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Original Research Article

Effectiveness of Quantitative Factors Used in the Evaluation of Lecturer's Teaching Workload

Maoncha Evans Ombati*, Simon Karume, Moses Thiga
Kabarak University Kenya

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Abstract

The teaching profession has one of the highest numbers of workforce grappling with heavy workload. Excessive lecturers' workload causes adverse effects to both employer and employee. Lecturers are assigned lectures in multiple independent universities and there is no platform to foster inter-university communication regarding the shared lecturers' employment state, tenure and lecturing obligations. Kenya's Commission for University Education has guidelines set to limit the maximum lecturer workload and yet there is no way in which Commission for University Education monitors and regulates inter-institution lecturers' teaching workload. There is the need to employ technology to address this problem. Hence this study examined quantitative factors used in evaluation of a lecturers' teaching workload. A critical survey of previous studies and current technologies associated with lecturers' workload management helped establish the technological gaps to be filled by a web-based model for monitoring inter-institution lecturer's teaching workload in institutions of higher learning. The methodology adopted by this research is the triangulation methodology while a proof of concept methodology was applied to develop and test the model. The research questions were answered through engaging industry experts in a validation exercise. The model's properties validated included confidentiality, integrity, availability, user interface and viability. During focus groups, the model's confidentiality attribute received the lowest rating of the five evaluated attributes. Participants acknowledged the need to monitor lecturers' workload to help in policy formulation and ultimately improve lecturers' competency. Management, human and technical challenges are anticipated during the adoption phase of the model. Feedback received from part of the participants also indicated that the model would be an efficient tool in safeguarding lecturers against burnout arising from heavy workload.

Keywords: quantitative factors, evaluating, lecturers' workload.

INTRODUCTION

The United Kingdom Government [1], acknowledges the importance of monitoring teachers' workload and they conduct biannual surveys to track teacher workload so that action can be taken if needed. Roberts [2] highlights the need for technology to reduce a teacher's workload. CUE has set guidelines on the maximum workload a university should assign to its lecturers [3]. Unfortunately, Commission for University Education has no established means that it can employ to monitor inter-institution lecturer's teaching workload as it lacks the organizational, technical and human capacities to monitor and enforce quality compliance [4].

Therefore, there is a need for Commission for University Education to employ technology to monitor and regulate the lecturers' teaching workload across the nation. Individual universities should also be provided an avenue which they can use to check the potential lecturer's lessons assigned before employment and also to check monitor the workload of their current lecturers. Online technological solutions are very useful as the solutions are inherently distributive [5]. This distributive characteristic of an online solution is helpful in sharing the relevant information amongst the relevant stakeholders. This thesis sought to prove that a web-based model for monitoring inter-institution lecturers' teaching workload in institutions of higher learning would help evaluate and monitor a lecturer's teaching assignments across all institutions of higher learning.

The need to improve accessibility to higher education in Kenya has resulted to the government instituting many institutions of higher learning. This effort has not been matched an equal effort in training additional teaching staff. This scenario has resulted to increased workload among the existing teaching staff with universities having no option other than sharing the few existing teaching staff in a part time arrangement. This arrangement has resulted to

Lecturers offering teaching services to multiple institutions in an unregulated manner and too often they end up biting more than they can chew in terms of the number of teaching sessions they commit to in a quest to increase their earnings. Workload management enables effective job distribution and facilitates the employees to attain best performance and efficiency levels. Unmonitored inter-institution lecturers' teaching workload may lead to conflict of commitment, conflict of interest, minimum publications, and minimum supervised students, substandard quality of lecture delivery, family conflict and stress. These and many other adverse effects which unmonitored inter-institution lecturer's teaching workload has on a lecturer's overall competency highlights the need for a technological solution to monitor all inter-institution lecturers' teaching workload. Unfortunately, there is no system whether technological or not that's currently in use by Commission for University Education to help keep track the number of lecture hours taken up by any individual lecturer in an academic semester in Kenya. The Commission for University Education it lacks the organizational, technical and human capacities to monitor and enforce quality compliance [6]. Having an Inter-Institution System for Lecturer Teaching Workload Management will help the university management and Commission for University Education and any other regulatory body in monitoring the number of teaching sessions and lecture hours assigned to every registered lecturer in any of the university campuses within the country.

