essential conditions include availability of ICT resources and acquisition of ICT knowledge (Wan et al., 2009). These conditions are needed for the implementation of ICT integration in the teaching.
- If one of these conditions is not present, then implementation of ICT integration would not take place.
- Some of the indices for these essential conditions include; infrastructure, policy, among others.
- ICT Infrastructure has been found to predict other attributes such as, access, ease of use, and technical assistance.
- The lack of sufficient infrastructure is known to be a major barrier to successful technology integration (Akbaba-Altun, 2006; Clarke, 2007; Goktas et al., 2008; Odabasi, 2000; Ololube, 2006; Pelgrum, 2001; Rajesh, 2003; Reddy and Srivastava, 2003; Williams, Coles, Wilson, Richardson, and Tuson, 2000).
- Infrastructure is the first step in terms of hardware; however, rich infrastructure should be accompanied with opportunities to access those facilities so that the integration becomes more effective (Kling, 2000; Rajesh, 2003; Warschauer, 2003aandb).
- In this regard, ease of use (Chang and Tung, 2008; Chin and Todd, 1995; Doll, Xia and Torkzadeh, 1994; Mehra and Mital, 2007; Odabasi, 2000).
Supporting teachers in integrating ICT in their practices is an ingredient for professional development (Newby, Stepich, Lehman, and Russell, 2000; Roblyer and Edwards, 2000).

The supporting metrics would therefore comprise; accessibility of ICT resources, existence of the support itself, integrator desire to change, the school practices, influence of external forces and teacher’s commitment to the innovation (Wan et al., 2009).

However such support should be based on student’s interests (Roblyer, 2004).

The support should involve continuous learning that focuses on developing lifelong skills and that occurs via connection with the real-world rather than only the teaching (Roblyer, 2004).

Since these supporting condition comprises mostly of human factors; their measurement requires dynamic metrics,

individualized and participatory so as to effectively enable determination of the varying levels at any instance of ICT integration in university teaching process
Metrics for Indexing Motivation and Commitment

• Sheingold and Hadley, (1990) in a survey of 12th grade teachers in USA found out that teachers motivation and commitment to their student learning and their own professional development was important.

• They also observed that ample technology, ample time to learn the technology provided

• Academic and cultural structure to encourage experimentation of work are sources of motivation for ICT integration.

• Collaboration during integration was also noted to have significant contribution to motivation and commitment (Pedretti, et al, 1999).
Metrics for Indexing Attitude in ICT Integration

• The attitude levels have been used to measure ICT integration levels.

• positive rather than negative attitude levels towards use of ICT, where positively disposed teachers towards ICT were found to be better integrators;

• pupil choice not teacher directive learning, whereby pupils guided learning improved more ICT integration than teacher directed learning;

• pupil empowerment as learners rather than receiving instructions; preference for individual pupil study rather than pupils receiving instructions.
Metrics for Indexing Barriers in ICT Integration

- This entails measuring of problems that emerge during ICT integration.
- The Malaysian technology-rich school observed time factor, irrelevancy of course content and technical malfunction as some of the barriers.
- Of these time has been observed to be the greatest barrier (Wan et al., 2009).
- The issues raised here include; too short free time to prepare lesson using ICT, lack of enough time to surf internet for information, and scheming and selecting information taking a long time.
- Regarding teaching time, all teachers felt that one-hour period was not enough for their students especially when they need to print their work at the end of the lesson.
- Observation data showed that students took about five to ten minutes to reach the classroom and five minutes to settle down. They took another five minutes to operate the computers.
Most of the teachers attending ICT courses couldn’t apply the acquired knowledge in their school.

For example, software and hardware they learned during the course were not the same with what was found in school.

Thus, they found their knowledge irrelevant to the school setting.

