Student-Centered Learning in Uganda: The Mwalimu Online Study Tool

John Byabazaire, Benedict Oyo, Rashid Mijumbi

***Abstract*— Education in high schools and colleges is changing rapidly. Student-centered learning (SCL) has shifted the focus from teachers to students. The idea of SCL is to encourage students to actively participate in their learning by providing them with an environment and resources that allow them to discover new knowledge and skills. In this paper, we present a design, implementation and evaluation of a student-centered learning tool - The Mwalimu – which is aimed at helping disadvantaged students in some high schools in Uganda. The objective is to bridge the ever widening gap in academic performance of students from the rich families and the low income ones, and/or that between rural and urban schools. To this end, we have developed an open courseware platform called Mwalimu Online Study Tool, from which students and/or teachers from any school can access subject specific content, examinations, learning video tutorials and a discussion forum which are moderated by carefully chosen teachers (Mwalimu subject consultants). The platform also accepts content from the crowd, verifies it using the subject consultants and adds it to the content repository if it is of acceptable quality. Even more, students can send feedback or seek for guidance with respect to specific content. Owing to the solid architecture on which it is developed, and the preliminary evaluations, Mwalimu promises to boost academic performance across all schools irrespective of their geographic location.**

***Index Terms*— Student-Centered Learning, Mwalimu, Active learning, Problem-based Learning, Online Learning.**

I. Introduction

The realistic goal of education is to impart knowledge and skills to students to nurture their innovation capacities. Student-centered learning is a form of learning that allows students to be active participants in their learning. The students do learn following their interests and based on their own motivation. Learning systems that promote student-centered learning should among other things provoke independent reasoning, problem solving and critical thinking [1]. There is mounting evidence that supplementing or replacing teachers with active learning strategies and engaging students in discovery and scientific process improves learning and knowledge retention [2]. In general, there are many reasons to shift from teacher centered to student centered learning, just like there are many forms of SCL [3]. The focus of the work in this paper is on providing students with resources so that even when they cannot directly communicate with teachers they can still learn. In Uganda, the performance of students both at high school and undergraduate levels can mainly be looked at in two ways: On one hand there are students in schools in urban areas that are characterized by high school fees, relatively good school facilities (equipped science laboratories, computer laboratories, and a conducive learning environment) and teachers that work so hard "*spoon-feeding*" their students to ensure that the students pass their final national examinations. On the other hand are students in rural schools who go to government aided public schools that are characterized by poor management, poor resources and teachers that are not only unequipped, and less experienced but also not motivated to do their work. In particular, in some areas in the northern part of the country, it is even difficult to find qualified teachers who are happy to settle there; mainly due to security concerns as well as the poor infrastructural facilities [4]. This has created student: teacher ratios of up to 1:200 in these areas [4].While both these cases do not really result into students that actually learn and pick interest in what they do, it can be noted from national examination [5] results that students from the former case always perform much better than their counterparts in rural areas [6]. For this and many other reasons, the draft ICT Policy for Uganda [7] envisages a long awaited shift from the current teacher centered education towards student centered learning through: increased investment into educational ICT equipment, software as well as broadband connectivity for primary, secondary and tertiary institutions; establishment of educational networks for sharing educational resources; and training teachers with the necessary ICT skills in order to enable them use ICTs in the teaching and learning process. In fact, the Uganda National Curriculum Development Centre (NCDC) [8] has already taken preliminary steps by making computer studies at both Ordinary and Advanced Level secondary education compulsory. To support this, the Ugandan government has committed funds through Uganda Communication Commission to establish computer laboratories across most public schools [9]. While this focus will inevitably lead to the improvement in the ICT infrastructure across most – up to recently - disadvantaged schools in the country, it is now time to take advantage of this shift to make sure that the students gain un reservedly from these changes. One key issue that has

Manuscript received August 24, 2013. This work has been supported by Google under the Computer Science for High School initiative. We also acknowledge support from RAN, ACIA and Gulu University.

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not been looked at in this regard is the fact that providing students with access to computers without education content would be wasteful not only in terms of the infrastructure investment, but could also lead the students to using them to engage more in activities that do not contribute as much to their early development. The work in this paper is therefore aimed at contributing to the ICT applications needed to achieve independent learning by proposing a platform that provides educational content to students across the country. Our emphasis is on innovation based education through deeper engagement of students, which helps them better understand content; succeed in examinations and graduate/drop-out with innovative skills. The application is developed with the state-of-the-art online technology allowing access through computers and smart mobile devices. The contributions of this paper are four-fold: a question and answer learning platform, access to a pool of rich instruction material with multimedia content, access to video tutorials and supporting continuous assessment through an examinations resource.

