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Existing Metrics Use in Indexing ICT Integration in University Teaching

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Abstract

ICT integration by universities teaching professionals is emerging as a major concern, this study demonstrate the need to address the integration problem by encouraging existing metrics use in indexing ICT integration as an ICT governance strategy. Quality of integration depends on quality indexing which also depend on quality of existing metrics and their use. Considering the role that University Information Technology Teaching Professionals' (UITTPs) continuous improvement indexing can offer, towards autonomic governance of the continuous emerging ICTs in the university teaching, this study examined extent in use of existing ICT integration metrics to index ICT integration by the UITTPs. Six metrics for ICT integration were investigated; time, workshop course content relevance, technical malfunctions, support conditions, support services, and motivation and commitment to student learning and staff professional development metrics. Descriptive survey design was used in which interviews were conducted to UITTPs in three (3) public and three (3) private purposively selected universities in Kenya. The findings were analyzed descriptively and inferentially using Kendall's correlation of concordance and tested using Chi-square on the extent of concordance and presented with help of frequency tables, figures and percentages. The findings revealed that all the metrics are rarely used for indexing ICT integration (32.8%), and most UITTPs were in discordance on this level of all the six metrics use except for support condition. This implied that the use of metrics for indexing integration has not been formalized across the Kenyan universities. Universities need to be encouraged to identify suitable metrics, formalize them and improve their frequency in use. Secondly, socio based metrics such as content relevance are used more frequently for indexing integration as compared to Technical metrics, socio-technical metrics balance therefore need to be emphasized by the universities management when determining and using metrics for indexing ICT integration.

Index Terms: ICT, integration governance, Index, Metrics, University IT Teaching.

1.0 Introduction

ICT (information Communication technology) is the convergence of the traditional Information technologies in one common platform, to enhance interfacing of the communicating technology parts. While the technology parts communication is enhanced, the original human (socio) purpose for initiating the communication need to remain fundamental as the enabler or the main driving force. The roles of ICT in any system need to be viewed as an integration activity as it aims at fitting or convergence of various ICTs.

Integration is the process of fitting a legacy system, practice to a new one, usually with the view of improving it. Such improvements need to be purposeful. The various types of ICT integration entail software to software or to hardware, hardware to hardware or user to hardware or software integration. The focus of this study was on end user ICT integration issues, specifically user - lecturers ICT integration (UNESCO-UIS, 2015). Many recent global studies shows that lecturers do not integrate ICT (Ly Thanh Hue and Habibah Ab Jalil, 2013, Federal University of Technology, Minna Atsumbe, Raymond, Enoch and Duhu , 2014, Farel,2015). In developing countries like Kenya, ICT integration levels in learning institutions is unknown (Chemwei, Njagi and Jerotich, 2014). However, ICT integration indexing should be based on sound metrics that can help improve integration and the metrics derivation should be guided by appropriate ICT governance models, such as COBIT5. A tightly integrated ICT index depicts a measure derived from metrics that bear a quality teaching skill value that results in university graduates productivity (Baskerville and Dulipovici, 2006) and above all that points to the sustainable development goals of Education and by extension the SDG (sustainable development goals. Lin, (2005) and Liu and Huang, (2005) developed measurement tools to investigate teacher attitudes towards ICTs. However, attitude is just one of the barriers, therefore this measurement tool lack adequacy in scope. This study adopted ICT governance – COBIT 5 implementation cycle to help map the existing metrics to Wan et., al (2009) indexing levels.

1.1 Statement of the Problem

Currently, there is lack of sufficient knowledge about the extent of existing use of metrics by University managements to index individual UITTPs ICT integration in universities. With the rapidly emerging Internet of Things (IoT) resulting into big data, then the management of UITTPs ICT integration is likely to be more complex if the metrics are not used. The UITTP-ICT-indexing need to be based on metrics that can be autonomous so as to effect continuous improvement given the myriad and vegetating ICT innovations (Akbulut et al., 2011; united nation Economic and Social Council 2011) The metrics also need to be grounded on Sustainable development Goal 4-Education (SDG4-Education). These aspects of ICT integration performance index and metrics currently lack and if they exist then they have not been evaluated empirically through sound models. University ICT integration metric need to be implemented based on sound ICT integration models such Cobit5, a situation that currently is not known therefore need to be investigated, this formed the basis of this study.

1.2 Study Objectives

This main objective of this study was to establish extent in use of existing metrics in indexing University Information Technology professionals' continuous improvement in ICT integration. The Specific Objectives were:

i. To establish the frequency in use of existing metrics in indexing University Information Technology professionals' continuous improvement in ICT integration

ii. To establish the extent to which the UITTPs agree on use of ICT integration metrics to index UITTPs improvement in ICT integration

2.0 Literature Review

This section reviews literature by beginning with the concept of ICT Integration in the Learning process, the role of metrics towards indexing n ICT Integration, influencing metrics to those classes and finally the conceptual model.

2.1 ICT Integration and the Learning Process

A learning process that fully integrates ICT seamlessly to the learning process is referred to as courseware integration. In the courseware learning context, Pisapia (1994) defines ICT integration as the use of ICT to introduce, reinforce, supplement and extend skills. A management approach to definition of ICT integration is exhibited by Low (2001-16) as illustrated in his ICTTRAPs model for integrating teaching. Low (2001-16) views ICT integration as an aid to achieve administrative proficiency and productiveness in and outside instruction. In the process, context Mahmud and Ismail (2008) define ICT integration as the process of determining where and how technology fits in the teaching and learning scenario. The where and how implies and points to the need for decision making and therefore the view of ICT integration in the governance and management lens. The integration process must therefore be planned, have policy and governance strategy, a concept that these authors fail to emphasize.

Low (2001-16) further adds a culture perspective in the process of integration by arguing that it is also an enculturation of organizations assimilating ICT infrastructure process. If ICT integration entails culture, then it is a complex process. Culture is dynamic and therefore ICT integration is dynamic. Grhavifekr et al., (2014) also asserts that integration is complex task due to its dynamic nature, they therefore recommend that it requires planning, and in addition policy, decision making need to be incorporated (Hashim, 2007; Grhavifekr and Sufean, 2010; Zellweger, 2006).

The enculturation dimension of ICT integration points towards the humanistic (socio) dimension, whose governance require; structures, processes and boundary. Therefore ICT integration needs governance and management through continuous improvement due to its dynamic perspective.

2.1.1 Viewing ICT Integration as Governance Activity

Governance is the providing of the structure for determining organizational objectives and monitoring performance to ensure that objectives are obtained (OECD, 1999).This definition emphasizes structuring of the objectives or goals so as to enable those goals monitoring. As already discussed in section 2.1 on the definition of ICT integration governance, then the ICT integration process (governance activity) should entail first, structuring the ICT integration goals for the learning process before they can be monitored. No single model of good corporate governance is the best but the key is that good governance must be based on supervisory boards to protect the rights of shareholder and other stakeholders such as employees, customers' creditors. (Weill and Ross, 2004). Therefore a good ICT integration governance activity should be context specific to the learning process of the universities; this is due to the humanistic (socio) nature of integration process.