They also felt that the course period did not teach them on how to integrate ICT in their teaching.
Metrics for Technology Mal-functioning ICT Integration index

• This include server break down, inaccessibility from home.
• Other technical problems that the teachers faced during implementation of ICT integration in school include malfunction of computer, server, router and LCD.
• eleven indicators as identified by Akbulut (2010) which can be perceived to influence the level of ICT integration performance.
• They include: Teaching-Learning Methods, E-learning, E-interaction, Learning Communities, Infrastructure, Access, Ease of Use, Technical Assistance, Policy, Special Education and Health.
• Therefore, understanding and appreciating the already existing system, futuristic view of integration process and use of objective measurement based on participatory and individualized measures remains important in developing a continuous ICT integration performance level metric.
Continuous Improvement Metrics

- A continuous improvement metrics can be viewed as the metrics that can capture the improvement needs of the ICT integrator. Such improvement should be based on continuous participatory learning approaches, requirements (objectives) for continuous learning. Identification of the key CSF is necessary in developing such a continuous learning metric tool as discussed below.

- Effective teaching at the universities is heavily dependent on the quality of continuous lifelong learning. Wetzel (2010) argues that learning can no longer be considered something that only occurs in an adult's early years, learning need to continue over a lifetime for career and personal success. Continual learning benefits career success through developing additional work skills and self-satisfaction. Multiple careers today is one fact that leads to the need to continually learn and prepare one for wherever the future leads an adult especially with the rapid change in ICT (UNECA, 2010).

- Swarts (2010) noted a global crisis in preparing and supplying well-educated teachers to cope with fast changing technologies, globalization and new ICT skills demands on teachers. As a result of the rapid changes and increasingly complex environments in which teachers would need to operate, it has become necessary to forge collaborative structures and strategic partnerships at institutional, country and regional levels to deal more effectively with the complex issues and demands, particularly in the context of scarce resources and challenges related to sustainability. Continuous learning by university teachers especially in ICT skills therefore remain the key even in a technologically rich and advanced environment like the universities.

- It is therefore necessary to focus more on the three types of learning; continuing education, professional development, self-directed learning in relation to ICT. The continuous lifelong learning during teaching should target these three types of learning to integrate ICT in teaching as an indicator of teaching professional development. The teacher professional development therefore can be safely be taken here.
2.4.9 Metric Scope and Scopes Types

• Any metric applies over one or more scope types. A scope type is a type of product or process over which the metric is measured for product metric, examples include “feature” meaning that we will compute a metric over a single feature, “support conditions for ICT integration”, “attitude of ICT integrators”, “ICT integration system”, “set of systems”. These obey an order relation corresponding to the containment order of the corresponding software elements: a feature belongs to an attitude, an attitude to a support condition and the support condition influences performance level of ICT integration.

• A scope may be of a particular instance of a scope type. For example a given support condition is an instance of the scope type “attitude”. To compute a measure is to apply a certain metric over a certain scope of an applicable scope type. For example we may compute the value of the metric attitude over a certain ICT integration performance system.
2.4.9 .1 Classes of Integration Metrics

The ICT integration metric framework should provide a number of predefined metrics but also enables users to define their own metrics in terms of the predefined ones. Metrics are divided into elementary and composite. An elementary metric measures the number of occurrences of a certain pattern in the product or process. A composite metric, defined by a user of the environment, applies a mathematical or logical formula involving other metrics (elementary or previously defined metrics). Composite metrics include raw and derived metrics; selection criteria.

Elementary metrics can further be divided into raw and derived metrics. Raw metrics are simple counts, built-in into the environment, of occurrences of certain basic elements. For example, support conditions can be classified into; raw metrics which measures the number of support conditions. It can be useful to define a new metric by subjecting a raw metric to one or more selection criteria.

Selection criterion for a raw metric is: a property with a fixed set of possible values (two or more) characterizing the patterns being counted by the metric. The reason for considering selection criteria and derived metrics is clear: without these notions, the environment would need to have predefined (raw) metrics including all possible combinations, such as “deferred and no invariant”. This would quickly grow out of hand. An example in this study we could be interested in measuring an ICT integration support, which may be either all the time, most of the time, averagely, not all. Separately, an ICT integration support may be of varied, quality, high or low; which can be measured as ‘support available all time but low quality or rarely but high quality’ as another selection criterion. A university administrator might want to know the number essential ICT integration condition types that all the time gets support services that are low quality; this may be defined as a derived metric by submitting the raw metric. Support service to both of these criteria should be connected by an “and” combinatory.