The rest of this paper is organised as follows: We present the related works in Section II. Section III presents a brief description of the problem, a proposed solution approach and its justification. The proposed system design and implementation is presented in Section IV, followed by a preliminary evaluation in Section V. We conclude the paper in Section VI.

II. Related Work

There are a number of applications that support online learning. These range from the generic eLearning [10] tools such as Moodle [11] and Blackboard [12] to more specialised ones. This section focuses on the latter as the tool developed in this paper belongs to the same category of eLearning applications.

A. Edmondo

Edmondo [13] is an online application which provides teachers and students a secure place to connect and collaborate, share content and educational applications, and access homework, grades, class discussions and notifications. The main goal is to help educators appreciate the power of computer based learning to customize the classroom for each and every learner. This tool is unique in that it's an application that supports all levels of education i.e. from lower primary to tertiary institutions. The relevance of such a system is to help students stay connected to their teacher wherever they are and hence increasing student innovation and discussion.

B. Smart classrooms

Smart Classrooms [14] is a comprehensive strategy for digital education in Queensland state schools. The key to the strategy is that it is student-centric; recognising the demand, from both students and their parents, for seamless movement between learning at school, home, work and play. Smart Classrooms provides direction for harnessing the learning and business potential of ICT now and into the future. This is yet another online application that cuts across all levels of education.

C. Edx

Edx [15] is designed such that it features learning designed specifically for interactive study via the web creating a new online-learning experience with online courses which lets the student study on his/her own. This not only increases the productivity of the student but also the innovativeness of the student and hence leading to student centered learning. Edx focuses on only higher education. In general, all the above solutions provide teachers and students a secure place to connect and collaborate, share content and educational applications, and access homework, grades, class discussions and notifications. They assume that the teachers will directly provide the content for the students, therefore ignoring content development [16] as a way of improving student innovativeness in the learning process. Our major focus is in helping those students in schools where to start with the teachers may not be available, or need more resources.

D. Ugandan context

In the Ugandan context, Cyber School Technology [17] is a premier provider of quality educational services offering world-class solutions to enhance the online educational environment globally. The one-stop-site for development, e-learning, communication solutions, Cyber School Technology Solutions works with experienced educators to provide student centered learning experience and easy access to syllabus specific lessons on Science and related subjects. Cyber School Technology currently supports secondary education. Unlike Cyberspace where it is up to the student to look for what they want from various locations which may be confusing Mwalimu is a one stop learning repository with content carefully filtered and organized into the respective subjects to let student only look at what they want. The examination resource is also a unique feature of Mwalimu. It helps the students in self-assessment by providing well set examinations and their solutions to let the students clearly know what is required of them from the main examinations board in Uganda.