MIT sloan ISCR (2003) developed one of the earliest frameworks linking ICT to corporate governance, in their framework they view IT as one of the key assets just like other traditional key assets like human ,physical, financial. ICT is therefore one of the key assets for achieving strategies and generating business value (Weill and Rose, 2004). Mechanisms of governance of key assets include structuring processes. Governance activity entails structuring of organization to enhance objectives performance monitoring while integration aims at fitting the legacy system to the new system parts. Both aim at improving performance in which the improvement according to Low (2001-16) is by extending and reinforcing the legacy (Pisapia 1994) or simply restructuring the learning process using the ICT. Basing on the earlier argument's, that ICT entails convergence of the legacy communication technologies and the new emerging ones, and then IT governance is necessary in ensuring extension and structuring of ICT integration. The extensions however, need oversight so as to know whether the original goals and objectives of the learning process are still being achieved or positively being extended. ICT integration as currently being used in university teaching is stealth on oversight and monitoring of the degree of alignment or fitting, a gap that need to filled in by an appropriate ICT integration governance strategy. ICTs governance in Universities teaching learning process is therefore a key asset in ensuring ICT integration.

Moving forward, ICT integration must be viewed in the lens of governance, especially in university teaching, a concept that appear to be currently lacking and may have led to the increased poor integration in Kenya. The next section discusses how ICT metrics use can be an asset as ICT integration governance strategy.

2.2 Existing Metrics use Towards Indexing Improvement in ICT Integration

Metric was originally used to mean standard in 1793 at napoleon's time and later used to refer to one tenth millionth part of distance from the equator to North Pole when measured straight along the surface of the earth to Paris. Metric is the best basis of representing other variable that share common purpose. Metrics has become popular in organizations as the concern to determine, control human productivity (Fletcher, 2015). Their applications in organization therefore need to have a basis to govern the myriads of variables influencing human productivity during ICT integration.

ICT based Metrics in organizations has had various applications such as; governing the emerging need for continuous integration of ICT in organizations , managers need to have standards or basis for determining current productivity of ICTs, determining the extent to which personnel use ICT effectively, especially with the need for continuous learning of ICT. Can we therefore have standards or basis (metrics) for indexing the continuous improvement in ICT integration? The next section 2.2.1 explores this.

2.2.1 Metrics as a Basis of Governing ICT Integration in Organizations

Literature review demonstrates the existence of various approaches towards standardizing measurement (metrics) of ICT integration for organization. Standardizing or formalizing of measurement is therefore viewed as a governance activity and it includes: the Nolan (1973) maturity/growth model and Poter & Millars (1985) model on the three ways by which IT affect organizations' competitiveness which include ; structure and rules, outperformance and new opportunities. Porter, (1980) also suggests competitive advantage metrics of the IT investment in terms of Products differentiation level measures like product; price, place and promotion. Porter

(1980) specifically singled out Value addition measures and Rogers' (2005) also suggested primary and Support to the primary activities metrics.

Other metrics include strategic alignment measures which emphasize compatibility with, and leverages upon the company's existing characteristics and advantage measures. Innovation in IT is of strategic importance only if it is compatible with, and preferably leverages upon the company's existing characteristics and advantages (Beath & Ives 1986, Clemons & Row 1987). One particularly important facet of this is the notion of 'strategic alignment' of IT policies and initiatives with the directions indicated by the corporation's senior executives (Earl, 1989, Broadbent & Weill 1991).

Cobit5 (Control business IT) is emerging as a useful IT Governance framework that can enable both comprehensive and dynamic metrics as it provides an integration framework for all other existing IT standards, it is end to end (ISACA, 2012). Its seven phases of implementation lifecycle recommends that any IT governance implementation should ask and address seven questions. This study focuses on the question two, where are we now? In terms of ICT integration in universities it entails asking two further questions :a) where are we with existing metrics and where are we with their use in indexing ICT integration?

University ICT integration activities need therefore be aligned to strategic objectives of the universities which must also align to the SDG4-education. It would be therefore necessary to examine the nature of the existing ICT integration metrics use in the universities before a sound ICT integration -governance model is adopted. The next section reviews on what entails existing ICT integration metrics and their influences on other metrics and indexing.

2.3 Existing Metrics used for Indexing ICT Integration

Wan et, al (2009) identified conditions which they used to classify ICT integration based on; 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. Essential conditions which entails mandatory needed condition for the ICT implementation, e.g. infrastructure, policy, while supporting conditions- are to assure the continuation of the ICT implementation .Each of these metrics have sub metrics that influence them as discussed below.

2.3.1 Metrics for Indexing Support Conditions

ICT integration Support condition is viewed as an ingredient for professional development (Newby, Stepich, Lehman, and Russell, 2000).It is influenced by student's interests, continuous learning that focuses on developing lifelong skills and that occurs via connection with the real-world rather than only the teaching (Roblyer, 2004). Support to accessibility of ICT resources, existence of the support itself and with those having adequate skills to support lecturers (Omariba et al.,,2016) , integrator desire to change, the school practices, influence of external forces and teacher's commitment to the innovation (Wan et al., 2009). They are mostly of human factors; their measurement therefore requires dynamic metrics, individualized and participatory so as to effectively enable their determination.

2.3.2 Metrics for Indexing Motivation and Commitment

This metric has been shown to be influenced by ample technology, ample time to learn the technology, academic and cultural structure to encourage experimentation of work (Sheingold and Hadley, 1990) and Collaboration during integration (Pedretti, et al, 1999).

2.3.3 Metrics for Indexing Attitude in ICT Integration

The sub metrics here include pupil choice rather than teacher directive learning, pupils guided learning than teacher directed learning; pupil empowerment as learners rather than receiving instructions; preference for individual student study rather than pupils receiving instructions (Ly Thanh Hue and Habibah Ab Jalil. ,2013).

2.3.4 Time based metrics

According wan et al, (2009) time sub metrics included free time to prepare lesson using ICT (Farell, 2007 and Hennessy et al.; 2010), lack of enough time to surf internet for information, and scheming and selecting information. Lack of time allocated to access ICT facilities freely (Muyaka, 2012 and Omariba, 2016).

2.4.5 Metrics for Workshop Course Content Relevance index

The influencing actors included applying the acquired knowledge during workshop in their school, software and hardware learned during the course being the same with what was found in school, workshop teaching them on how to integrate ICT in their teaching (Wan et al., and Omariba et al.,,2016 pg.207).