A composite metrics applies one or more mathematical operators to a set of metrics, either elementary (raw or derived) or already composite. They include the following kinds.
2.4.9.2 Linear Metrics:

- These are metrics of the form $\Sigma k_i \cdot m_i$, where the $k_i$ are real values and the $m_i$ existing metrics (either elementary or basic) with the same unit, other than RATIO. (It would be improper to add two ratios since they might be ratios of incompatible things.)
2.4.9.3 Ratio Metrics

• Metrics of the form \( m_1 / m_2 \) where the mi are two previously defined metrics, not necessarily with the same unit, neither of which a ratio (again because ratio is a catch-all category for all divisions, so we can’t divide further without courting incoherence). The resulting unit is a ratio.
2.4.9.4 Scope Comparison Metrics

- These are metrics that measure the ratio of the value of a given non-ratio metric over two different scope types. For example, by choosing the metric attitude level and the scope types “support level” and “ICT integration performance level of the system” it is possible to measure the proportion of attitude’s influence in the ICT integration performance level of the system that belong to the current support level. However, not all metrics may be applied to all scopes therefore each raw metric has one or more basic scope types, on which the environment has built-in mechanisms to compute it. The list of basic scope types is part of the metric’s definition. Then the rule to compute the metric on any scope of scope type (st) is as follows:
  1. If st is one of the metric’s basic scope types, apply the environment’s built-in mechanism to determine the result.
  2. If st is smaller than the smallest of the metric’s basic scope type, the result is zero by convention.
  3. Otherwise, the computation will add the measures made on the constituent scopes, applying the rule recursively.
- This rule applies to raw metrics; it immediately generalizes to derived and composite metrics. However, there exists small subtlety in the rule that explains the possibility of several basic scope types rather than just one.
2.5 Theoretical Framework

The study extends the Wan et al (2010) proposed four performance levels index of ICT integration in teaching specified as level (LI, LII, LIII, and LIV). This extension is necessary because presence of these indexes alone are not enough as these indices requires continuous improvement and especially at individual integrator level. None of these previous studies has developed metrics for individualized continuous improvement index. Such indices would provide a basis for identifying simple steps that developing countries could undertake to build vibrant, efficient and effective UITTPs knowledge based system.

This research will be based on two theories; Earls’ theory of multiple methodologies (Earl, 1989) and organization learning theory as proposed by Argyris (1978). Earl suggests three elements of any information systems strategy: Understanding the current circumstances, an appreciation of what opportunities exist in the environment and a vision for future. It involves identifying and agreeing on business objectives through interview, debates and existing policies - gap (process); defining critical success factors (necessary for survival and growth); finding Information Technology that support or enable these CSF. The Earl theory is suitable for large, complex and complicated situations. It will provide a basis for the process of deriving metrics. This makes it suit ICT integration in university teaching, which is a broad complex system. The Earl strategy here will guide the process used to derive effective metric that is necessary to continuously improve ICT integration index (LI), where university teachers integrate ICT as verbal resource, level two (LII), where a university teacher integrates ICT as printed resources, level three (LIII) as hands-on experience and a combination of all the approaches at level IV (Wan et al., 2009).

The improvement of ICT integration performance levels from LI to LV and to LN, are dependent on a continuous improvement of ICT integration Index for UITTP. This view borrows from Argyris (1978) organization learning theory, where improvements in ICT integration need to be characterized by an individual or group learning, an effective UITP indexing need to be based on learning metrics. The university ICT integration index also need to be based on some scope (comprehensiveness) of the current ICT integration index, barriers and enablers of collaborative indices of the teaching process such as attitude levels of university teachers in using ICT, the supporting conditions for ICT integration and as moderated by the basic essential conditions of ICT integration such as Hardware and software resources and policy that govern the people ware. This is as conceptually represented below in Figure 1.
CHAPTER THREE
RESEARCH METHODOLOGY

• This chapter describes the research philosophy, strategy and design to be employed in developing a metrics model for indexing UITTPs ICT integration, the study area, population, sampling procedures and size, are then proposed. Data collection procedures, instruments and how quality controls of the instruments were ensured as shown. Finally, ethical consideration and data analysis methods for the research are also discussed.