III. Problem Description

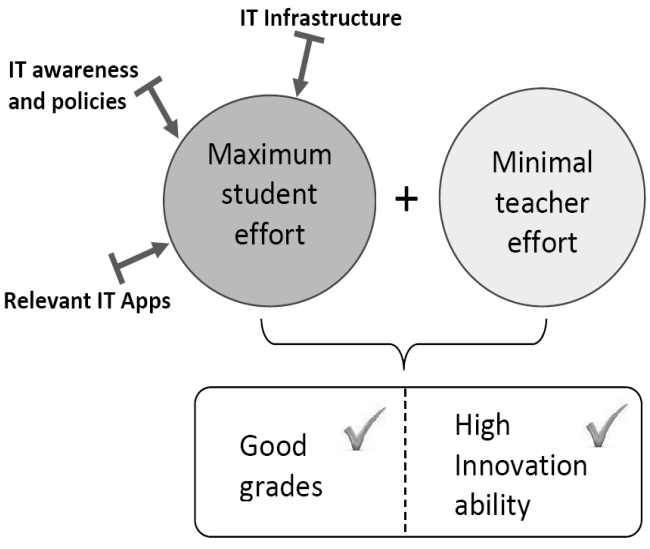

Fig. 1. Illustration of teacher-centered learning

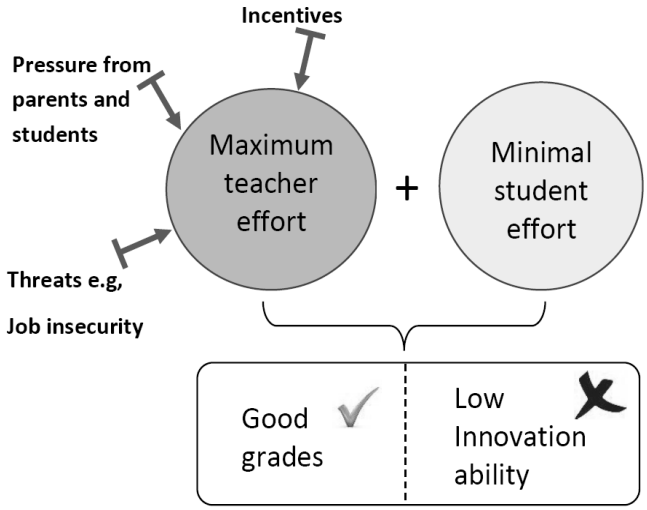

Fig. 2. Illustration of student-centered Learning

A. *Problem*

Leading scholars on education using ICTs are beginning to craft the next model of education, they are sharing their imaginations such as: how to create an educational system that is more participatory, more engaging and better at enabling each learner to move at their own pace; and, how to move institutions to leverage mobile devices and transition to digital resources [18]. Other researchers in eLearning have raised questions at the interface of applications development and institutional readiness for adoption. The overall challenge to the Ugandan education system is the low skills of graduates/drop-outs at all levels as reflected by their low innovation capacity. This is attributed to teacher centered learning which emphasizes academic performance at the expense of innovativeness of students. This is illustrated in Fig. 1. These are usually teachers in private schools who are highly paid and their sole task is to make sure that students perform well in national examinations. At the same time, there is significant disparity in academic performance between central and upcountry schools or wealthy and poor schools, which reflects the imbalances in distribution of competent teachers [6]. A government effort to reduce this disparity by use of stringent policies on teacher transfers from urban areas to rural ones has not been successful as most of the transferred teachers opt for employment in high paying private schools in the central region rather than work in upcountry schools where the working conditions are not as good.

B. *Proposed Approach*

The work in Mwalimu is based on the important considerations to be made when exploring emerging technologies to be used to impact learning and teaching [10]. The overall idea of this work is that if the students have interest in learning, they should not be hindered due to problems in getting direct access to teachers. We illustrate this in Fig. 2. To this end, we make use of the rapid advances in Internet, digital and mobile technologies. This work is based on the consideration that it has been found difficult to emphasize the teacher for the disadvantaged areas in Uganda. Instead, we shift the effort onto the students; motivate them through regular career guidance sessions, train them with basic ICT skills and let them learn on their own even when they cannot access teachers. Our hope is that in the long run, this will actually produce even better students than those in areas where the focus is on the teacher.

IV. System Design And Implementation

The proposed system focuses on content development that drives proper use of ICT infrastructure in schools. Aware of the fact that education involves teaching, reading/revision and examinations, the solution provided by Mwalimu Online