Lecturers' Workload Problem in Kenya

In Kenya, the accrediting commission for universities is CUE (Commission for University Education)[7]. Due to the growth and expansion of the university sub sector in Kenya, CUE was established to address the need to regulate, coordinate and assure quality in university education [8]. Too often, lecturers overload themselves or get overloaded by their employer's demands. A basic lecturer's work description includes delivering lectures, seminars and tutorials; designing, preparing and developing teaching materials; developing and implementing new methods of teaching to reflect changes in research; assessing students' coursework; setting and marking examinations; undertaking personal research projects; writing up research and preparing it for publication; supervising students' research activities; continuous professional development activities; representing the institution at professional conferences and seminars[9].

Tully [10] describes teaching workload as the time-tabled delivery of a lecture. This study focused on lecturers' teaching workload and uses the number of lecture sessions and hours per academic semester to quantify the teaching workload. An institution of higher learning is any educational institution that is accredited by a nationally recognized accrediting commission, or if not so accredited, it has been granted pre-accreditation status by such a commission that has been recognized by the secretary for the granting of pre-accreditation status, and the secretary has determined that there is satisfactory assurance that the institution will meet the accreditation standards of such a commission within a reasonable time [7].

Kenya has been struggling to match university rising enrollments with teaching staff [4]. Lecturers who engaged take up teaching jobs at several institutions experienced increased lecturer workloads and this in turn was hurting their ability to provide quality education to students and to conduct research [1]. The number of professors in public universities in Kenya rose by a meager 11% (238 to 265)[25] over a period of three years (2012-2015) while student numbers soared up by 56% (140,000 to 300,000) over a five-year period (2010-2015). The overall teaching workforce in Kenya's public universities grew by a negligible 8% (4,800 to 5,189) over a three-year period (2012-2015)[1]. While the United Nations Educational, Scientific and Cultural Organization (UNESCO) recommends a ratio of 1:45, the average lecturer to student ratio stood at 1:500 as at 2015. In some instances, the lecturer to student ratio rises to 1:900 [11]. This shortfall in the number of lecturers instigates some lecturers to take up extra teaching jobs in more than one campus [11]. This means that one lecturer may teach several courses in different university campuses. Kaburu and Embeywe [11] point out that a shortage of teaching staff in universities has led to lecturers teaching up to 36 hours per week. Workload management enables effective job distribution and facilitates employees to attain best performance and efficiency levels [12].

CUE university standards and guidelines states that "the maximum lecturer workload shall be 40 hours per week and shall include teaching; preparation of examination papers; marking of examination scripts; preparation of teaching tutorials; supervision of academic work; administrative work; laboratory and laboratory preparation; and research/research assignments [3] ". This policy is the only discernible score that Commission for University Education has racked up in an effort to regulate its lecturers' workload. CUE hasn't gone a step further to devise a way in which they can monitor each individual lecturer's workload across several campuses. CUE has also no means to keep track of a lecturer teaching in multiple university campuses due to the lack of an inter-institution information sharing platform. Having more administrative and off-the-class duties affects a lecturer's overall workload.

Lecturer Management Models and Software Available

Some universities across the globe may have their own management information systems but no technology is available currently to manage the

lecturers' teaching workload across several university campuses and ultimately the whole nation. Whenever universities or university departments have their own Management Information Systems, it brings about access and monitoring difficulties to CUE. Roberts [2] points out that, "Despite schools being the owners of the data, the power of marketplace-based integration into other, rapidly deployable applications, is not accessible by schools. Access to their data is, in general, effectively controlled by Management Information Systems providers as it is limited by the cost, methods and extent to which they make such data available to third parties". Management Information Systems are monopolistic in nature and the business-like, costly methods of integration may repress this process. In a presentation on developing a university data collection System in Kenya, Prof. Jan Denium emphasized on the importance of data in informing advisories to better the University sector. He urged universities to co-operate in availing data to CUE even as CUE worked on implementing a new data collection tool [3].

Learn Speed- An Education Services Management Software

Learn Speed [12] is a business modeled education services data management system. It is used in managing tutors, therapists, counselors, administrators, students, and parents. A tutor gives private lessons to one student or a small group of students and tutoring companies help link up tutors with students. LearnSpeed features integrated scheduling software, payment processing, QuickBooks integration and much more. Learn Speed can be used by tutoring and test-preparation centers, counseling offices, special education services providers, music schools and many other professional session-based businesses.