2.3.5 Metrics for Technology Mal-functioning ICT Integration Index

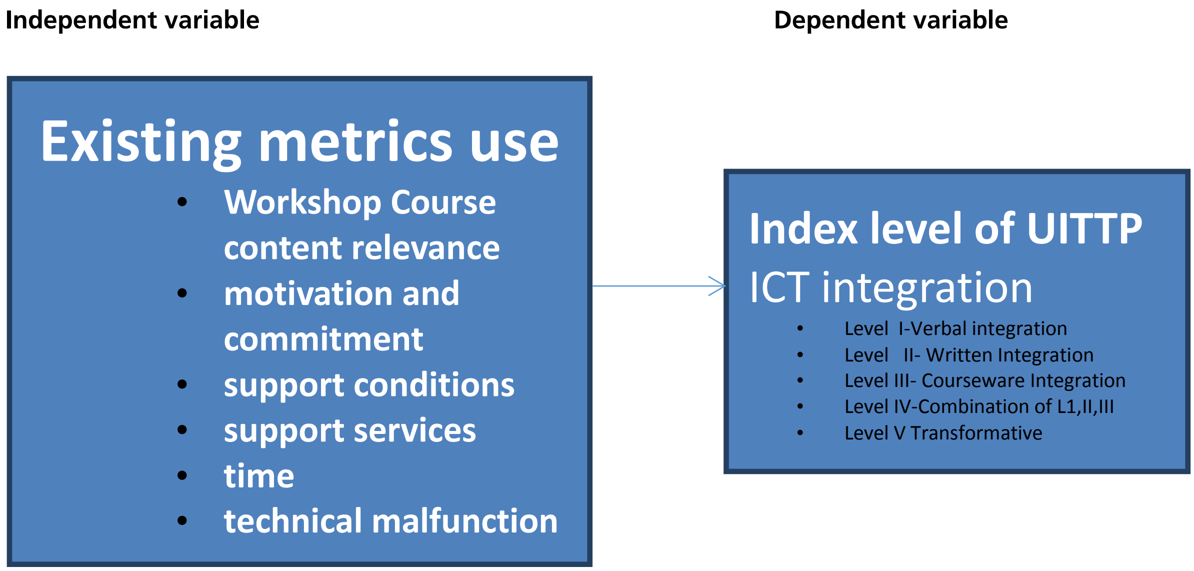
This entailed server break down, inaccessibility from home, malfunction of computer, server, router and LCD. (Wan et.,al 2009) , power outages (Omariba et al.,,2016)

2.4 Conceptual 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) using COBIT 5 continual improvement life cycle framework. As has been discussed above Cobit5 suggests in its phase two of the implementation cycle, there is need to understand the current circumstances. It involves identifying and agreeing on business objectives through interview, debates and existing policies - gap (process). Cobit5 theory is suitable for large, complex and complicated situations, it provide a basis for the process of deriving metrics that suit ICT integration in university teaching. The Cobit5 strategy guided the process used to derive effective metric that is necessary to continuously improve ICT integration index (monitors) (LI to Lv**)**, as shown in figure 2.4. The improvement of ICT integration performance levels from LI to LV and to LV are dependent on frequency in use of existing use for indexing ICT integration which include support conditions (attitude), supporting services time metrics ,course content and technical malfunctions as proposed by Wan et al.(2009). This is as conceptually represented below in Figure 2.4.

Figure 2.4 Conceptual framework

Source: Author, 2017



3.0 RESEARCH METHODOLOGY

Using post positivist research methodology paradigm and deductive research process, observation about the existing metrics use in ICT integration was examined from the purposively selected six Kenyan universities. The study adopted design based mixed research approach by undertaking a literature review and descriptive survey. A purposive sample of 3public and 3private UITTPs populace practicing in Information Technology and computing departments was selected based on intensity of IT related programmes (Cue 2015).

Interviews were done to 36 (12 UITTPs,6heads of IT related departments,6Human Resource officers,6Directors of ICT,6Quality Assurance) and their opinion were rated on a five point likert scale which was used to capture frequency in metrics use in the last Semester (not all, less frequently, moderately, satisfactorily and very frequent).The findings were quantitatively and qualitatively analyzed and rank correlation analysis done, using Kendall coefficient of concordance of correlation and significance levels of agreement of ranks correlation tested at 90% significant levels using chi square test .

4.0 RESEARCH FINDINGS, ANALYSIS AND DISCUSSION

The study examined existing ICT Integration metrics and their use through six sub themes: Existing use of time metrics as an index, ICT workshop Course content and training relevance metrics, Technical malfunction, Extent of using support conditions metrics, support services, Motivation and commitment to student learning and professional development. The study was done by interviewing; human resource officers (HR), Chair of IT department (COID), quality assurance officers(QA), and UITTPs. The distribution is as shown in the appendix table 4.0.

The rating on extent of use of the metrics were based on a 1 to 5 scale of ascending intensity of exiting metrics use from not all (1), less frequently, moderately frequent, satisfactorily frequent to very frequently (5).The findings were as shown in appendix tables 4.1 to 4.6

4.1 Extent of using Time Metrics for Indexing

Various UITTPs ,HR, COID, QA through interview were asked to rank extent of frequency in use of eight constructs of time (metrics) during ICT integration. Data from some four interviewees were cleaned out for inconsistency so the total sample size analyzed was 32 instead of 36. The findings of the eight time constructs evaluated for use are shown in the appendix table 4.1.

4.1.1 Descriptive Analysis

The mean use of time as metric was ranked at 1.4 (not at all used metric) on the likert scale of 1-5.This value was just slightly below less frequent .However six out of eight items of the time metrics were ranked at less frequent in which extent of adequate time for teaching/lesson presentation using ICT had the highest ranking (1.67) all of the other five of them ranked at 1.5 .The least frequently used time metrics were extent of adequate time to operate the computers/software (1.4) and extent of adequate time for students to settle down (1.25)

4.1.2 Inferential analysis

Inferential analysis was done against the null hypothesis; Ho=there is no agreement in ranks given to the eight time metrics by the COID, HR, UITTPs and QA. Kendall's Coefficient of Concordance correlation of observations N=32 and K =8 showed a very weak correlation (W=0.029) or agreement in the ranking of the metrics. A Chi-square test at 90 % significance at df =7 which had a calculated value of X^2=6.23 against tabulated value of X^2 =12.02, since calculated value is less than the tabulated value therefore, null hypothesis(Ho) is accepted. This implies that there is no agreement in the ranking in the use of the eight time metrics constructs in indexing ICT integration.
It is therefore concluded that it is not reliable to infer that time metrics are not used at all by the departments because the interviewees did not agree. It can therefore be argued that time as a metric has probably not been formalized or thought of as a critical metric of ICT integration in the Kenyan universities. Commission of University education (CUE) the body in charge of ensuring quality education has not thought of this. This is against the studies by Wan et al., (2009) who suggests the critical importance of time during ICT integration.