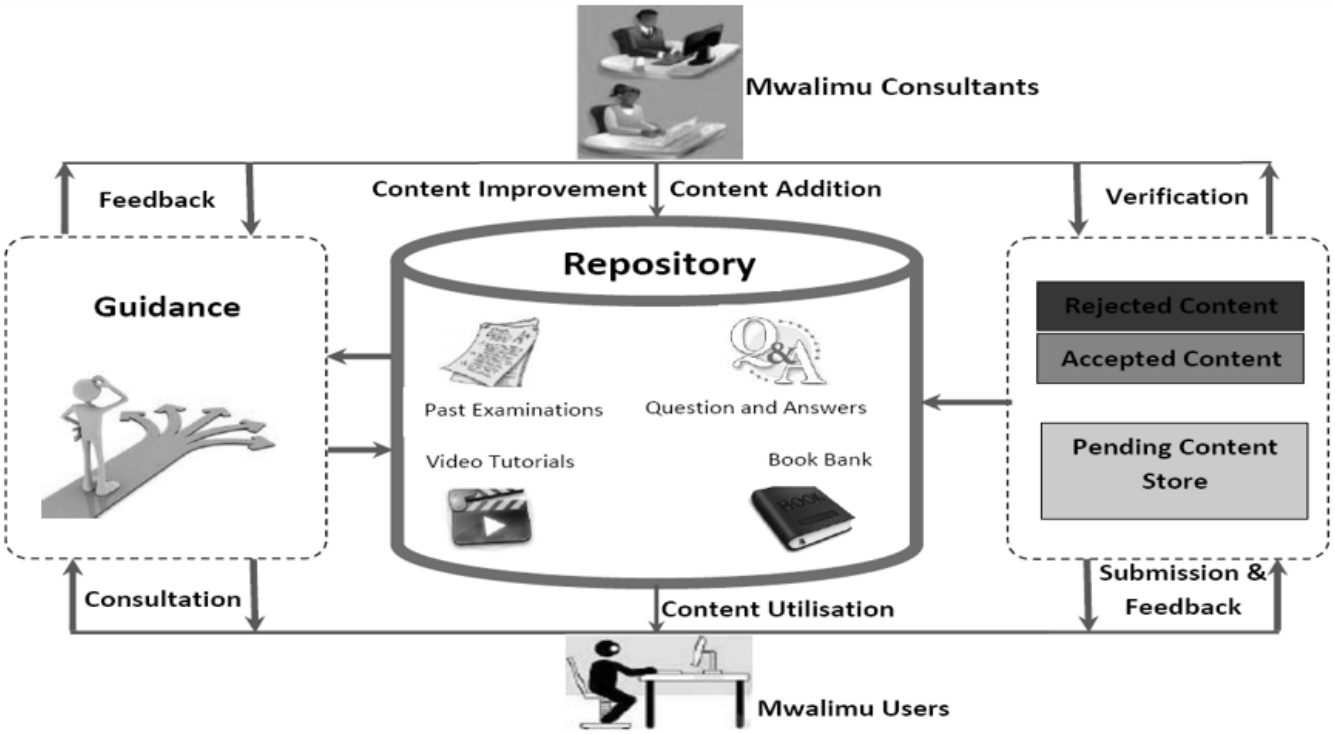

Fig. 3. Mwalimu Architecture

Study Tool is made up of three major components: Content Submission, Content Utilisation and Consultation. These are shown in Fig. 3.

A. *Content Submission*

This happens when users (crowd) contribute towards the Mwalimu repository. Such content (Questions and Answers, Notes and Videos) is added to the pending content database and is not accessible to the end users until it has been verified by the subject consultants. The Mwalimu Consultants area (which is a restricted area) allows each consultant to only review content in their area of specialization (specialized subject). After such is verified and it conforms to the set quality standards, it is approved to end-user usage. If the content requires modification it is modified then approved, but if it cannot not be improved, it is deleted. In any case, feedback is provided to the contributors with regard to their submissions. We state that at the moment, content submission is restricted to consultants only.

B. *Content Utilisation*

This is the major part of the tool and involves users accessing content from system. The content shared can be made up of four different types: rich content that can be downloaded as books; relevant questions and answers to strengthen student reading/revision; standard examinations and solutions to empower schools irrespective of their location to test students learning at equal footing; and video tutorials which can be watched online or downloaded and used in offline study.

C. *Consultation*

This module is motivated by the fact that different students learn at different rates and that in some cases we cannot cover all aspects of a given topic in the initial content we provide. The Tool therefore supports asking of subject specific questions which can be answered by either fellow users or subject consultants. Once an answered question is deemed appropriate by a subject consultant, it is added to the Q and A bank. We however note that at the moment, the response time (The time it takes from submitting a question to receiving an answer.) is quite long, but efforts are underway to make this not only more interactive and interesting but also effective.

V. EVALUATION OF CURRENT PERFORMANCE

A. *Evaluation Parameters*

Mwalimu Online Study Tool was launched to the Internet in February 2013. Our current evaluation of the performance of the tool is based on three attributes: the number of public presentations that we have been invited to, the number of schools that have enrolled onto the network and the content (examinations and other educational material) that has been downloaded from our content repository. In our opinion, the number and nature of the presentations to which we have been invited is a measure of the confidence which the public in general have in Mwalimu. This also translates directly into the number of schools that have enrolled, which shows the trust the head teachers have in the effect that the tool could have on the student development. Finally, and most importantly, the number rate of examination downloads is measure of how the users/students are shifting the trend to doing more work on their own.