As education services business software, LearnSpeed partners with single person companies to multi-location organizations with hundreds of instructors and thousands of students to improve their quality of service while decreasing their administrative costs. It has an availability tracking tool which each staff can use to create 'Available' event types indicating their scheduling availability for tutoring sessions e.g. between specified times during the day and note whether they work Saturdays or Sundays. LearnSpeed has left the availability control at the discretion of each tutor which is only okay in business modeled software. The main limitation of this system is that it has no functionality which a governing agency or an oversight authority can be incorporated to monitor every lecturers' availability status thus monitor the workload of all the lecturers in the system.

Skills Matrix- A Tutor Management Software

Skills Matrix [13] is another fully configurable online tutor management system for organizations that use freelance, hourly-paid or associate lecturers and tutors. It's designed to make it as easy as possible for managers to recruit and manage hourly-paid staff, commission work from them and track progress, payments and budgets. Similar to Learn Speed [12], it has features that allow for the recruitment and subsequent approval workflow online. Skills Matrix [13] also faces the same limitation as Learn Speed [12], in that the tutor's availability is only at the discretion of the tutor himself/herself and no provision is available for a regulatory body/agency to be incorporated into the system. Tutor Panel [14] is among many other web-based tutor management systems that concentrate more on the business part of billing, scheduling and recruitment of tutors with no regards to provision given to having an oversight/regulatory institution to monitor the tutors' workload.

A Tutor –A free Open Source LCMS

A Tutor is an open source web-based Learning Content Management System [14]. It is used to create online courses, create and share e-learning content. If any potential instructor aspires to be an A Tutor Instructor, he/she sends a request to an A Tutor Administrator. A Tutor Administrators are informed via email whenever new requests are made. An A Tutor administrator reviews instructor's personal information and assigns instructor status so they may create courses. The system allows the instructor to create, edit and delete users. An A Tutor Instructor can manually create or automatically generate as many workgroups as he/she prefers. Similar to a classroom, these groups provide a private area where students can work, instructors can create an assignment submission area, and instructors can assign tests to specific students or for a variety of tutoring uses. In terms of an instructor's workload management, the A Tutor LCMS has left a lot to be desired by leaving the workgroups functionality management at the total discretion of the instructor. A Tutor is more focused on using technology to assemble, package, store and transmit web-based content between instructors and students.

Academic Record Management System

There are many academic management systems but they mainly focus on students' academics. Ofos and Bemile [15] published a scholarly paper in which Microsoft Access would be used to design and develop an academic record management system to keep track of a lecturer's activities like the publications made in an academic year, conferences attended, research in progress, courses taught in the academic year and qualifications earned in the academic year. Their focus was to evaluate and salute a lecturer's academic achievements throughout the year. Ofos and Bemile also described how the academic record management system would run on the institutions intranet and would involve processes like electronic transmission of forms and database operations line querying and updating. Their system would simplify the Quality Assurance Unit of Methodist University

College Ghana's process of preparing annual reports by eliminating the long line of processes characteristic of the old system. The reports generated by the new system were made available for the Principal's annual report, the Academic Board and the National Accreditation Board.

Unlike PHP, Microsoft access doesn't have triggers and advanced functions (e.g. scheduled jobs like backups) unless you employ complex coding and external programs/libraries. The academic record management system was able to provide information about all lecturers' accomplished teaching workload in the Methodist University College Ghana within an academic year but would not be able to quantify the time spent in each of the various campuses a lecturer may be engaging in part-time lecturing in other campuses within the country. Another drawback of the system in monitoring lecturer's workload was that it provided lecturer workload reports after completion of an academic year rather than before the start of the academic year. Knowing the expected or current workload for a specific lecturer beforehand or in real-time will help the relevant stakeholders take appropriate measures to limit the workload before the lecturer embarks in doing the actual duty if it is deemed to affect the lecturers' competency.

METHODOLOGY

The methodology adopted by this study was a hybrid/mixed method approach. This study used a design called Triangulation. Triangulation is the combination of two or more theories, data sources, methods or investigators in one study of a single phenomenon to converge on a single construct and can be employed in both quantitative (validation) and qualitative (inquiry) studies [16]. In this design, there was a single data collection phase, during which both quantitative and qualitative data was collected. Quantitative research was useful in quantifying the lecturer teaching workload monitoring problem by generating numerical data or data transformable into usable statistics while qualitative research helped this study to quantify behaviors and generalize results from a larger sample population [17].