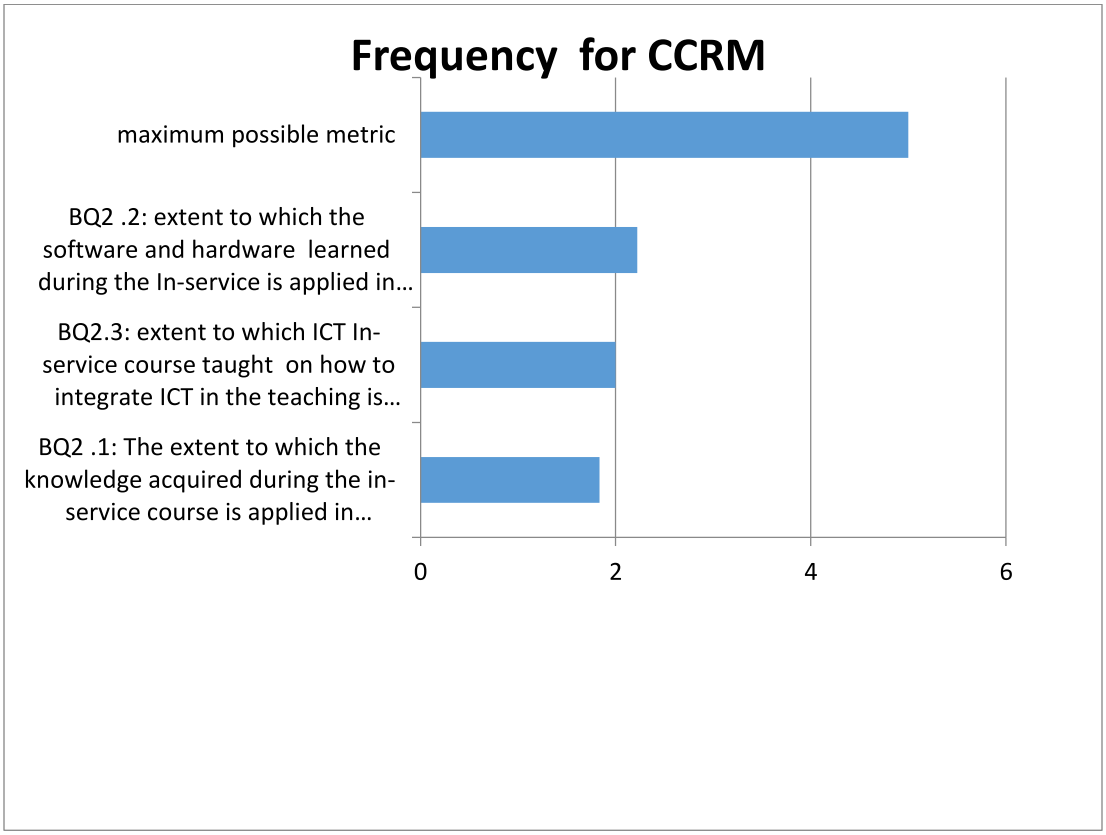
4.2 Course Content Relevance Metrics

Various UITTPs, HR, COID, QA (N=36) through interview were asked to rank the extent of frequency in use of three constructs of Course Content Relevance (metrics) during ICT integration. The findings of Course Content Relevance constructs evaluated are shown in the appendix table 4.2.

4.2.1 Descriptive Analysis

The most frequently measured course content and training relevance metrics was the extent to which the software and hardware learned during the In-service is applied in teaching at (2.2) on the likert scale of 1-5 ,followed by the extent to which ICT in service course taught on how to integrate ICT in the teaching (2.0) , while the least measured metric in this construct was the extent to which the knowledge acquired during the in-service course is applied in teaching (1.8) details are illustrated in figure 4.2 below.

Figure 4.2 Frequency for course content relevance



This resulted in a mean of less frequently used in indexing of course content relevance at (2.0) implying less frequent use.

4.2.3 Inferential Analysis

Inferential analysis was then done against the null hypothesis; Ho=there is no significant agreement on ICT integration metric use ranks given to the three course content relevance metrics by the COID, HR, UITTPs and QA. Kendall's Coefficient of Concordance correlation of observations N=36 and K =8 showed a very strong positive correlation (W=0.97) or agreement in the ranking of the metrics. A Chi-square test at 90 % significance at df =2 had calculated value of X^2=3.5 against tabulated value of X^2 = 4.6. Since the calculated chi square value is less than the tabulated value therefore, Ho-null hypothesis is accepted .This implies that there is no agreement in the ranking of the course content relevance metrics. This implies that there is no coordinated neither integrated use of course content relevance metrics. In addition, the mean of 2.0 depicts a very low level in frequency of its use in indexing ICT integration levels. Further, such metrics have no coordinated basis of course content relevance metrics. Therefore there is need for the course content metrics standardization.

In conclusion the extent to which metrics for ICT course content and relevance are being used to index integration is rarely used and has not been agreed upon; therefore the mean metric level (2.0) of less frequent use is not formalized therefore may not be used as the true course content relevance existing index.