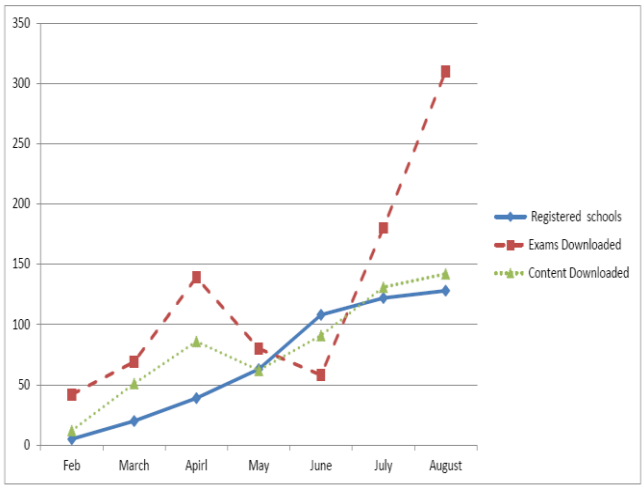

Fig. 4. Performance Evaluation

B. *Discussion of Current Performance*

The trend of the number of registered schools, examination and other content downloads is shown in Fig. 4. As can be seen, number of schools registering has increased up 128 schools as of August, 2013 [19]. This can be attributed to the quality of content, fully functional Question-Answer bank, Video bank and the examination bank. We also note an an increase in examinations as well as other content downloaded from the Mwalimu resource with a slight decrease during holidays.

C. *Presentations and awards*

Mwalimu has been part of the following presentations;

1) Google's CS4HS: CS4HS (Computer Science for High School) [20] is an initiative sponsored by Google to promote Computer Science and Computational Thinking in high school and middle school curriculum. With a gift from Google's Education Group, universities develop 2-3 day workshops for local high school and middle school CS teachers. With support from Google CS4HS programme, the Department of Computer Science of Gulu University organised an open courseware development workshop using Mwalimu Online Study Tool (in June 2013). The main objective of this workshop was to train CS, other science subject teachers and students to develop and share content through the online Mwalimu content space, and to also promote adoption of the Mwalimu resource in teaching and learning through awareness of available incentives to schools that are active in enriching and/or using the Mwalimu resource.

2) Resilient Africa Network (RAN): The Resilient Africa Network (RAN) [21] is one of USAIDs Higher Education Solutions Network (HESN) Development Labs. The purpose of RAN is to leverage the unique capabilities of Universities in identification, incubation and development of innovative solutions to development challenges in sub-Saharan Africa. Makerere University is the prime implementer, supported by Tulane University, Stanford University and the Center for Strategic and International

Studies (CSIS). RANs network includes 20 universities representing 16 countries in Sub-Saharan Africa. RAN will strengthen the resilience of communities by nurturing and scaling up innovations from the different Universities. Mwalimu Online Study Tool was one of the applications that showcased on the launch of RAN [21].

3) ACIA - ICT Innovation For National Development: Uganda Communications Commission (UCC) in a bid to promote innovation within the ICT sector holds ACIA Award[22], to celebrate, recognise and reward persons that have developed innovative ICT products, services and applications in Uganda. In recognition of the linkage between innovation and economic development, the ACIA Awards seeks to foster greater local involvement and research in the development and use of ICTs in Uganda. Mwalimu Online Study Tool was one such applications that were rewarded.

D. Limitations

The Mwalimu Online Tool is still a progressing work. The current implementation of the tool only has content for ordinary level subjects. We are working hard to extend this not only to cover advanced level content but also higher levels. In addition, this tool is mainly intended for schools and students in rural areas where Internet connectivity is still a challenge. We have already began supporting such schools especially those in the Acholi sub-region and West Nile by providing them with Internet Modems and paying for their ISP subscriptions.

VI. CONCLUSION

In this paper, we have presented the design and implementation of a student centric learning system that allows students from disadvantaged schools in Uganda to access educational content online, without the need to directly interact with teachers. Our preliminary usage statistics show that the communities are gradually but surely making use of the tool. In addition, our interactions with users reveal that students are seeking greater flexibility in their engagement with class rooms. Online delivery is an important way of providing this flexibility.

It is however important to be mindful not to use this development, as a replacement for face-to-face teaching, but as an alternative delivery mode. In some situations it may well be a more flexible alternative that better suits the needs of students. However, we are aware that the development of the tool is not yet complete. Specifically, we will need to finalise the consultation module to make the response times shorter. We also plan to have more community based presentations in different schools to make more head teachers and students aware of the availability of these resources and take full advantage of them. An excellent style manual and source of information for science writers is [9].

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