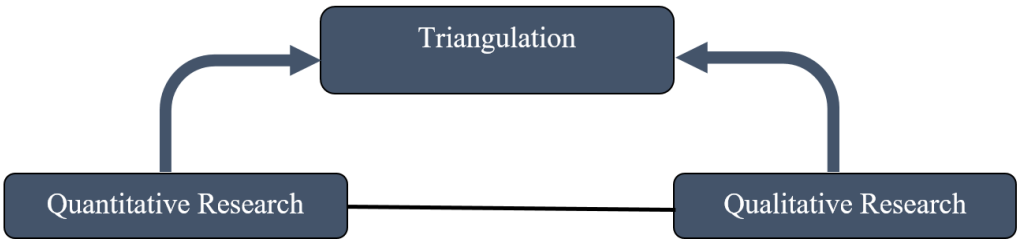

Fig-1: Basic 'triangulation' research model

This study adopted a research design that allowed for the researcher to systematically follow a series of actions that included preparations, model development and implementation, desktop validation, expert validation, focus groups and results analysis as shown in the Table 1 below.

Table-1: Process steps followed during this research design

Step	Action	Description
1	Preparations	Adhering to administrative and regulatory requirements, identification of subjects.
2	Model Development, Model Implementation	Development and implementation of the model design i.e. Designing and actual coding
3	Desktop Model Validation	The developer executes a test plan using dummy data and test results reporting
4	Expert Validation	Study subjects/experts interact with the developed model, and validate with the help of a test regime
5	Focus Groups Meetings	Conduct with relevant stakeholders/participants to collect data/feedback after they validated the model
6	Results Analysis	Analysis of feedback collected from the experts

Focus groups were used to collect information from the participants in this study. Focus groups were held in the four university institutions and CUE premises. Settling on a specific time when all participants would be present introduced a major challenge due to the busy nature of the participants' schedule. Random selection or random sampling was the subject selection criteria used in this study. In random sampling, each individual had an equal probability of being selected from the population, ensuring that the sample was representative of the population. The researcher generalized the results to a wider phenomenon. The results reporting methodology used gave emphasis to simplicity. The simplification was sought through clear writing, minimization of technical (particularly mathematical) details and liberal

use of simple tables, charts and diagrams. There was no indication of major confounding variables "polluting" the results. This study used the narrative reporting style where complete sentences were formulated. A few relevant visual aids e.g. simple charts and graphs helped report on quantitative data. Unlike their institutions, the lecturers in this study were not revealed. Reporting the results collected during the validation exercise served to; communicate useful information, provide a historic record of findings and develop a logical description of this state.

RESULTS AND FINDINGS

Model Design Process

Requirements feasibility tests were carried out to find out if the requirements are testable. The System Requirements Document specified the overall system requirements that governed the development and implementation of the model. It entailed creation of POC-specific use cases for minimal but necessary functionalities within the POC scope (for proof of capability initiatives, aligned use cases to each capability in scope). This phase also established initial security, training, capacity and architecture requirement. Deliverables in the 'Develop' phase included: Use Cases, Success Criteria (revised based on preliminary findings throughout this process step).

To create UML diagrams, this study used StarUML version 2.8.0. Star UML supports eleven kinds of UML diagrams: class, object, use case, component, deployment, composite structure, sequence, communication, state chart, activity and profile diagram [18].

- **General System Requirements**

This model had three main categories of users; regulatory body (Commission for University Education), universities and individual lecturers. A use case diagram demonstrated the main essential features which the model must perform. In addition to providing these user functionalities, the developed model had to be available on the internet, be available 24 hours per day and accessible by mobile devices. Figure 8 below shows the model's use case diagram.