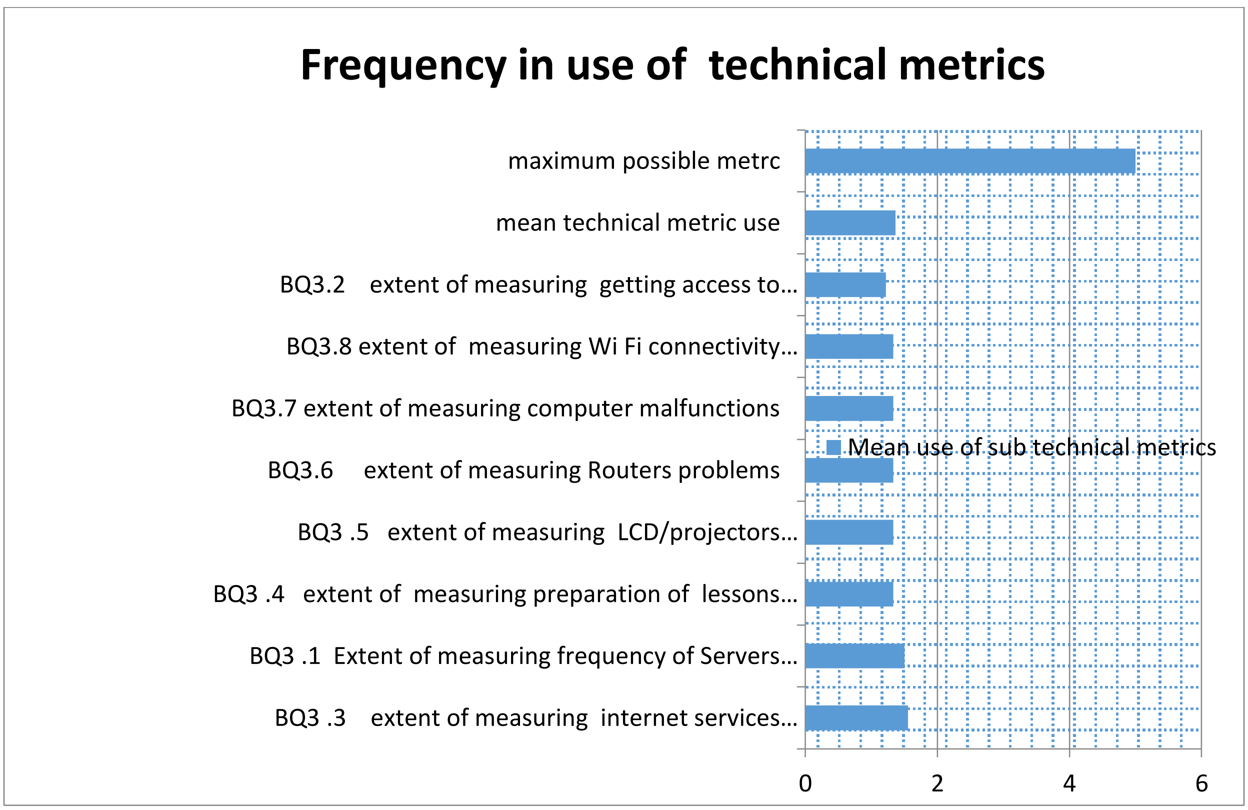
4.3 Technical Malfunction

Various UITTPs ,HR, COID, QA (N=36) through interview were asked to rank extent of frequency in use of eight constructs of technical malfunction (TMM) during ICT integration. The findings of Course Content Relevance constructs evaluated are shown in the table 4.3 in appendix section and the details of the descriptive and inferential analysis are as shown in appendix table 4.3 and as discussed below.

4.3.1 Descriptive Analysis

The most frequently used TMM was internet access form home (1.56) and then server breakdown at (1.5) on a 1-5 point likert scale, both of which are indexed less frequently.

Figure 4.3 Frequency in use of Technical malfunction Metrics (TMM)



The mean extent to which (TMM) levels of ICT integration are being indexed was 1.36, implying it is not indexed at all by any university ICT department. However, the rest of the TMM are also not meaningfully indexed at all with a mean of (1.333) each.

4.3.2 Inferential Analysis:

Inferential analysis was done against the null hypothesis; Ho=there is no significant agreement in ranks given to the TMMs by the COID, HR, UITTPs and QA. Kendall's Coefficient of Concordance correlation of observations N=36 and K =8 showed a very strong positive correlation (W=0.039) or agreement in the ranking of the metrics. A Chi-square test at 90 % significance at df =7 had calculated value of X^2=9.758 against tabulated value of X^2 = 12.02. Since the calculated chi square value is less than the tabulated value therefore, Ho is accepted implying that there is no significant relationship between the rankings of the various eight TMM. This means that these TMM are independent. This implies that the current use of TMM are not integrated i.e. indexing of TMM is not formalized across various universities. In conclusion there is need for standardizing these metrics for any continuous improvement in indexing to be realized.

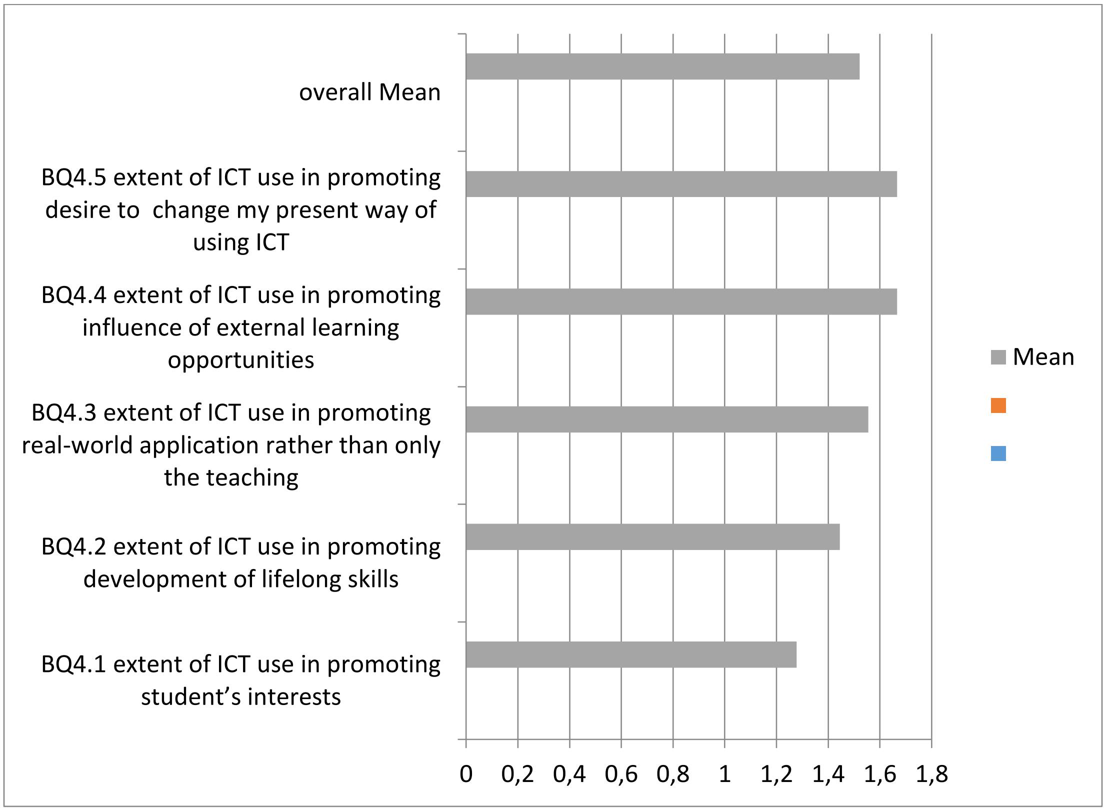
4.4 Extent of Indexing Support Conditions Metrics

Various UITTPs ,HR, COID, QA (N=36) through interview were asked to rank extent of frequency in use of eight constructs of support condition metric during ICT integration. The findings on support condition metric constructs evaluated are shown in the appendix table 4.4 and the details of the descriptive and inferential analysis are as shown in table 4.4 in the appendix and as discussed below.

4.4.1 Descriptive Analysis

The most frequently indexed support condition metric were ICT use in promoting influence of external learning opportunities (1.66) and ICT use in promoting desire to change their present way of integration at a mean frequency of less frequent (1.66).While the least frequent was ICT use to promote student interest at a not all frequency (1.277).The distribution is as shown the figure 4.4 below.