• 3.2 Research Design
• Using positivist research methodology paradigm and deductive research process, observation about the current practice in ICT integration was examined at the selected 4 universities. Data was collected and then a general understanding on current index and use of existing metrics for indexing ICT integration were derived (Kathuri and Pals, 1993). Since research in ICT is socio-technical in nature, it lacked a single well established research method (Jarvenpaa, 1988), this study therefore adopted multiple research methods (Galliers, 1992; Trauth, 1997), that borrows from social sciences and engineering sciences. Descriptive survey research design was largely used in investigating objective one, two and three.

• The descriptive survey was used to identify current and existing metrics for indexing ICT integration levels of the Kenyan - UITTP. To address these objectives, literature review was done. Descriptive survey research design was used to examine existing metrics in purposively selected public and private Kenyan universities; through interview and observation using video. Descriptive survey research design was suitable here as it helped determine the state of existing metric characteristics of the UITTP integrators (Kathuri and Pals, 1993).Survey also helped in finding out more about the ICT integration metrics scope based on enabler and barrier factors to ICT integration as measured by essential conditions, support conditions, attitude, segmentation of teachers, barriers levels. Most descriptive research takes the form of survey and observational research (Kathuri and Pal, 1993).This helped explore and describe the ICT integrators opinions, attitudes, preference and perceptions on the suitable and existing metrics.

• To achieve comprehensive analysis of these metrics, the survey adopted system analysis through participatory approaches and iterative involvement of a selected team of expert drawn from ICT departments and schools, faculties, quality assurance and human resource offices.
RESEARCH FINDINGS AND ANALYSIS, INTERPRETATION

- The study aimed at establishing current ICT integration index,
- examining the existing metrics based on the metrics use
- evaluated their suitability, established a metric scope for indexing University Information Technology professionals’ continuous improvement in ICT integration.
- Interviews were done to 30 University IT teaching professionals and 6 human resource, 6 quality assurance officers and 6 ICT directors.

Current ICT integration levels

- The interview was done to UITTP and COD who had 10 years and above experience with ICT integration and who had frequently taught degree students.
- UITTP and COD view on comfort with student levels ever taught using ICT was degree/masters.
- Current ICT integration was perceived to be generally moderate to frequent (74%)
- highest contributor to this index was ICT integration Conditions during teaching with an index of (84.6%) ranking and the
- lowest current integration index was contributed by various poor methods of ICT integration such as referring students to websites (50.8%).
Extent of use of Existing Metrics by departments

- Study was done by interviewing; Directors of ICT, human resource office, COD, quality assurance, UITTP
- Use of existing metrics to index integration was generally less frequent at 33%
- with UITTP motivation and commitment metrics and workshop content relevance being the most frequently used metrics at (40.8%) and 34.4% ranks respectively.
- The least used metric being technical malfunctions at (26.4%).
Extent of Suitability Of The Various Metrics Scope For Indexing

- The Study was done by interviewing; Directors of ICT, human resource office, COD, quality assurance, UITTP.
- It was evident that the university management and UITTP strongly feel that ICT integration metrics are highly suitable for managing university teaching (92%).
- in which internet access from home metric was the least perceived suitable metric at (76%) ranking, being rated moderately suitable while the most perceived suitable metric was attitude rated as highly suitable (96%).
- The other highly perceived suitable metrics includes the workshop content relevance and UITTP motivation, then ICT support service metric and commitment to student learning metrics with ratings of 95%, 92% and 94% respectively.
- The least suitable preferred metrics was technical metric perceived as satisfactory metric (84%)
- It was evident that human factors metrics to ICT integration is still perceived as more suitable metrics compared to technological factors metrics
Discussion Conclusion and Recommendations