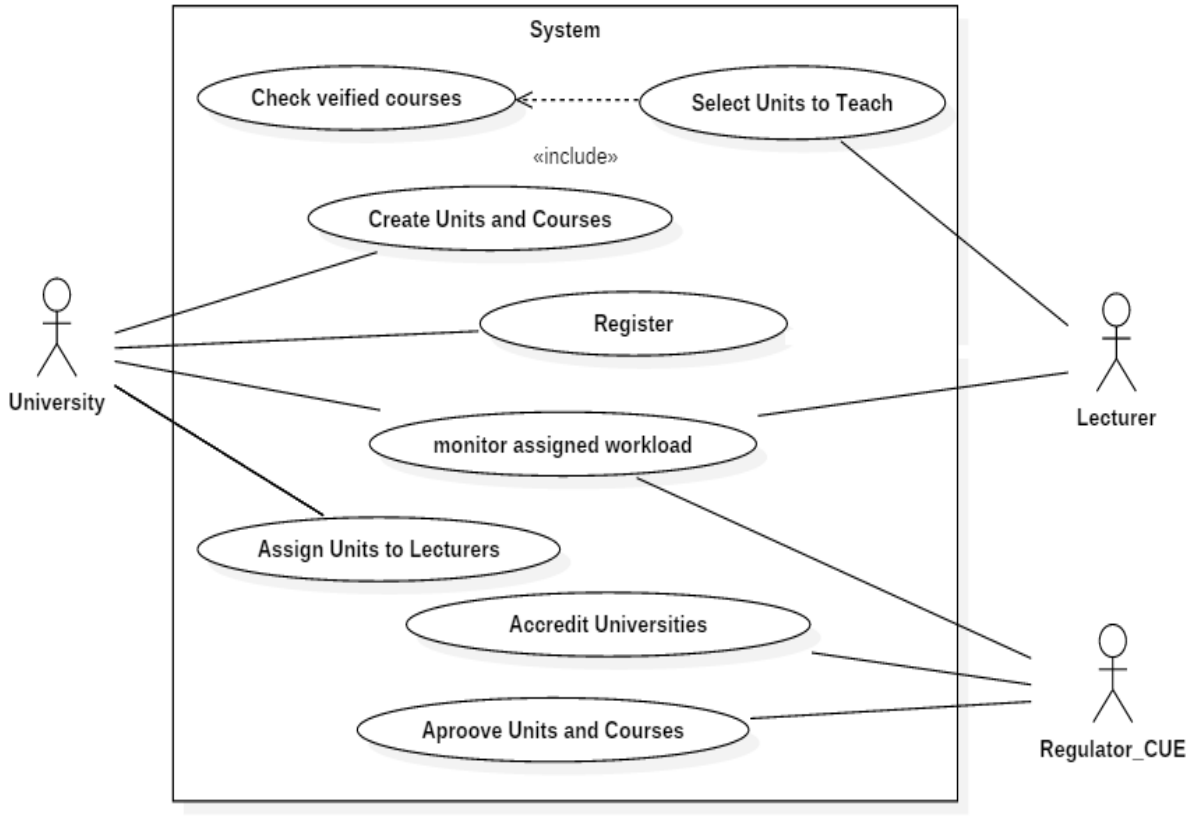

Fig-1: Model's use case diagram

- **Security Requirements**

The model adhered to ISO/IEC 27001:2013 (ISO 27001) and 27002 standards which outline the best practices for ISMS (Information Security Management System) and Cyber Security Standards [19]. The model had authentication and verification mechanisms, access controls levels and collect detailed logs as part of its security features.

- **Policy and Regulatory Requirements**

Commission for University Education is meant to address the need to regulate, coordinate and assure quality in university education as a result of growth and expansion of the university sub sector in Kenya [8]. This instigated the need for the Commission for University Education to have greater administrative rights and control over the universities and lecturers. Only CUE (Commission for University Education) accredited academic institutions were allowed access into the model by this study. The university standards and guidelines states that "the maximum lecturer workload shall be 40 hours per week and shall include teaching; preparation of examination papers; marking of examination scripts; tutorials; preparation of teaching; supervision of academic work; administrative work; laboratory and laboratory preparation; and research/research assignments[3]". The model therefore ensured that the value of lecture sessions taken up by any lecturer is not manually editable by any individual but only racks up or drops off in tune to the teaching courses committed to or relieved from.

Model Definition/Exploration

Initiative teams and key stakeholders were identified in this phase. Resource commitments during the process were also established in this step. All possible requirements of the model to be developed in this study were captured in this phase of the POC and documented in a model RSD (Requirements Specification Document)/ RUD (Requirements Understanding Document). This entailed understanding and describing the objectives needed to correct performance deficiencies. Deliverables in the 'Define' phase included: detailed Proof of Concept Scope and Plan Documentation, Success Criteria, and a Proof of Concept Schedule.