Figure 4.4: frequency of indexing support conditions



The mean frequency of indexing support condition was less frequent (1.55).

4.3.5.2 Inferential Analysis

Inferential analysis was done against the null hypothesis; Ho=there is no significant agreement in ranks given to the support conditions metrics use by the COD, HR, UITTPs and QA. Kendall's Coefficient of Concordance correlation was done for observations N=36. The Calculated Chi-square X^2 =9.348 was greater than tabulated X^2=9.24; the Ho is therefore rejected meaning that the various support conditions metrics have significant relationship although of a weak agreement of W^a =0.204. Therefore there is a coordinated agreement that support conditions are being used as a metric. Despite this formalized use of Support metrics , the practice of using these metrics are barely less frequent with a mean below this less frequent of (1.5) meaning that there is its use as a metric but at less frequent level. There is therefore need to improve the support conditions metrics to be used to be frequently as it is already perceived useful by the UITTP. It will be an easier metric to implement and accept because there is an agreement that it is already in use.

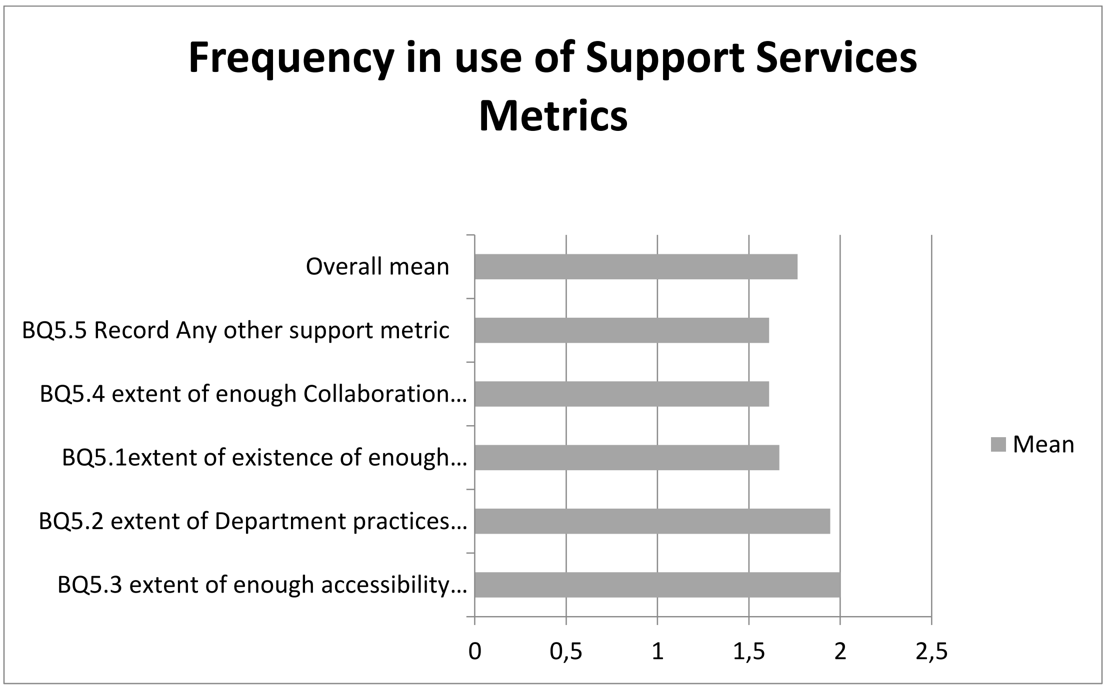
4.5 Extent of Indexing Support Services Metrics

Various UITTPs ,HR, COID, QA (N=36) support service metric metrics during ICT integration. The findings of support service metric constructs evaluated are shown in the appendix table 4.5 below and the details of the descriptive and inferential analysis are as shown in table 4.5 and as discussed below.

4.5.1 Descriptive Analysis

The most frequently indexed Support services Metrics is the extent of enough accessibility to ICT (2.0) also at less frequent index. While collaboration (1.66) and extent of existence of enough ICT support (1.61) were the least indexed but at less frequent levels. The details are shown the figure 4.5 below.

Figure 4.5 frequency of indexing Support Service Metrics



The mean frequency of indexing SSM was less frequent (1.77)

4.5.2 Inferential Analysis

Inferential analysis was done against the null hypothesis; Ho= there is no significant agreement by the COID, HR, UITTPs and QA on the indexing of support services by universities departments. Kendall's Coefficient of Concordance correlation of observations N=36. Wa =0.032 depicting a weak agreement in ranking or relation and a Calculated Chi-square X^2=4.667 is less than and a tabulated X^2=7.78 at df= 4, the Ho: is accepted therefore, there is no significant agreement by the UITTP on the indexing support services metrics in measuring integration by university implying that there is no coordinated or no formalized metrics on how to measure support services in Kenyan universities. Further, support service indexing mean is less frequent (1.8) and there is a weak correlation in the ranks depicting that UITTPs have a view that there is some element of relationship which can be exploited. This is in agreement with the support service metric theorist (Gökoğlu, S., & Çakıroğlu, 2017) who argues that support conditions must be considered during any ICT integration process for the integration to be effective.

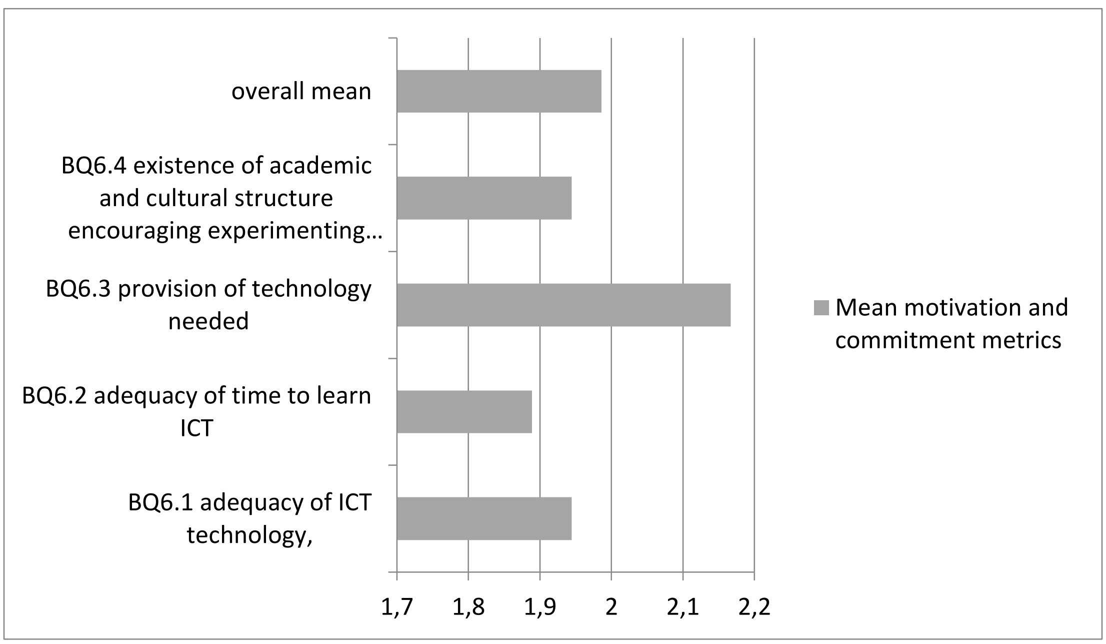
4.6 Extent of indexing Motivation and Commitment to Student Learning and Professional Development (MCSLPD)