• Current ICT integration was perceived to be generally moderate to frequent (70.8%).
• Relating this to Wan (2009), it is apparent the UITTP are currently at level III and IV of ICT integration.
• Wan et al., (2009) argues that Teachers found to be in Level III and IV are perceived to be actively integrating ICT in their teaching and were very committed to the technology, they were very enthusiastic (Wan et al., 2009).
• Level three (LIII) are also referred to as hands on experienced teachers, they teach with the aid of computer, courseware, software or internet only.
• At level four (LIV); the teacher teaches with the aid of computer, courseware, software or internet in delivering the lesson they should also give out handouts with information printed from the Internet or courseware.
• Generally the interviewees felt that ICT integration Conditions during teaching had the highest index contribution being present at (84.6%) ranking
• while the lowest current integration index was contributed by various poor methods of ICT integration during teaching such as referring students to websites (50.8%).
• This agrees with the earlier studies by Atsumbe, et al., (2014), (Ly Thanh Hue and Habibah Ab Jalil, 2013 ) that despite the existence of essential conditions, the Lecturers would still not integrate ICT. Therefore there is need to continuously support integrators, monitor them.
• UITTP and COD view on comfort with student levels ever taught was degree/masters levels () . This implies a lack of competent skills and staff to who can integrate ICT for doctorate studies in Kenyan universities.
Use of Existing Metrics to Improve ICT Integration

• use of existing metrics to index integration was generally less frequent
• with UITTP motivation and commitment metrics and workshop content relevance metrics being the greatest contributor at (40%) and 39% respectively.
• The least contributing metric being technical malfunction metrics at (27.4%).
• This implies that the university managements do not know whether the ICT investments are worthwhile, neither do they know whether the students are benefiting from the ICT integration efforts.
• Little is known why they do not measure the ICTs because if we do not measure then we do not know Kelvin (1824-1907) and Wagner et al,(2012)
Suitability of Existing Metrics for ICT Integration

- The Study was done by interviewing: Directors of ICT, human resource office, COD, quality assurance, UITTP.
- It was evident that the university management and UITTP strongly feel that ICT integration metrics are highly suitable for managing university teaching (92%).
- However, it was evident that human factors metrics to ICT integration is still perceived as more suitable metrics compared to technological factors metrics,
- in which internet access from home metric was the least perceived suitable metric at (76%) ranking, being rated moderately suitable
- while the most perceived suitable metric was attitude rated as highly suitable (96%).
- The other highly perceived suitable metrics includes the workshop content relevance and UITTP motivation, then ICT support service metric and commitment to student learning metrics with ratings of 95%, 92% and 94% respectively.
- The least suitable preferred metrics was technical metric perceived as satisfactory metric (84%)
5.4 Conclusion and

- **It is apparent the UITTP are currently at level III and IV of ICT integration.**
- Generally the interviewees felt that ICT integration **Conditions** during teaching had the highest index contribution in Kenyan universities.
- UITTP and COD view on comfort with student levels ever taught was degree/masters levels () .This implies a lack of competent skills and staff to who can integrate ICT for doctorate studies .
- the lowest current integration index was contributed by the use of various poor methods of ICT integration during teaching such as referring students to websites (50.8%).T
- his agrees with the earlier studies by Atsumbe, et al., (2014), (Ly Thanh Hue and Habibah Ab Jalil, 2013 ) that despite the existence of essential conditions ,the Lecturers would still not integrate ICT .Therefore there is need to continuously support integrators, monitor them .
- **It was apparent that use of existing metrics to index integration was generally less frequent**
- UITTP motivation and commitment metrics and workshop content relevance metrics being the greatest contributor .
- The least contributing metric being technical malfunction metrics at (27.4%).This implies that the university managements do not know whether the ICT investments are worthwhile, neither do they know whether the students are benefiting from the ICT integration efforts. Little is known why they do not measure the ICTs because if we do not measure then we do not know Kelvin (1824-1907) and Wagner et al.,2012

- **It was evident that the university management and UITTP strongly feel that ICT integration metrics are highly suitable (92% )for managing university teaching perceived as satisfactory metric.**
- However, it was evident that human factors metrics to ICT integration is still perceived as more suitable metrics compared to technological factors metrics, in which internet access from home metric was the least perceived suitable metric, while the most perceived suitable metric was attitude .The other highly perceived suitable metrics includes the workshop content relevance and UITTP motivation, then ICT support service metric and commitment to student learning metrics. The least suitable preferred metrics was technical metric.
- Further analysis is on going based on demographic data
- Further research on ranking various metrics; deriving the model, developing an AI software
Recommendation

• Training more IT related UITTP to handle doctoral levels (including current Doctors and Profs)
• Need to continuously support integrators, monitor them.
• Software based metrics