Model Engineering

The SDD (System Design Document) describes the architecture, files and database design, human-machine interfaces, detailed design, and external interfaces of the model. Program/architectural/detailed design involves the formulation of blueprints for a particular solution and with modeling the detailed interaction between its components [20]. Deliverables in the 'Engineer' phase included: Solution Design, Implementation Plan, Success Criteria (revised again based on latest findings).

Model Architecture

The model was accessed through a browser installed on a user's end device, these devices included laptops, smart phones, desktop computers etc. a web server hosted the application and a database server stored the data. The web server used hypertext transfer protocol to serve the web pages to the end devices. A database server provided a database service to respond to a query language [21]. The load balancer improved performance and reliability by distributing the workload across more servers. The load balancer enabled horizontal scalability and provided protection against DDOS attacks by limiting client connections to a sensible amount and frequency. Having a database outside the DMZ (Demilitarized Zone/ Demarcation Zone) improved the security of the model [22].

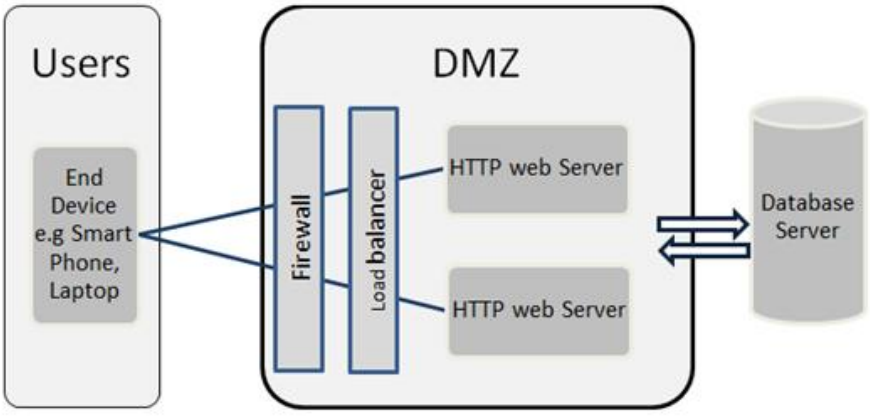

Fig-2: Basic hardware architecture of the model

Error Handling

Errors that occur while processing the form were caught by the CodeIgniter Validation Library. Errors were also handled using HTTP Status Codes. HTTP Status Codes tells the users much about what has gone wrong and even without additional information, it gives users hints about what to do next. 5XX codes indicate something is wrong with the server and 4XX indicate something is wrong with the request [23].

Entity Relationship

Every qualified lecturer and accredited institutions of higher learning have to register into the model. CUE accredits universities and approves verified programmes proposed by universities. University institutions employ lecturers, create programmes and associated courses for approval by CUE. Each program contains several courses. Lecturers are required to identify and select one or more courses

which he/she is comfortable teaching. Figure 10 below shows the entity relationship diagram.