Various UITTPs, HR, COID, QA (N=36) support service metric metrics during ICT integration. The findings of support service metric constructs evaluated are shown in the appendix table 4.6 below and the details of the descriptive and inferential analysis are as shown in table 4.6 and as discussed below.

4.6.1 Descriptive Analysis

The most frequently indexed metric under this category was the extent of provision of technology needed (2.16) followed by adequacy of technology and existence of academic and cultural structure encouraging experimenting both ranked at (1.94) on the 1-5 point likert scale. The details are shown the figure 4.6 below.

Figure 4.6: Frequency in use of Motivation and Commitment to Student Learning and Professional Development metrics



The mean frequency in use of Motivation and Commitment to Student Learning and Professional Development metrics was 1.99 implying not all metric use but tending towards less frequent use.

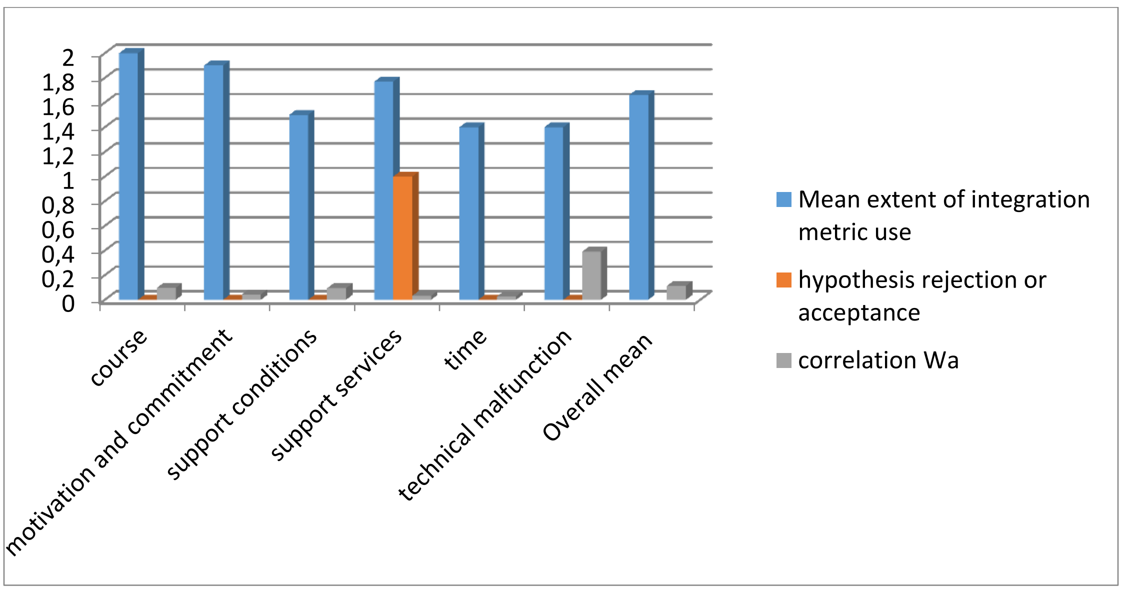
4.6.2 Inferential Analysis

Inferential analysis was done against the null hypothesis, Ho=There is no significant agreement by the COID, HR, UITTPs and QA on the relationship between teacher motivation variables on their use indexing integration .The correlation of concordance was Wa =0.044, and calculated Chi-square (X^2) =4.80 against tabulated X^2=6.25 value, this calculated value is less than tabulated value therefore the Ho is accepted. Implying that there is uncoordinated use of motivation and commitment to ICT integration metrics .Even though there is slight or weak agreement (wa =0.044) on their use .Implying that the UITTP are agreeing that if the MCSLPD are indexed then they can positively influence ICT integration .But currently their measurement is less frequent moving towards no measuring at all in some university departments.

4.7 Summary

Extent of using the integration metrics by the departments mostly fell at level I and II with a mean of 1.6. This implied that metrics were not generally used at all and in cases where some were used then they were used less frequently. This means that the universities are not aware of their integration problems or strength because if they don't measure them then they can't know (lord kelvin words).

Figure 4.3.7 : Extent of ICT integration Metric Use



Acceptance of hypothesis depicts a discordance or lack of agreement on whether these metrics are being used; this could imply that metrics use for indexing ICT integration in teaching is still a grey area in the Kenyan universities except for support condition metrics in which all the UITTPs are in agreement that it is being used for indexing. It can be concluded that University experts and management are not conscious of integration metrics role in management of teaching despite the increased application of ICT in teaching systems.

5.0 CONCLUSION AND RECOMMENDATIONS

The Study was done by interviewing; UITTPs, HR, COID, QA. It was apparent that 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 (40.8%) and 39.4% 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).

Kenyan Universities have not thought of developing manual based measures, nor is static software based metric, neither continuous metrics, metrics therefore still a pipe dream. This is in contrast to other industries like financial systems like IFMIS and technological processes. Infact, socio-technical systems are hard hit compared to technical systems .This is probably because of the difficulty in scoping the socio technical systems metrics. The technical systems have less dynamics compared to human –technical systems. With the increased development in the field of Artificial Intelligence and IoT specifically deep neural networks, dynamic systems such as ICT use can be scoped, modeled and implemented in such a way that takes care of socio –technical systems such as usability metrics for integration of ICT and they can be deployed everywhere any time in the teaching learning environment.

Even though the existing metrics use rare, it is necessary to conduct further research on extent of suitability of the existing metrics towards indexing ICT integration.

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Appendix

Table 4.0: Interviewees Bio Data for Existing Metrics Use

		Total number	Sample%	Sample size
IT teaching professional	private	(at least from all of the 5 grades)	Convenience - 9	9
	public	(at least from all of the 5 grades)	Convenience - 9	9
Chairperson of the department (COD)	private	3	100	3
	public	3	100	3
HR		6		6
QA		6		6
Total				36

Table 4.1 Existing use of Time metrics as an index

Existing use of Time metrics	N	Mean	% mean	Std. Deviation	Minimum	Maximum	Mean Rank
BQ1. 1: extent of adequacy of Free time to prepare the lesson using ICT.	32	1.5000	30.0000	1.21106	1.00	5.00	4.56
BQ1. 2 : extent of adequate time for Surfing Internet to search for information,	32	1.5000	30.0000	1.21106	1.00	5.00	4.56
BQ1. 3: extent of adequate time for Scheming/ organizing information for	32	1.5000	30.0000	1.21106	1.00	5.00	4.56

teaching.							
BQ1. 4 : extent of adequate time for teaching/lesson presentation using ICT	32	1.6875	33.7500	1.35247	1.00	5.00	4.63
BQ1. 5: extent of adequate time for Teaching period for students.	32	1.5000	30.0000	1.21106	1.00	5.00	4.56
BQ1. 6 : extent of adequate time to print work at the end of the lesson	32	1.5000	30.0000	1.21106	1.00	5.00	4.50
BQ1. 7 extent of adequate time to operate the computers/software	32	1.4375	28.7500	1.03078	1.00	4.00	4.38
BQ1. 8 : extent of adequate time for students to settle down	32	1.2500	25.0000	.77460	1.00	4.00	4.25
mean use of Time metrics as an index		**1.4844**	**29.6875**				

	N			32	29.6875
	Kendall's W[a]			.029	
	Chi-Square			6.533	
	df			7	
	Asymp. Sig.			.479	
Monte Carlo Sig.		Sig.		.417[b]	
		90% Confidence Interval	Lower Bound	.251	
			Upper Bound	.582	

a. Kendall's Coefficient of Concordance

Table 4.2 Course content relevance metrics

	N	Mean	%Mean	Std. Deviation	Minimum	Maximum	Mean Rank
BQ2 .1: The extent to which the knowledge acquired during the in-service course is applied in teaching	36	1.8333	36.6667	1.52128	1.00	5.00	1.86
BQ2 .2: extent to which the software and hardware learned during the In-service is applied in teaching	36	2.2222	44.4444	1.77460	1.00	5.00	2.11
BQ2.3: extent to which ICT In-service course taught on how to integrate ICT in the teaching	36	2.0000	40.0000	1.65616	1.00	5.00	2.03
		2.0000	40.3704				

Test Statistics			
N			36
Kendall's W[a]			.097
Chi-Square			7.000
df			2
Asymp. Sig.			.030
Monte Carlo Sig.	Sig.		.063[b]
	90% Confidence Interval	Lower Bound	0.000
		Upper Bound	.133
a. Kendall's Coefficient of Concordance			

Table 4.3 Technical malfunction.

Descriptive Statistics							
technical metric use	N	Mean	%Mean	Std. Deviation	Minimum	Maximum	Mean Rank

BQ3 .1 frequency of Servers breaks down	36	1.5000	30.0000	1.18322	1.00	5.00	4.69
BQ3.2 extent of getting access to applications server	36	1.2222	24.4444	.54043	1.00	3.00	4.25
BQ3 .3 extent of internet services accessed from home	36	1.5556	31.1111	1.27491	1.00	5.00	4.69
BQ3 .4 extent of preparing lesson at the university	36	1.3333	26.6667	.95618	1.00	5.00	4.47
BQ3 .5 extent of LCD/projectors problems	36	1.3333	26.6667	.95618	1.00	5.00	4.47
BQ3.6 extent of Routers problems	36	1.3333	26.6667	.95618	1.00	5.00	4.47
BQ3.7 extent of computer malfunctions	36	1.3333	26.6667	.95618	1.00	5.00	4.47
BQ3.8 extent of Wi Fi connectivity problem	36	1.3333	26.6667	.95618	1.00	5.00	4.47
		1.3681	27.3611				

Test Statistics

N			36
Kendall's W[a]			.039
Chi-Square			9.758
df			7
Asymp. Sig.			.203
Monte Carlo Sig.	Sig.		.250[b]
	90% Confidence Interval	Lower Bound	.131
		Upper Bound	.369

a. Kendall's Coefficient of Concordance

Table 4.4 Extent of Using Support Conditions Metrics

Descriptive Statistics

	N	Mean	% mean	Std. Deviation	Minimum	Maximum	Mean Rank

BQ4.1 extent of ICT use in promoting student's interests	36	1.2778	25.5556	.74108	1.00	4.00	2.78
BQ4.2 extent of ICT use in promoting development of lifelong skills	36	1.4444	28.8889	1.13249	1.00	5.00	2.92
BQ4.3 extent of ICT use in promoting real-world application rather than only the teaching	36	1.5556	31.1111	1.31897	1.00	5.00	2.97
BQ4.4 extent of ICT use in promoting influence of external learning opportunities	36	1.6667	33.3333	1.51186	1.00	5.00	3.17
BQ4.5 extent of ICT use in promoting desire to change my present way of using ICT	36	1.6667	33.3333	1.51186	1.00	5.00	3.17
		1.5222	30.4444				

Test Statistics

N			36
Kendall's W[a]			.094
Chi-Square			13.581
df			4
Asymp. Sig.			.009
Monte Carlo Sig.	Sig.		.000[b]
	90% Confidence Interval	Lower Bound	0.000
		Upper Bound	.062

a. Kendall's Coefficient of Concordance

.

Table 4.6 Motivation and Commitment to Student Learning and Professional Development

Descriptive Statistics

	N	Mean	% mean	Std. Deviation	Minimum	Maximum	Mean Rank

BQ6.1 adequacy of ICT technology,	36	1.9444	38.8889	1.56651	1.00	5.00	2.50
BQ6.2 adequacy of time to learn ICT	36	1.8889	37.7778	1.50765	1.00	5.00	2.39
BQ6.3 provision of technology needed	36	2.1667	43.3333	1.73205	1.00	5.00	2.61
BQ6.4 existence of academic and cultural structure encouraging experimenting new ICT	36	1.9444	38.8889	1.60258	1.00	5.00	2.50
		1.9861	39.7222				

Test Statistics

N			36
Kendall's W[a]			.044
Chi-Square			4.800
df			3
Asymp. Sig.			.187
Monte Carlo Sig.	Sig.		.167[b]
	90% Confidence Interval	Lower Bound	.064
		Upper Bound	.269

a. Kendall's Coefficient of Concordance

Table 4.7: Summary of Extent of using ICT integration metrics

position	metric	mean extent of integration metric use	% extent of integration metric use	hypothesis rejection-1 or acceptance-0	correlation Wa
1	course	2	40	0	0.097
2	motivation and commitment	**1.9**	**38**	**0**	**0.044**
3	support conditions/Attitude	1.5	30	0	0.094
4	Support services	1.77	35.4	1	0.032
5	time	1.4	28	0	0.029

6	technical malfunction	1.4	28	0	0.39
	average	**1.64**	**32.8**		**0.1308**