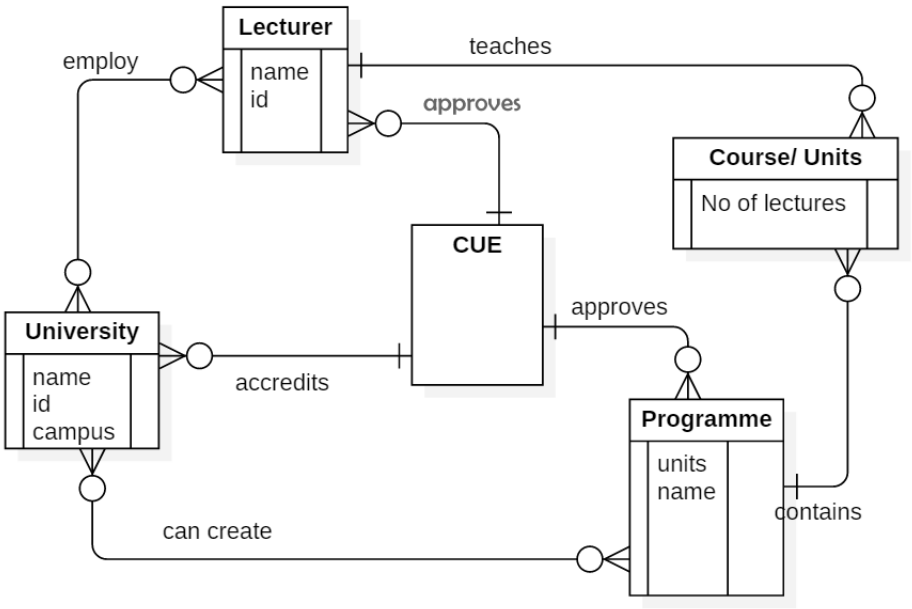

Fig-3: Entity relationship diagram

Workload Computation Derivation

Multiplication of each course sessions count (C_1) by its session duration (D_1) requirements gave the course total time contribution (CD) to a Lecturer's Total Teaching Workload ($LTTW$). To get a Lecturer's Total Teaching Workload ($LTTW$), this study computed the sum of each course time contribution.

$\boldsymbol{C_1, C_2, C_3}$ …. $\boldsymbol{C_n}$ Course lecture sessions Count per academic semester

$\boldsymbol{D_1}$, $\boldsymbol{D_2}$, $\boldsymbol{D_3}$ …. $\boldsymbol{D_n}$ Course session Duration in hours

$\boldsymbol{C_n \cdot D_n = C_1D_1 + C_2D_2 + C_3D_3}$ ……..$\boldsymbol{+ C_nD_n}$

$\boldsymbol{C_1D_1}$, $\boldsymbol{C_2D_2}$, $\boldsymbol{C_3D_3}$ … $\boldsymbol{C_nD_n}$

Lecturer's Total Teaching Workload ($\boldsymbol{LTTW}$) in hours per semester

$\boldsymbol{C_n \cdot D_n}$ = Lecturer's Total Teaching Workload ($\boldsymbol{LTTW}$) in hours per semester

Model Implementation

The developed model was powered by: -

- Virtual machine: Linux Operating System
- Server: Apache 2.4.25
- Database: MySQL 5.1+ via the MySQLI (MySQL Improved) and PDO (PHP Data Objects) drivers
- Languages: PHP 5.6+ (Hypertext Pre-processor), JavaScript
- Frameworks: CodeIgniter 3.1.6 (PHP framework), Bootstrap 3.1.1.4 (HTML, CSS, JavaScript framework), jQuery
- Styles: HTML (Hypertext Markup language), CSS (Cascading Style Sheets)

CONCLUSION

This model's successful adoption is strongly hinged upon the support and co-operation of various stakeholders. Management, human and technical challenges are expected during the adoption phase. Human challenges are expected to be the major obstacle amongst these. There's the need to conduct consultations, stakeholder sensitizations and an advanced pilot study before rolling out of the model. The full participation of lecturers and universities in the solution will help develop a solution with effective, efficient and mutually reinforcing working condition sensitive policies and programs that will foster the empowerment and advancement of lecturers within the institution [24].

Recommendations

Development of a model to monitor a lecturer's inter-institution teaching workload using alternative quantifiable attributes. Feasibility of the use of the total number of students taught by the lecturer, years of lecturing experience, type of course(s) which the lecturer teaches, number of university campuses a lecturer teaches in and any other quantifiable attribute should be looked upon. Corroboration of a couple of these properties with the total tutoring hours will help develop a more robust solution.

REFERENCES

1. Ng'ang'a, G. (2015). New Rules on Masters, Moonlighting and Lecturer PhDs. (S. Dell, Ed.) *University World News.* (152). Retrieved June 14, 2017, from University World News:

http://www.universityworldnews.com/article.php?story=2015052112575049
2. Roberts, J. (2016). Can technology genuinely reduce teacher workload. *Advanced Learning*, 10. Retrieved March 22, 2017, from http://www.advanced-learning.co.uk/wp-content/uploads/2016/02/Can-technology-genuinely-reduce-teacher-workload.pdf
3. Commission for University Education. (2016). The state of higher education in Kenya. *Report of the 1st biennial conference on the state of higher education in Kenya*. (p. 14). Nairobi: Commission For University Education.
4. Munene, I. (2016). *kenyas' Universities are in the grip of a quality crisis*. Retrieved March 24, 2017, from The Conversation: http://theconversation.com/kenyas-universities-are-in-the-grip-of-a-quality-crisis-54664
5. Corral, L., Janes, A., & Remencius, T. (2012). *Potential Advantages and Disadvantages of Multiplatform Development Frameworks*–A Vision on Mobile Environments. Procedia Computer Science. 10. 1202-1207. 10.1016/j.procs.2012.06.173.
6. Munene, I. (2016). *Part time lecturers are the norm in kenya*. Retrieved March. 23, 2017, from The Conversation: http://theconversation.com/part-time-lecturers-are-the-norm-in-kenya-theres-a-plan-to-reverse-the-practice-65977
7. KE Const. (2012). Universities Act. In Constitution, *Universities Act* (pp. Universities Act, No. 42). Act of Parliament.
8. Commission for University Education. (2017). *Vision and Mission*. Retrieved February 16, 2017, from Commission for University Education: http://www.cue.or.ke/index.php/about-us/vision-and-mission
9. AGCAS Editors. (2015). *Job Profile*. Retrieved February 10, 2017, from Prospects: https://www.prospects.ac.uk/job-profiles/higher-education-lecturer
10. Tully, J. (2016). The Workload Allocation Process and the Workload Model. *Workload Management Framework*, 7. Retrieved May 26, 2017
11. Wesangula, D. (2015). *Kenya's shuttling lecturers*. Retrieved February 16, 2017, from The Guardian: https://www.theguardian.com/global-development-professionals-network/2015/jul/29/kenyas-shuttling-lecturers-university-shortages-are-taking-toll
12. Field Promax. (2014). *Using Workload Management to improove your productivity*. (Field Promax) Retrieved February 22, 2017, from Field Promax: http://fieldpromax.com/workload-tracking-software
13. Skills logic. (2017). *Online Tutor Management System*. Retrieved March 17, 2017, from Skills Logic: http://www.skillslogic.com/services
14. ATutor. (2017). *ATutor Features*. Retrieved April 2, 2017, from ATutor: www.atutor.ca
15. Ofos, J. B. & Bemile, R. K. (2013). Lecturer Academic Record Management System(A Case of Methodist University College Ghana). *Open Science Repository Computer and Information Sciences*, 1. Retrieved February 16, 2017, from http://www.open-science-repository.com/computer-and-information-sciences-23050476.html
16. Yeasmin , S. & Rahman, K. F. (2012). 'Triangulation' Research Method as the Tool of Social. *BUP Journal, I*(I), 156. Retrieved June 2017, 24, from https://www.bup.edu.bd/journal/154-163.pdf
17. Slevich, L. (2011). Qualitative and quantitative methodologies compared:Ontological and Epistemological Perspectives. *Journal of Quality Assurance in Hospitality and Tourism*, 12, 73-78.
18. MKLab. (2016). *StarUML*. (MKLab, Editor) Retrieved May 29, 2017, from StarUML: http://www.staruml.io
19. IT Governance. (2017). *ISO/IEC 27001 Information Security Management Standard*. Retrieved May 20, 2017, from IT Governance: https://www.itgovernamce.co.uk/iso27001
20. Budgen. (1896). *Sofware Engineering Institute Report.*
21. Oracle. (2017). *Cluster Architectures*. Retrieved April 17, 2017, from Oracle: https://docs.oracle.com/cd/E13222_01/wls/doc90/cluster/planning.html
22. Anicas, M. (2014). *5 Common Server Setups For Your Web Application*. Retrieved August 30, 2017, from Digital Ocean: http://www.digitalocean.com/community/tutorials/5-common-server-setups-for-your-web-application
23. StaticApps. (2014). *Front End Error Handling*. Retrieved May 27, 2017, from Static Apps: https://www.staticapps,org/articles/front-end-error-handling/
24. Adedoyin, O. O., Richard, I. A., & Wasiu, O. A. (2013). Moonlighting Among University Lecturers and Their Performance in. *Journal of Management and Sustainability. 3*(4), 92-101.
25. Rose, S., Spinks, N. & Canhoto, A. I. (2015). *Management Research: Applying the Principles.* London: Routledge. Retrieved January 20, 2018, from http://documents.routledge-interactive.s3.amazonaws.com/9780415628129/Chapter%209%20-%20Determining%20sample%20size%20final_edited.pdf